Rethinking Multimodal Fusion for Time Series Forecasting: Text Modalities Need Constrained Fusion

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Abstract

Recent advances in multimodal learning have motivated the integration of auxiliary modalities such as text or vision into time series (TS) forecasting. However, most existing methods provide limited gains, often improving performance only in specific datasets or relying on architecture-specific designs that limit generalization. In this paper, we show that multimodal models with naive fusion strategies (e.g., simple addition or concatenation) often underperform unimodal TS models, which we attribute to the *uncontrolled integration of auxiliary modalities* which may introduce irrelevant information. Motivated by this observation, we explore various **constrained fusion** methods designed to control such integration and find that they consistently outperform naive fusion methods. Furthermore, we propose **Controlled Fusion Adapter** (**CFA**), a simple plug-in method that enables controlled cross-modal interactions without modifying the TS backbone, integrating *only relevant textual information aligned with TS dynamics*. CFA employs low-rank adapters to filter irrelevant textual information before fusing it into temporal representations. We conduct over 20K experiments across various datasets and TS/text models, demonstrating the effectiveness of the constrained fusion methods. Code is available at: https://github.com/seunghan96/cfa.

1 Introduction

Time series (TS) forecasting is widely used across domains such as finance [19], traffic [5], and climate [1]. With the emergence of large language models (LLMs), multimodal TS forecasting has gained attention [12]. Recent studies attempt to enhance TS forecasting by incorporating auxiliary modalities, including text [27, 29, 38, 44], vision [9, 42], and tabular [2], under the assumption that contextual information enhances the modeling of temporal dependencies.

Existing methods often adopt *naive fusion* strategies (e.g., simple addition or concatenation) [14, 20, 29] without considering how modalities should interact, or rely on model-specific architectures[22, 27, 38] that are not easily integrated into unimodal TS models. Additionally, prior work shows that fusion does not consistently

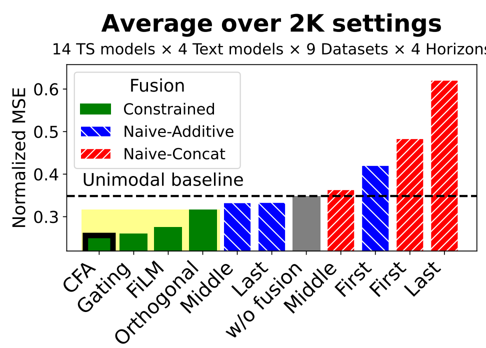


Figure 1: Constrained vs. naive fusion. Across 2K settings, naive fusion often underperforms the unimodal baseline, while constrained fusion consistently improves over it.

improve performance [14], attributing this to the difficulty of alignment among modalities. Moreover, even when improvements are reported, we find that they often depend on the dataset or the TS model, indicating limitations of naive fusion strategies.

In this paper, we conduct extensive experiments across diverse datasets and models (Table 3), evaluating fusion at the first, middle, and final layers with additive and concatenation operators. As shown in Figure 1, we find that *multimodal models with naive fusion often underperform unimodal models*, as both concatenation-based (red) and additive (blue) fusion frequently fall below the unimodal (gray) baseline. Note that each setting is tuned with 10 learning rates, selecting the best-performing configuration. This observation motivates the need for improved fusion mechanisms, suggesting that *controlled fusion between TS and text is required*.

We attribute this phenomenon to the intrinsic nature of multimodal TS forecasting, where TS serve as the *primary* modality, while other modalities serve as *auxiliary* modalities that provide contextual guidance [21, 32, 42], *which may introduce irrelevant or conflicting information* [47] that is misaligned with TS. Therefore, indiscriminate fusion can degrade forecasting performance, highlighting the necessity of **constrained fusion**, which we refer to as

Table 1: Multimodal forecasting models. Existing multimodal forecasting models are either 1) tied to a specific backbone or 2) rely on naive fusion, while CFA combines plug-in applicability with constrained fusion. A detailed discussion of related work is provided in Appendix A.

Type		Methods
Architecture-specific		[4, 22, 27, 38, 42, 44]
Plug-in	Naive	[11, 13, 14, 20, 23, 29]
	Constrained	**CFA** (Ours)

a fusion strategy that *incorporates auxiliary signals in a controlled manner* while preserving core temporal (TS) representations.

To this end, we explore various constrained fusion methods (Section 2.2), which consistently outperform naive methods, as shown in Figure 1 (green). Furthermore, we propose **C**ontrolled **F**usion **A**dapter (**CFA**), a plug-in method that injects textual information via a residual connection constrained to a low-rank subspace, filtering irrelevant textual information and enabling incorporation of auxiliary signals while preserving temporal dynamics. CFA outperforms other constrained fusion methods and is effective even when naive fusion degrades performance. The main contributions are:

- We show that *naive* multimodal fusion often underperforms unimodal TS forecasting and demonstrate that *constrained* fusion consistently improves over naive strategies across diverse datasets and models, where we evaluate four constrained fusion methods, including our proposed method.
- We propose Controlled Fusion Adapter (CFA), a simple yet effective fusion method for multimodal TS forecasting, which injects auxiliary textual information into TS representations via a residual connection constrained to a low-rank subspace, enabling controlled integration without modifying the backbone. In contrast to prior multimodal TS forecasting works—which are either *architecture-specific* and thus tied to a particular backbone [4, 22, 27, 38, 42, 44], or *plug-in but restricted to naive fusion* [11, 13, 14, 20, 23, 29]—CFA is the only method that is *both* a plug-in module applicable to *any unimodal TS model* and a *constrained* fusion approach that filters irrelevant auxiliary information (Table 1).
- We conduct over 20K experiments across various settings (9 multimodal datasets, 4 forecasting horizons, 14 TS models, and 4 text models) with 10 fusion strategies, demonstrating the effectiveness of constrained fusion including CFA. Additionally, we provide detailed analyses explaining *why constrained fusion strategies yield superior performance* compared to naive fusion strategies.

2 Necessity of Constrained Fusion for Multimodal TS Forecasting

In multimodal forecasting, a model predicts future values $\mathbf{y} = (\mathbf{x}_{L+1}, \dots, \mathbf{x}_{L+H})$ given a lookback window $\mathbf{x} = (\mathbf{x}_1, \dots, \mathbf{x}_L)$ and a paired text sequence $\mathbf{t} = (\mathbf{t}_1, \dots, \mathbf{t}_L)$. Each $\mathbf{x}_i \in \mathbb{R}^C$ denotes observations at time step i, where L, H, and C represent the lookback length, forecast horizon, and number of channels, respectively. Each text $\mathbf{t}_i$ is encoded by a language model as $\mathbf{z}_{\text{Text},i} = g_{\text{Text}}(\mathbf{t}_i)$, forming a text embedding $\mathbf{Z}_{\text{Text}} = (\mathbf{z}_{\text{Text},1}, \dots, \mathbf{z}_{\text{Text},L})$.

Algorithm 1 Multimodal TS forecasting. First / Middle / Last fusions are mutually exclusive.

Input: $\mathrm{X} = [\mathrm{X}_1, \dots, \mathrm{X}_L]$, $\mathrm{T} = [\mathrm{T}_1, \dots, \mathrm{T}_L]$
Output: $\hat{\mathrm{Y}} = [\hat{\mathrm{X}}_{L+1}, \dots, \hat{\mathrm{X}}_{L+H}]$
  $\mathbf{Z}_{\text{TS}} \leftarrow g_{\text{TS}}(\mathbf{X})$ // Input projection (TS)
  $\mathbf{Z}_{\text{Text}} \leftarrow g_{\text{Text}}(\mathbf{T})$ // Input projection (Text)
  $\mathbf{Z}_{\text{TS}} \leftarrow \mathcal{F}(\mathbf{Z}_{\text{TS}}, \mathbf{Z}_{\text{Text}})$ // First fusion
  for m in encoder layers **do**
    $\mathbf{Z}_{\text{TS}} \leftarrow f(\mathbf{Z}_{\text{TS}})$
    $\mathbf{Z}_{\text{TS}} \leftarrow \mathcal{F}(\mathbf{Z}_{\text{TS}}, \mathbf{Z}_{\text{Text}})$ // Middle fusion
  end for
  $\mathbf{Z}_{\text{TS}} \leftarrow \mathcal{F}(\mathbf{Z}_{\text{TS}}, \mathbf{Z}_{\text{Text}})$ // Last fusion
  $\hat{\mathrm{Y}} \leftarrow h(\mathbf{Z}_{\text{TS}})$ // Output projection (TS)

2.1 Naive Fusion

Naive fusion integrates textual information using a fusion operator (e.g., addition or concatenation), where the text embeddings produced by the text encoder are *directly* fused with TS embeddings *without any constraint.* Fusion can be applied before the encoder (first fusion), within intermediate encoder layers (middle fusion), or after temporal encoding (last fusion), as shown in Algorithm 1. Many multimodal TS forecasting methods follow this approach [11, 13, 14, 20, 23, 29], whereas methods that do not follow this paradigm typically adopt architecture-specific designs to fuse different modalities [4, 27, 38, 42, 44], which are not generally applicable to existing TS models.

2.2 Constrained Fusion

In this paper, we argue that TS forecasting primarily relies on learning temporal representations, while auxiliary modalities provide contextual guidance *that may contain information irrelevant to TS.* However, naive fusion methods do not account for this misalignment, which may disrupt temporal representations and underperform a unimodal (TS-only) model. To investigate this effect, we explore various constrained fusion strategies[1], which incorporate auxiliary information from other modalities in a constrained manner while preserving temporal representations as follows:

- **[1] Gating mechanism** determines the relevance of text information at each time step using a learned gate, allowing the model to utilize only the necessary textual information.
- **[2] FiLM (Feature-wise Linear Modulation)**[2] [30] modulates the scale and bias of TS embeddings based on text embeddings, preserving temporal structure while adjusting representations.
- **[3] Orthogonal fusion** projects text embeddings into TS embedding space and injects only the orthogonal component, explicitly preserving temporal information without overwriting it.

Naive fusion vs. Constrained fusion. As shown in Figure 1, these *constrained fusion strategies consistently outperform naive fusion strategies* across various settings. Nonetheless, they can *still underperform unimodal baselines under certain settings*, as shown in Table 4. This observation motivates the need to more effectively filter irrelevant textual signals while preserving informative ones. A comparison of naive and constrained fusion is provided in Figure 2.

[1]Details of the constrained fusion strategies are discussed in Appendix G.
[2]Note that FiLM [30] is different from (TS model) FiLM [46], discussed in Section A.

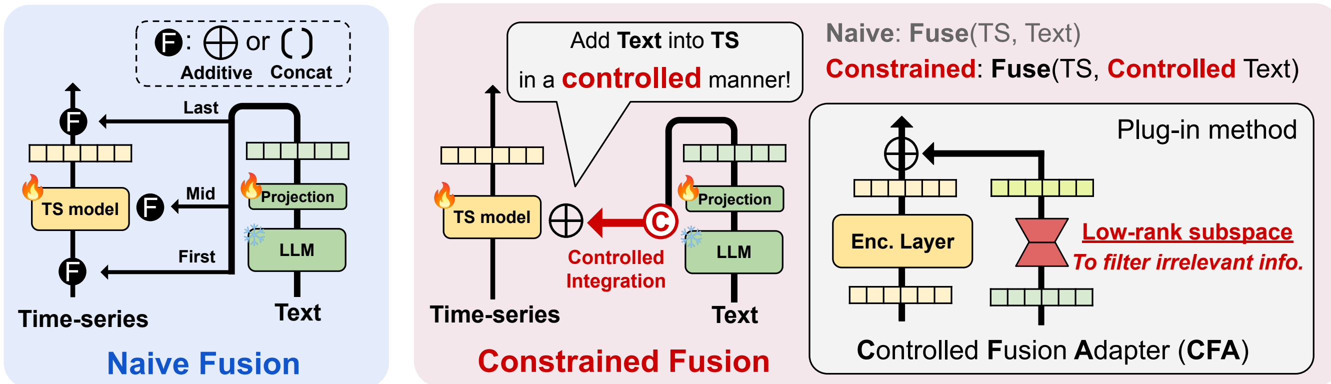


Figure 2: Comparison of multimodal fusion strategies for TS. (Left) *Naive fusion* applies simple additive or concatenation operators at first, middle, or last stages without considering modality relevance. (Right) *Constrained fusion* incorporates textual information in a controlled manner by considering its relevance to TS. *CFA* injects textual signals via a residual connection constrained to a low-rank subspace to filter irrelevant information while preserving TS representations.

Table 2: Comparison of constrained fusions.

Methods		
	Gating	$\mathbf{z}_{\text{TS},t} + \mathbf{g}_t \odot \mathbf{z}_{\text{Text},t}$
	FiLM	$\boldsymbol{\gamma}_t \odot \mathbf{z}_{\text{TS},t} + \boldsymbol{\beta}_t$
	Orthogonal	$\mathbf{z}_{\text{TS},t} + \mathbf{z}^{\perp}_{\text{Text},t}$
	CFA	$\mathbf{z}_{\text{TS},t} + \mathbf{W}_{\text{up}}\,\phi(\mathbf{W}_{\text{down}}\mathbf{z}_{\text{Text},t})$.

2.3 Controlled Fusion Adapter (CFA)

Building on these insights, we propose Controlled Fusion Adapter (**CFA**), a model-agnostic fusion method where text embeddings are projected through a low-dimensional bottleneck and added to the TS embedding as a small residual. It is important to note that our goal is *not to develop a novel adapter* but to design a *controlled fusion formulation* that constrains the textual signal effectively. To implement this, we adopt a LoRA-style parameterization [10], enabling lightweight integration into diverse TS backbones. The low-rank bottleneck limits textual capacity and encourages retention of information useful for TS forecasting while filtering irrelevant components. This design preserves the TS backbone and enables text-guided integration into any TS model as:

$$\mathbf{z}_{\text{Adapter},t} = \mathbf{W}_{\text{down}}\,\mathbf{z}_{\text{Text},t} \;\in \mathbb{R}^{D/r} \tag{1a}$$

$$\mathbf{z}'_{\text{Adapter},t} = \text{ReLU}(\text{LayerNorm}(\mathbf{z}_{\text{Adapter},t})) \tag{1b}$$

$$\mathbf{z}''_{\text{Adapter},t} = \mathbf{W}_{\text{up}}\,\mathbf{z}'_{\text{Adapter},t} \;\in \mathbb{R}^{D} \tag{1c}$$

$$\tilde{\mathbf{z}}_{\text{TS},t} = \mathbf{z}_{\text{TS},t} + \mathbf{z}''_{\text{Adapter},t}. \tag{1d}$$

Here, $\tilde{\mathbf{z}}_{\text{TS},t}$ denotes the fused embedding at time step t, and the residual addition is applied at each encoder layer of any TS model. The bottleneck dimension D/r controls parameter efficiency, where we set $r = 8$. Note that initializing $\mathbf{W}_{\text{up}}$ near zero ensures that textual influence is minimal at the early stages of training. A comparison of how the four constrained fusion strategies construct the fused embedding is shown in Table 2, and robustness to the choice of r is discussed in Appendix J.

Table 3: Experimental settings across 20K configurations.

Experimental settings ([1] × [2] × [3] > 2*K*)			
[1] Datasets (Time-MMD [23])			Agriculture, Climate, Economy, Energy, Environment Public Health, Security, Social Good, Traffic
[2] Models	TS	Transformer	Nonstationary Transformer [24], PatchTST [28], iTransformer [25] Crossformer [41], FEDformer [45], Autoformer [36] Reformer [16], Informer [43], Transformer [33]
		Linear/MLP	DLinear [40], TiDE [6], TSMixer [3]
		Others	Koopa [26], FiLM [46]
	Text		BERT [7], GPT2 [31], Llama3 [8], Doc2Vec [17]
[3] Forecasting horizons (*H*)			Daily: {48, 96, 192, 336}. Weekly: {12, 24, 36, 48}. Monthly: {6, 8, 10, 12}.
Fusion methods (10)			
Naive	Additive		First [11, 20], Middle, Last [23]
	Concat		First [13, 14, 29], Middle, Last
Constrained			Orthogonal, FiLM [30], Gating [4, 42], **CFA** (Ours)

Role of low-rank bottleneck. To understand the role of the bottleneck, we conduct a toy experiment examining how it affects fusion under 1) informative, 2) contradicting, and 3) irrelevant texts. The results show that *the low-rank projection suppresses misleading textual signals while preserving useful guidance*. Detailed analyses are provided in Appendix F, with three complementary analyses:

- **a) Performance comparison (F.1).** We compare forecasting performance w/ and w/o the low-rank bottleneck across matching, contradicting, and irrelevant text. The results show that the low-rank bottleneck consistently improves performance and provides the *largest gain when text is irrelevant*.
- **b) Representation analysis (F.2).** We measure the text-contribution ratio at the adapter to quantify how much textual signal survives the bottleneck. Matching text exhibits stronger contribution than contradicting text, indicating that the bottleneck *selectively preserves useful information*.
- **c) TS visualization (F.3).** Forecast trajectories show that the bottleneck *prevents misleading predictions under contradicting text* while *preserving accurate forecasts when text is helpful*.

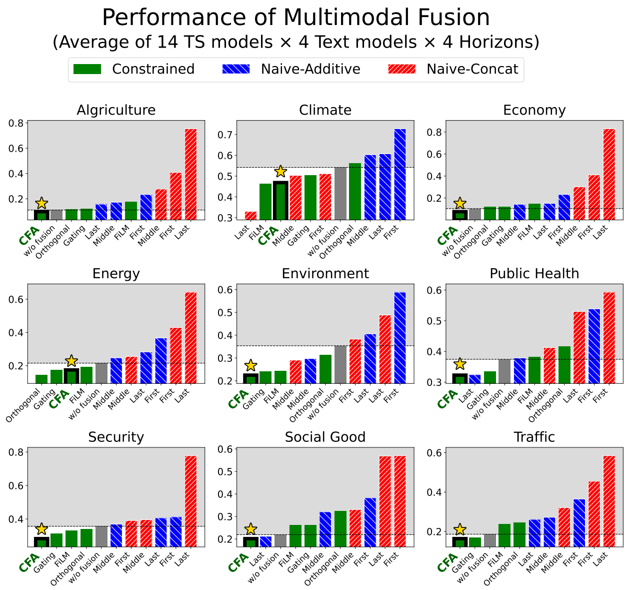
A theoretical perspective showing how the low-rank bottleneck constrains the textual signals to a low-dimensional subspace during fusion is provided in Appendix H.

Table 4: Comparison of multimodal fusion strategies for TS forecasting. While naive fusion strategies often underperform the unimodal baseline, *constrained* fusion methods consistently perform better, with our *CFA showing robust improvements across diverse settings*. Red/blue denotes improvements/degradations over the unimodal model, respectively, averaged across four Hs. Divergence (*Div.*) indicates cases where the MSE exceeds that of the unimodal baseline by more than $10\times$.

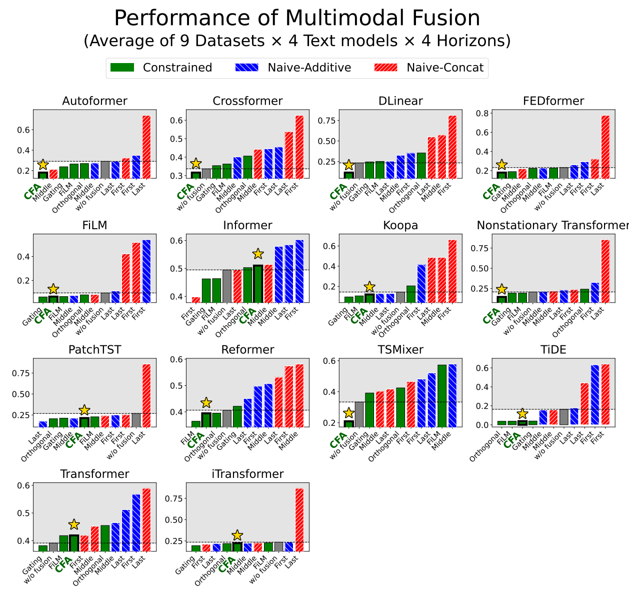
	TS Model	Dataset	Unimodal (w/o text)	Naive						Constrained			
				Additive			Concat						
				First [11, 20]	Middle (–)	Last [23]	First [13, 14, 29]	Middle (–)	Last (–)	Orthogonal (–)	FiLM [30]	Gating [4, 42]	**CFA (Ours)**
Transformer	**Nonstationary Transformer [24]**	Agriculture	0.084	0.089	**0.082**	**0.079**	0.090	0.084	0.892	**0.084**	0.085	0.085	**0.082**
		Climate	1.248	1.287	**1.229**	**1.210**	**1.215**	**1.230**	**1.153**	1.264	**1.208**	**1.232**	**1.170**
		Economy	0.019	0.020	0.020	0.020	0.020	0.019	4.562	0.019	0.019	0.020	**0.019**
		Energy	0.247	0.268	0.256	0.257	0.252	0.252	0.572	**0.240**	**0.243**	**0.243**	**0.244**
		Environment	0.437	0.478	0.447	0.437	0.447	0.453	0.461	0.441	**0.436**	0.447	0.442
		Public Health	1.210	1.224	**1.141**	**1.176**	1.271	1.240	1.465	1.235	1.285	**1.153**	**1.086**
		Security	106.4	106.4	107.8	107.4	**106.1**	107.0	121.5	**105.7**	**105.3**	**106.1**	**105.8**
		Social Good	0.942	**0.940**	**0.918**	**0.893**	1.000	**0.910**	2.362	0.993	**0.932**	**0.925**	**0.910**
		Traffic	0.199	0.201	0.201	0.210	0.201	**0.194**	0.419	0.202	0.201	**0.198**	**0.197**
		Win rate (vs. Unimodal) (%)		11.1	44.4	44.4	22.2	33.3	11.1	33.3	55.6	66.7	**88.9**
	PatchTST [28]	Agriculture	0.092	0.092	0.093	**0.088**	0.092	0.093	0.547	0.093	0.092	0.093	**0.091**
		Climate	1.259	**1.254**	**1.243**	1.260	**1.254**	1.259	**1.169**	**1.243**	1.265	**1.236**	**1.252**
		Economy	0.017	0.017	**0.017**	0.019	0.017	0.017	*Div.*	0.017	0.018	0.018	**0.017**
		Energy	0.264	0.265	**0.263**	**0.252**	0.265	**0.258**	0.723	**0.262**	**0.257**	**0.260**	**0.263**
		Environment	0.502	0.502	**0.447**	**0.492**	0.502	**0.471**	0.583	**0.456**	**0.451**	**0.455**	**0.442**
		Public Health	1.390	**1.388**	1.413	**1.194**	**1.388**	1.418	1.472	1.400	**1.384**	1.394	**1.390**
		Security	109.5	**108.8**	**106.7**	**108.0**	**108.8**	**107.5**	128.7	**106.5**	**108.5**	**108.0**	**109.1**
		Social Good	0.955	0.966	**0.943**	**0.890**	0.966	**0.948**	2.195	**0.943**	**0.939**	**0.954**	**0.920**
		Traffic	0.199	**0.198**	0.201	0.210	**0.198**	**0.197**	0.744	**0.198**	**0.195**	**0.195**	0.201
		Win rate (vs. Unimodal) (%)		44.4	66.7	66.7	44.4	55.6	11.1	66.7	66.7	66.7	**88.9**
Linear/MLP	**DLinear [40]**	Agriculture	0.205	**0.183**	**0.188**	**0.191**	0.651	0.746	0.609	**0.169**	0.259	**0.188**	**0.124**
		Climate	1.225	1.324	1.309	1.283	1.227	**1.167**	**1.159**	1.312	**1.090**	1.312	**1.098**
		Economy	0.129	**0.116**	**0.124**	**0.126**	*Div.*	*Div.*	*Div.*	**0.110**	0.248	**0.125**	**0.040**
		Energy	0.263	0.326	0.314	0.291	0.670	0.382	0.368	0.298	0.313	0.299	**0.243**
		Environment	0.545	**0.491**	**0.489**	**0.479**	**0.528**	**0.501**	**0.497**	0.549	**0.500**	**0.485**	0.546
		Public Health	1.554	1.604	1.569	**1.549**	1.790	1.637	1.570	1.736	1.682	**1.517**	**1.530**
		Security	109.0	110.7	109.8	109.2	142.6	137.6	136.1	110.1	**108.6**	109.3	**108.8**
		Social Good	0.934	1.096	1.069	1.068	1.928	1.587	1.491	1.037	0.981	1.026	**0.904**
		Traffic	0.276	0.334	0.358	0.343	0.841	0.883	0.757	0.301	0.333	0.340	**0.233**
		Win rate (vs. Unimodal) (%)		33.3	33.3	44.4	11.1	22.2	22.2	22.2	33.3	44.4	**88.9**
	TiDE [6]	Agriculture	0.108	*Div.*	**0.107**	**0.099**	*Div.*	**0.107**	0.824	**0.096**	**0.096**	**0.095**	**0.095**
		Climate	1.469	*Div.*	1.487	1.506	2.954	1.505	**1.231**	**1.261**	**1.267**	**1.255**	**1.264**
		Economy	0.035	*Div.*	**0.034**	0.042	*Div.*	0.038	*Div.*	**0.017**	**0.017**	**0.018**	**0.017**
		Energy	0.287	*Div.*	0.290	0.291	*Div.*	0.288	0.768	**0.256**	**0.262**	**0.259**	**0.260**
		Environment	0.534	*Div.*	0.535	**0.515**	*Div.*	**0.534**	0.555	**0.534**	**0.533**	**0.533**	**0.533**
		Public Health	1.568	*Div.*	**1.561**	1.643	*Div.*	1.588	1.752	**1.459**	**1.476**	**1.476**	**1.463**
		Security	138.3	143.9	**135.4**	**134.5**	140.1	**132.2**	146.1	**109.7**	**109.7**	**111.7**	**110.1**
		Social Good	1.185	*Div.*	**1.083**	**1.143**	126.8	**1.115**	2.125	**1.004**	**1.025**	**1.016**	**1.001**
		Traffic	0.295	*Div.*	**0.279**	0.325	6.016	0.302	0.472	**0.245**	**0.247**	**0.245**	**0.244**
		Win rate (vs. Unimodal) (%)		0.0	66.7	44.4	0.0	44.4	11.1	**100.0**	**100.0**	**100.0**	**100.0**
Others	**Koopa [26]**	Agriculture	0.091	**0.084**	**0.084**	**0.084**	*Div.*	0.699	0.699	0.092	0.123	**0.085**	**0.090**
		Climate	1.249	5.219	1.257	1.257	2.602	**1.147**	**1.147**	1.284	**1.088**	1.252	**1.248**
		Economy	0.018	0.028	0.024	0.024	*Div.*	*Div.*	*Div.*	0.028	0.051	0.021	**0.018**
		Energy	0.253	*Div.*	**0.252**	**0.252**	*Div.*	0.534	0.534	0.270	0.262	**0.247**	**0.253**
		Environment	0.526	*Div.*	**0.497**	**0.497**	*Div.*	**0.470**	**0.470**	0.530	**0.483**	**0.496**	0.527
		Public Health	1.442	*Div.*	**1.184**	**1.184**	*Div.*	**1.381**	**1.381**	1.637	**1.367**	**1.176**	**1.439**
		Security	108.5	**108.2**	**107.6**	**107.6**	130.1	131.6	131.6	110.1	111.8	**106.6**	**107.0**
		Social Good	0.964	0.996	0.976	0.976	2.180	2.097	2.097	0.993	**0.841**	**0.918**	**0.959**
		Traffic	0.233	0.256	0.244	0.244	0.431	0.366	0.366	0.249	0.239	0.242	**0.219**
		Win rate (vs. Unimodal) (%)		22.2	55.6	55.6	0.0	33.3	33.3	0.0	44.4	66.7	**88.9**
	FiLM [46]	Agriculture	0.098	5.460	**0.095**	**0.092**	1.313	0.099	0.896	**0.096**	**0.097**	**0.095**	**0.094**
		Climate	1.286	8.799	**1.286**	**1.274**	6.623	1.291	**1.168**	**1.280**	**1.282**	**1.274**	**1.264**
		Economy	0.018	*Div.*	0.022	0.029	*Div.*	0.022	9.140	0.018	**0.018**	0.018	**0.018**
		Energy	0.271	*Div.*	0.285	0.294	0.807	0.307	0.737	**0.260**	**0.268**	0.275	**0.259**
		Environment	0.534	*Div.*	**0.504**	**0.512**	*Div.*	**0.492**	0.565	0.535	**0.509**	**0.493**	**0.532**
		Public Health	1.501	*Div.*	1.531	1.615	2.589	1.646	1.726	1.505	1.529	**1.493**	**1.490**
		Security	118.5	122.3	**106.7**	**114.7**	*Div.*	**107.0**	144.7	**108.8**	**107.4**	**107.2**	**110.0**
		Social Good	1.057	*Div.*	**0.993**	**1.032**	*Div.*	**1.048**	2.289	**1.013**	**1.019**	**0.990**	**1.018**
		Traffic	0.230	0.587	0.231	0.239	1.064	0.237	0.698	0.256	0.233	0.238	0.234
		Win rate (vs. Unimodal) (%)		0.0	55.6	55.6	0.0	33.3	11.1	55.6	77.8	66.7	**88.9**

3 Experiments

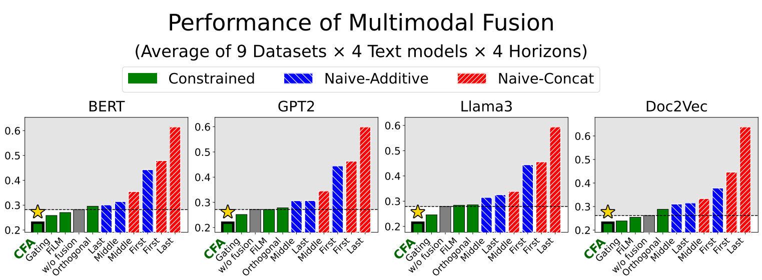
Experimental settings. To evaluate the generality of the proposed method, we conduct experiments on 9 multimodal datasets [23], 14 TS backbones, and 4 language models across 4 Hs, as shown in Table 3. In all experiments, only the TS model is trained while the text model remains frozen. Each setting is evaluated over 10 learning rates, reporting the best result. Following Time-MMD [23], datasets are split into train, validation, and test sets with a ratio of 7:1:2. Performance is evaluated using MSE and MAE.



(a) Performance by Dataset.



(b) Performance by TS models.



(c) Performance by Text models.

Method	Normalized MSE
Concat - F/M/L	0.484/0.364/0.621
Additive - F/M/L	0.421/0.333/0.334
w/o fusion	0.349
Orth./FiLM/Gating	0.317/0.275/0.261
CFA (Ours)	**0.256**

(d) Average performance.

Figure 3: Performance across diverse settings. (a), (b), and (c) show the performance (normalized MSE) by Dataset, TS model, and Text model, respectively. (d) shows the overall average performance across all settings.

3.1 Multimodal Time Series Forecasting

Table 4 presents the forecasting performance (MSE) of multimodal fusion strategies across TS models and datasets using BERT [7] as the language model. Due to space limitations, we report six TS models [6, 24, 26, 28, 40, 46], selecting the two representative methods from each model category with the highest performance. Overall, *naive fusion* methods, whether additive or concatenation-based, frequently fail to outperform the unimodal baseline and even lead to severe degradation or divergence. In contrast, *constrained fusion* methods consistently yield more stable and better performance across models and domains. Notably, CFA achieves the best performance, indicating that controlled integration of textual information is crucial for robust multimodal TS forecasting. Comparison with other (architecture-specific) methods are shown in Appendix K.

3.2 Performance with Various Settings

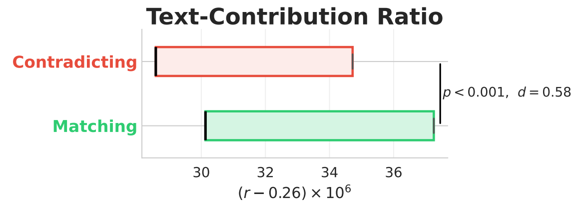
In this section, we evaluate the proposed method across diverse **1) datasets**, **2) TS backbones**, and **3) text encoders** to verify its general effectiveness. To account for scale differences across datasets, we report normalized MSE averaged over 10 fusion strategies.

[1] Various datasets (Figure 3a). We conduct experiments on 9 real-world multimodal datasets [23] for TS forecasting. Across datasets, constrained fusion strategies (green) generally outperform the additive (blue) and concatenation-based (red) fusion. While many fusion methods exhibit dataset-dependent behavior, CFA consistently outperforms the unimodal model on all datasets and ranks first on 7 of the 9 datasets.

[2] Various TS models (Figure 3b). We evaluate the effectiveness of our method across diverse TS backbones (e.g., Transformer-based, linear/MLP-based). Similar to the dataset-level analysis, constrained fusion strategies (green) generally outperforms the additive (blue) and concatenation-based (red) approaches. Specifically, CFA improves over the unimodal baseline on 13 out of 14 backbones, with the exception of Transformer [33]. We attribute this to the fact that the standard Transformer exhibits substantially lower performance than other TS backbones, indicating a limitation of the backbone itself rather than the fusion strategy. For Transformer variants specifically designed for TS forecasting [24, 25, 41], CFA consistently yields improvements over unimodal models.

Text type	w/o bottleneck	w/ bottleneck	Improv. (%)
Matching	0.1683	**0.1477**	+12.19
Contradicting	0.1635	**0.1560**	+4.59
Irrelevant	0.1851	**0.1480**	+20.04

(a) Per-type MSE: w/ vs. w/o low-rank bottleneck.



(b) Text-contribution ratio by text type.

Figure 4: Experiment on low-rank bottleneck. (a) CFA with a bottleneck consistently outperforms the version without a bottleneck across all text types, with the largest gain observed for irrelevant text. (b) The text-contribution ratio shows that matching text is injected more strongly than contradicting text, indicating that it selectively suppresses conflicting signals.

[3] Various text models (Figure 3c). To verify robustness to text encoders, we compare four text models, including three LLM-based encoders [7, 8, 31] and Doc2Vec [17] to account for scenarios where LLM deployment is restricted. Consistent with previous observations, constrained fusion strategies (green) outperform additive (blue) and concatenation-based (red) methods. Among them, CFA consistently achieves the best performance, demonstrating robustness to the text model.

[4] Overall comparison (Table 3d). Table 3d reports the average normalized MSE across more than 2K settings (9 datasets × 14 TS models × 4 text models × 4 horizons) with 10 fusion methods. Among simple fusion strategies, only additive fusion at the middle or last layer improves over the unimodal baseline, whereas other naive approaches fail to do so. This highlights the necessity of constrained fusion for consistent performance gains. Furthermore, CFA achieves the best performance, confirming its superiority over various fusion strategies. Note that we tune each setting over 10 learning rates and compare the best performance to ensure that gains or losses are not due to optimization effects.

4 Analysis

In this section, we analyze *how and why the proposed method operates effectively*, using BERT [7] as the text model:

- **1) Performance with irrelevant text.** We inject *mismatched textual inputs* from unrelated datasets and observe that CFA exhibits the smallest degradation relative to the unimodal baseline, demonstrating robustness to irrelevant information.
- **2) Effect of low-rank bottleneck.** Using a synthetic dataset with matched, contradicting, and irrelevant text, we show that the bottleneck reduces MSE across text types. The largest gain occurs for irrelevant text, and matching text is injected more strongly than contradicting text.
- **3) Representation similarity.** We compute *cosine similarity between TS-only and TS+Text representations* and observe that the best performance does not correspond to the largest representation shift, highlighting constrained modification.
- **4) Visualization of TS forecasting.** We visualize the predicted values in TS forecasting and observe that CFA captures late-stage trends missed by the unimodal model.
- **5) Temporal attribution analysis.** We analyze temporal attribution to quantify *how each input step contributes to the prediction* and find that CFA yields a distinct temporal importance distribution, indicating that it selectively references time steps.

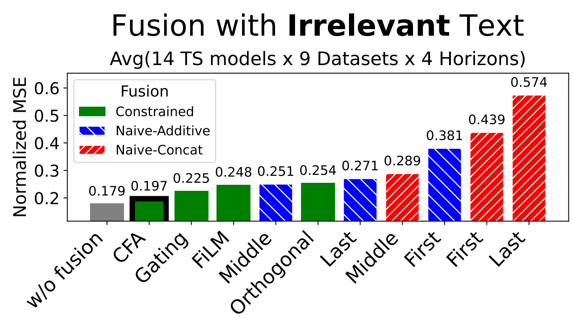


Figure 5: Irrelevant text experiments.

- **6) Efficiency analysis.** We compare the number of parameters and FLOPs across fusion methods and observe that CFA introduces marginal overhead relative to the unimodal baseline, while several strategies significantly increase computational overhead.
- **7) Information analysis.** We compute the rank correlation between MAE and effective rank across diverse settings and find that methods with higher effective rank tend to achieve lower MAE, suggesting that models with more distributed representations tend to forecast more accurately.

1) Performance with irrelevant text (Figure 5). To assess the effect of multimodal fusion, we conduct an *irrelevant text* experiment, where we replace the text aligned with each TS by text sampled from entirely different datasets. For instance, when evaluating on the Agriculture dataset, we randomly sample text from the remaining eight datasets. This design examines how each fusion strategy responds when irrelevant textual information is injected.

A robust fusion strategy is expected to ignore unrelated information and rely primarily on TS representations, such that its performance does not substantially degrade compared to the unimodal setting. As shown in Figure 5, CFA exhibits performance most similar to the unimodal model and shows the smallest degradation. In addition, constrained fusion strategies except Orthogonal effectively filter out unnecessary information and primarily utilize TS representations. These results confirm that CFA incorporates relevant textual signals while remaining robust to irrelevant inputs.

2) Effect of low-rank bottleneck (Figure 4). To analyze the filtering behavior of CFA's low-rank adapter, we conduct a controlled toy experiment on a synthetic dataset containing three text types: **matching** (reflecting the TS trend), **contradicting** (opposing the TS trend), and **irrelevant** (topically unrelated). We compare CFA w/ and w/o the bottleneck, with details in Appendix F.

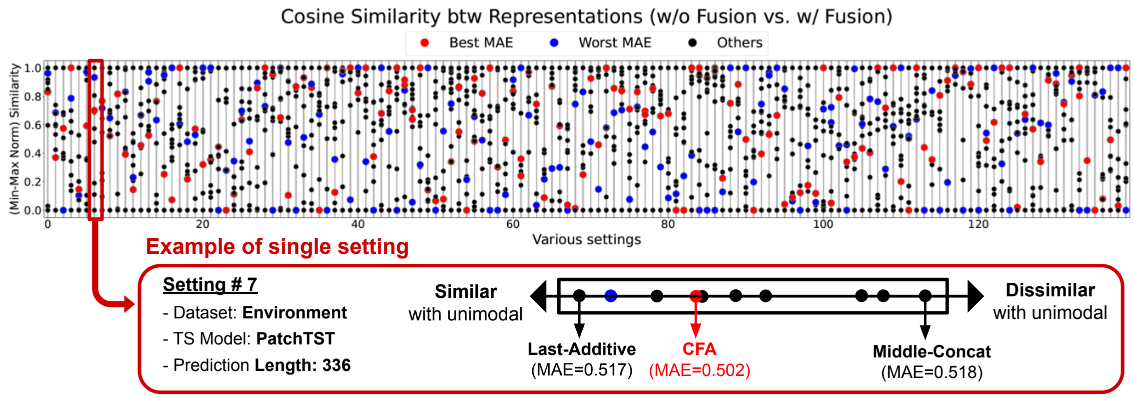


Figure 6: Cosine similarity between representations of TS-only and TS+Text models. We apply multiple fusion strategies across diverse settings, where each dot represents a single fusion method. The best-performing method (red) does *not* consistently induce the largest representation shift from the unimodal baseline, highlighting the importance of controlled integration of textual information into temporal representations rather than simply increasing the magnitude of representation shift.

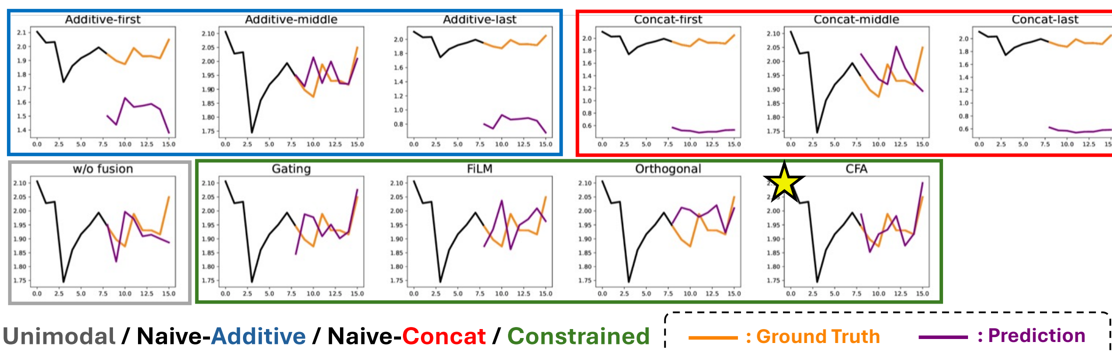


Figure 7: 4) Visualization of multimodal TS forecasting. Although the unimodal model captures the initial pattern, it fails to model the subsequent upward trend, whereas CFA accurately captures the rise in the later horizon. In addition, some fusion strategies even fail to converge (e.g., concat-first), indicating that naive fusion can hinder effective learning.

Table 4a shows that the bottleneck consistently reduces MSE across all text types. The largest improvement occurs for irrelevant text, indicating that *the bottleneck suppresses uninformative texts*. Without the bottleneck, contradicting text yields *lower* MSE than matching text, suggesting that all text is treated as undifferentiated noise. With the bottleneck, the expected ordering appears, where matching text yields the lowest MSE, followed by irrelevant text and contradicting text.

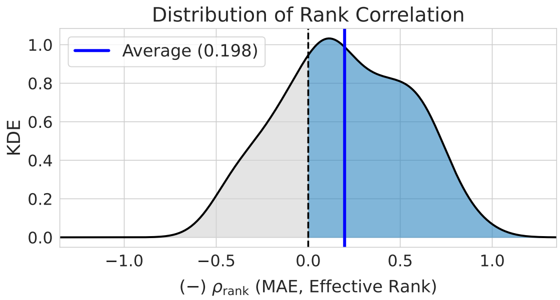
Figure 4b reports the text-contribution ratio (See Appendix F.2) measured at the adapter output. Matching text produces a higher mean ratio than contradicting text with strong statistical significance (p<0.001, Cohen's d=0.58). This indicates that CFA *injects helpful text more strongly while suppressing conflicting signals*. Visualization of forecast trajectories are illustrated in Appendix F.3.

3) Representation similarity (Figure 6). To quantify how text fusion reshapes temporal representations, we measure the cosine similarity between the layer-wise representations $\mathbf{Z}_\ell^{\mathrm{TS}}$ and $\mathbf{Z}_\ell^{\mathrm{TS+Text}}$ at layer ℓ, where $\ell \in \{1, \dots, L\}$ denotes the layer index. We compute the layer-wise cosine similarity between $\mathbf{Z}_\ell^{\mathrm{TS}}$ and $\mathbf{Z}_\ell^{\mathrm{TS+Text}}$, and obtain the final similarity score by averaging across layers:

$$S = \frac{1}{L} \sum_{\ell=1}^{L} \frac{\langle \mathbf{Z}_\ell^{\mathrm{TS}}, \mathbf{Z}_\ell^{\mathrm{TS+Text}} \rangle}{\|\mathbf{Z}_\ell^{\mathrm{TS}}\|_2 \, \|\mathbf{Z}_\ell^{\mathrm{TS+Text}}\|_2}. \tag{2}$$

We repeat this analysis across different settings and fusion strategies. As shown in Figure 6, best-performing fusion method (red) does not consistently correspond to the largest deviation from the unimodal baseline. This indicates that effective fusion requires *controlled modification* of temporal representations with textual information rather than simply increasing representation shift.

4) Visualization of TS forecasting (Figure 7). To assess how textual fusion influences temporal prediction, we visualize forecasting results on the Agriculture dataset [23] using TiDE [6], with both input and output horizons set to 8. While the unimodal model captures the initial pattern yet fails to model the subsequent upward trend, CFA accurately captures the rise in the later horizon. Moreover, most constrained fusion (green) methods successfully capture the late-stage upward trend that the unimodal model fails to capture. In contrast, several naive fusion strategies (red, blue) even underperform the unimodal baseline, indicating that improper fusion can hinder effective learning.



(a) Distribution of rank correlation.

Method	MAE ↓	Effective Rank ↑
CFA (Ours)	0.0929 (1/11)	24.05 (1/11)
Orthogonal	0.0967 (4/11)	19.37 (3/11)
w/o fusion	0.0970 (5/11)	18.97 (4/11)
Additive (First)	0.0983 (7/11)	16.79 (9/11)
Concat (Middle)	0.0996 (9/11)	16.10 (10/11)
Rank correlation (ρ)	0.6727 (p-value: 0.023)	

(b) Example of rank correlation.

Figure 8: Rank correlation(MAE, Effective rank). (a) Distn of rank correlations across various settings, showing that higher effective rank tends to associate with lower MAE. (b) Methods with higher effective rank generally achieve lower MAE (w/ positive rank correlation of $\rho = 0.6727$).

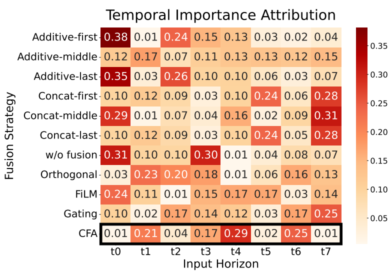


Figure 9: Temporal importance. CFA exhibits a distinct importance distribution over time steps.

Average	Unimodal (w/o text)	Naive						Constrained			
		Additive			Concat						
		First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Params. (1e+06)	9.382	9.384 + 0.02%	9.408 + 0.28%	9.384 + 0.02%	9.384 + 0.02%	10.539 + 12.33%	9.384 + 0.02%	9.403 + 0.23%	9.423 + 0.46%	12.067 + 28.62%	**9.439 + 0.61%**
FLOPs (1e+08)	1.436	1.436 + 0.00%	1.436 + 0.02%	1.436 + 0.00%	1.436 + 0.00%	1.616 + 12.53%	1.436 + 0.00%	1.436 + 0.02%	1.436 + 0.03%	1.885 + 31.26%	**1.436 + 0.04%**

Table 5: Efficiency analysis of fusion strategies. The table shows the average 1) training parameters and 2) FLOPs, where CFA achieves negligible overhead compared to the unimodal baseline, maintaining comparable efficiency.

5) Temporal attribution analysis (Figure 9). Under the same experimental setting as **Analysis 4)**, we further analyze the importance scores that quantify *how much each input TS step contributes to the prediction.* Specifically, we compute a gradient × input attribution with respect to the encoder input and aggregate over channels to obtain one importance value per time step. As shown in Figure 9, CFA assigns a different importance distribution over input TS steps compared to w/o fusion and other methods, indicating that textual information influences which temporal regions are referenced during prediction. See Appendix I for details on the computation of temporal attribution.

6) Efficiency analysis (Table 5). To demonstrate the efficiency of CFA, we compare the average number of training parameters and FLOPs across 10 fusion methods, aggregated over 14 TS backbones and 9 datasets under prediction lengths of 8, 36, and 96 for monthly, weekly, and daily frequencies. While certain strategies substantially increase computational overhead, most designs introduce marginal overhead. Notably, CFA increases parameters by only 0.61% and FLOPs by 0.04% relative to the unimodal model, indicating that it maintains *efficiency comparable to the unimodal setting*.

7) Information analysis (Figure 8). We analyze the fusion using the *effective rank* of layer-wise representations. Given a hidden representation $\mathbf{H}$, we compute its singular values $\{\sigma_i\}_{i=1}^{r}$ and define $p_i = \frac{\sigma_i}{\sum_{j=1}^{r}\sigma_j}$ and $\text{erank}(\mathbf{H}) = \exp\left(-\sum_{i=1}^{r} p_i \log p_i\right)$, where higher rank indicates more distributed representations. To assess its relevance, we compute the rank correlation between MAE and effective rank across fusion strategies under diverse settings (four TS backbones [24, 25, 28, 46], nine datasets, four Hs). Figure 8a shows that methods with higher effective rank tend to achieve lower MAE, as confirmed by a positive Spearman rank correlation, with example shown in Table 8b.

5 Conclusion

In this paper, we show that naive fusion often underperforms unimodal baselines, suggesting that indiscriminate cross-modal fusion fails to preserve temporal representations. We demonstrate that constrained fusion consistently improves performance by filtering irrelevant auxiliary signals while preserving temporal representations effectively. Furthermore, we propose CFA, a constrained fusion method that suppresses irrelevant textual information in the low-rank subspace. Extensive experiments across various datasets and backbones validate the effectiveness of our approach.

Limitations and Future Work. As our study focuses on textual modalities, extending constrained fusion to other modalities (e.g. vision and tabular) remains a promising direction for future research. In addition, although CFA shows consistent improvements across diverse settings, our analysis remains largely empirical, and deeper theoretical understanding would strengthen the framework.

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A Related Work

TS forecasting models. Recent TS forecasting methods employ Transformers [33] to capture temporal and channel dependencies. PatchTST [28] segments TS into patches and adopts channel-independent modeling. PITS [18] embeds patches independently without inter-patch interaction. Crossformer [41] captures channel interactions via hierarchical attention. iTransformer [25] applies attention across features to model channel dependencies. Nonstationary Transformer [24] models non-stationarity within attention to address distribution shifts. Several works adopt lightweight architectures without attention, where DLinear [40] uses linear decomposition to capture trend and seasonal components. TSMixer [3] employs MLP-based mixing across temporal and feature dimensions. TiDE [6] employs an MLP-based encoder-decoder with temporal embeddings. FiLM [46] introduces a Frequency-improved Legendre Memory model with Legendre projection and Fourier denoising. Koopa [26] learns latent dynamics through Koopman operator.

Multimodal TS forecasting models. Recent work integrates external modalities with TS to enrich forecasting with contextual information [12, 13, 37]. UniCast [29] combines pretrained vision and text encoders with a frozen TS foundation model. CAPTime [38] aligns TS representations with LLM-derived textual context within a probabilistic forecasting framework. BALM-TSF [44] mitigates modality imbalance by aligning TS and textual embeddings before fusion. SpecTF [27] performs frequency-domain fusion by projecting textual embeddings into the spectral space and integrating them with TS components. Multi-Modal Forecaster [14] jointly models TS and text through shared embeddings. Time-VLM [42] leverages pretrained vision-language models to construct multimodal representations. TimeCMA [22] performs cross-modality alignment with dual branches. GPT4MTS [11] employs LLMs to generate task-aware textual prompts to guide TS forecasting. T3Time [4] employs temporal, spectral, and prompt features with a gating mechanism.

As shown in Table 1, these works either adopt naive fusion strategies or focus on designing architecture-specific models for multimodal forecasting, which are not generally applicable to existing unimodal TS models. While TaTS [20] can be plugged into existing unimodal TS models, it adopts a naive first-layer additive fusion scheme included as a baseline in our experiments. Additionally, although ContextFormer [2] can be applied to arbitrary TS encoders, its module accounts for over 75% of the total parameters due to multiple cross-attention layers, limiting general applicability.

B Details of Models

We use the `mmtslib` package provided by Time-MMD [23]. We adopt 14 TS models and 4 text models implemented in the library.
TS Models. We use 14 TS models from three categories as follows:

- **Transformer-based Models**
  - **Transformer** [33]: A standard sequence-to-sequence model based on multi-head self-attention.
  - **Informer** [43]: A sparse-attention Transformer designed for efficient long-term TS forecasting.
  - **Reformer** [16]: An efficient Transformer variant using locality-sensitive hashing and reversible layers.
  - **Autoformer** [36]: A decomposition-based Transformer that replaces attention with an auto-correlation mechanism.
  - **FEDformer** [45]: A frequency-enhanced Transformer leveraging Fourier decomposition for long-horizon prediction.
  - **Crossformer** [41]: A multivariate Transformer that models cross-dimension dependencies.
  - **iTransformer** [25]: An inverted Transformer that treats variates as tokens to model inter-variable relationships.
  - **Nonstationary Transformer** [24]: A Transformer tailored to capture non-stationary temporal patterns.
  - **PatchTST** [28]: A patch-based Transformer that segments TS into subseries tokens for scalable forecasting.
- **Linear / MLP-based Models**
  - **DLinear** [40]: A linear model that performs forecasting via direct regression on historical inputs.
  - **TiDE** [6]: An MLP-based encoder-decoder model designed for long-term TS forecasting.
  - **TSMixer** [3]: A fully-MLP architecture that mixes temporal and feature information for prediction.
- **Other Architectures**
  - **Koopa** [26]: A Koopman-operator-inspired model that decomposes TS into stable and dynamic components.
  - **FiLM** [46]: A frequency-based method that applies Fourier and Legendre projections for denoising and trend modeling.

Text Models. We use 4 text models, including three LLMs as follows:

- **BERT** [7]: A bidirectional Transformer pre-trained with masked language modeling.
- **GPT-2** [31]: An autoregressive Transformer trained to predict next-token distributions.
- **Llama-3** [8]: A recent large language model with improved text generation and comprehension capabilities.
- **Doc2Vec** [17]: A document-level embedding model that learns fixed-length vector representations of text.

C Details of Datasets

We use the nine multimodal datasets from various domains proposed in Time-MMD [23]. The input length (L) and forecasting horizons (H) are determined according to the frequency of each dataset (daily, weekly, or monthly). Detailed information about the datasets is provided in Table C.1.

The qualitative descriptions of each dataset are as follows:

- **Agriculture**: Tracks U.S. retail broiler (chicken) composite prices, reflecting supply–demand dynamics and seasonal patterns in the agricultural market.
- **Climate**: Measures drought severity levels across regions, capturing long-term climate variability and extreme weather trends.
- **Economy**: Represents the U.S. international trade balance, indicating macroeconomic conditions and global trade fluctuations.
- **Energy**: Records U.S. gasoline prices, a key indicator of energy market volatility and consumer economic burden.
- **Environment**: Monitors daily air quality index (AQI), reflecting pollution dynamics and environmental risk levels.
- **Health**: Tracks weekly influenza-like illness (ILI) proportions, serving as a proxy for epidemic spread and public health trends.

Table C.1: Meta information of the nine Time-MMD [23] datasets. We report the domain, dimensionality, data frequency, number of samples, timespan, input length (L), and forecasting horizons (H) for all nine multimodal datasets.

Domain	Dim.	Freq.	#Samples	Timespan	L	H
Agriculture	1	M	496	1983–Present	24	{6, 8, 10, 12}
Climate	5	M	496	1983–Present	24	{6, 8, 10, 12}
Economy	3	M	423	1989–Present	24	{6, 8, 10, 12}
Energy	9	W	1479	1996–Present	48	{12, 24, 36, 48}
Environment	4	D	11102	1982–2023	336	{48, 96, 192, 336}
Health	11	W	1389	1997–Present	48	{12, 24, 36, 48}
Security	1	M	297	1999–Present	24	{6, 8, 10, 12}
Social Good	1	M	900	1950–Present	24	{6, 8, 10, 12}
Traffic	1	M	531	1980–Present	24	{6, 8, 10, 12}

Table D.1: Input and output horizon settings.

Frequency	**Lookback window (L)**	**Forecast horizons (H)**
Daily	96	[48, 96, 192, 336]
Weekly	36	[12, 24, 36, 48]
Monthly	8	[6, 8, 10, 12]

Table D.2: Learning rate configuration.

Optimizer	Target module	Learning rate	Default value
Model Optimizer	Time Series Model	η_{TS}	1×10^{-4}
MLP Optimizer	Text Embedding MLP	η_{MLP}	1×10^{-2}
Projection Optimizer	Projection Layer	η_{Proj}	1×10^{-3}

- **Security**: Captures disaster and emergency grant allocations, reflecting the temporal impact of large-scale natural and societal crises.
- **Social Good**: Measures unemployment rates, highlighting labor market disparities and socioeconomic stability.
- **Traffic**: Represents travel volume statistics, indicating mobility trends and transportation demand dynamics.

D Experimental Setup

(1) Evaluation metrics. We evaluate forecasting performance using Mean Squared Error (MSE) and Mean Absolute Error (MAE), which are standard metrics in TS forecasting.

(2) Input and output horizons. We consider different forecasting horizon settings depending on the reporting frequency of each dataset, as shown in Table D.1.

(3) Optimizer. We use the Adam optimizer [15] for all trainable modules with a batch size of 32.

(4) Learning rate. We assign separate optimizers and learning rates to different components. The default learning rates are defined as follows:

To identify the best configuration, we multiply each default learning rate by the following scaling factors: {0.05, 0.1, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 50.0, 100.0}, resulting in 10 different learning rate configurations per component.

(5) Epochs. We train the model for a maximum of 10 epochs with patience 5.

Table E.1: Default hyperparameters of the 14 TS models.

Model	d_{model}	n_{heads}	L_{enc}	L_{dec}	d_{ff}	p_{drop}
***Transformer*-based methods**						
Transformer [33]	512	8	2	1	2048	0.1
Informer [43]	512	8	2	1	2048	0.1
Autoformer [36]	512	8	2	1	2048	0.1
FEDformer [45]	512	8	2	1	2048	0.1
Nonstationary Transformer [24]	512	8	2	1	2048	0.1
Reformer [16]	512	8	2	—	2048	0.1
iTransformer [25]	512	8	2	—	2048	0.1
PatchTST [28]	512	8	2	—	2048	0.1
Crossformer [41]	512	8	2	—	2048	0.1
***Linear/MLP*-based methods**						
DLinear [40]	—	—	—	—	—	0.1
TSMixer [3]	512	—	2	—	—	0.1
TiDE [6]	512	—	2	1	2048	0.1
Others						
FiLM [46]	512	—	2	—	—	0.1
Koopa [26]	—	—	—	—	—	0.1

(6) Data split. All datasets are divided chronologically into train:validation:test = 7:1:2.

(7) Compute resource. All experiments are conducted on a single NVIDIA L40-48G GPU.

E Model Hyperparameters

Table E.1 presents the hyperparameter settings of the 14 TS models used in our experiments. We follow the default configurations adopted in Time-MMD [23]. Here, d_{model} denotes the model (hidden) dimension, n_{heads} the number of attention heads, $L_{\mathrm{enc}}/L_{\mathrm{dec}}$ the number of encoder/decoder layers, d_{ff} the feed-forward dimension, and p_{drop} the dropout rate.

Note that since DLinear [40] has no hidden representation, all three injection positions (first, middle, and last) operate directly on the channel dimension C_{in} rather than a latent dimension d_{model}. Specifically, first fusion adds or concatenates the projected text embedding $\mathbf{W}_{\mathrm{proj}}\mathbf{e}_t \in \mathbb{R}^{C_{\mathrm{in}}}$ to the raw input $\mathbf{x} \in \mathbb{R}^{L \times C_{\mathrm{in}}}$ before decomposition. Middle fusion injects the text signal into the seasonal and trend components $\in \mathbb{R}^{C_{\mathrm{in}} \times H}$ independently after the `seq_len` $\rightarrow$ `pred_len` linear projection but before their summation. Last fusion modifies the final output $\in \mathbb{R}^{H \times C_{\mathrm{in}}}$ after the linear mapping. For CFA, the adapter bottleneck dimension is computed as $\lfloor C_{\mathrm{in}}/r \rfloor$ rather than $\lfloor d_{\mathrm{model}}/r \rfloor$. Thus, the low-rank text residual is injected into the variate space instead of a token-level or hidden-level space.

F Toy Experiment with Multimodal Fusion

We conduct a controlled toy experiment to analyze *the effect of the low-rank bottleneck (low-rank adapter)* in CFA. The low-rank adapter constrains the projection of text embeddings through a low-rank bottleneck before they are injected into the TS backbone, which is expected to *suppress irrelevant or contradicting textual signals while preserving useful guidance.*

To examine this effect, we compare CFA with and without the low-rank constraint. Throughout this section, **w/ bottleneck** denotes CFA with the low-rank bottleneck, while **w/o bottleneck**

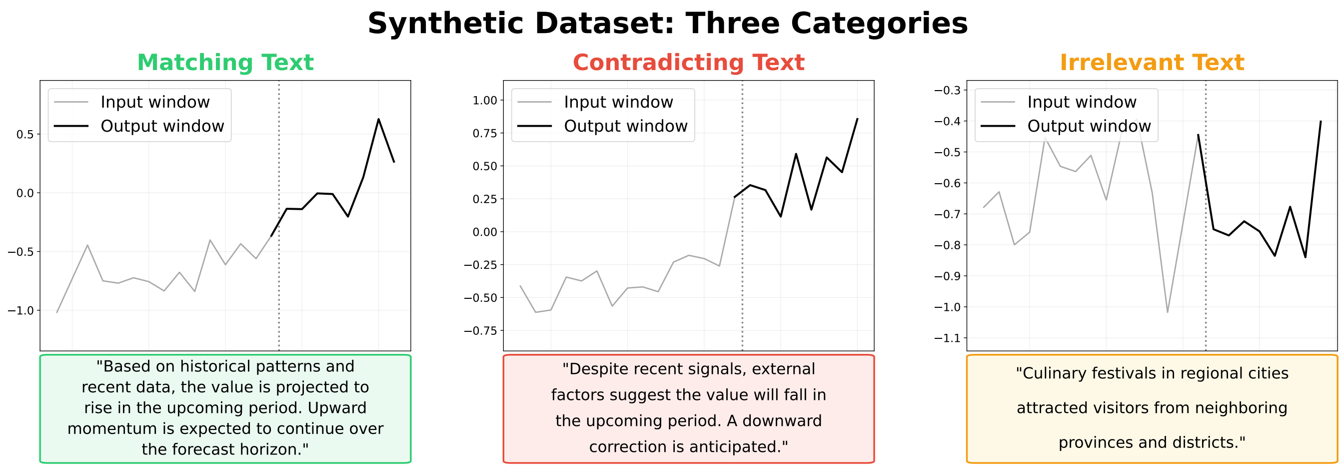

Figure F.1: Illustration of the toy dataset. Each time step of the TS is paired with a text description, categorized as 1) matching, 2) contradicting, or 3) irrelevant. Matching descriptions align with the TS trend, contradicting ones oppose it, and irrelevant ones provide no useful signal.

	Matching	Contradicting
Mean	33.50	31.56
Std	3.56	3.07
t, p	$t = 4.03$, $p < 0.001$	
Cohen's d	0.58	

Table F.1: Text-contribution ratio. The table shows how much of the text signal survives the low-rank bottleneck for each text type. Matching text is injected more strongly than contradicting text, indicating that the adapter selectively suppresses conflicting information.

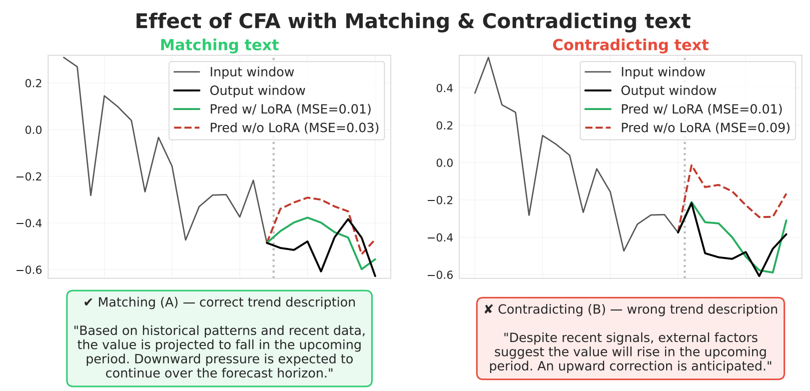

Figure F.2: Forecast comparison for a matched (left) and a contradicting (right) text sample. Green solid: w/ bottleneck. Red dashed: w/o bottleneck. Black solid: ground truth. The vertical dotted line separates the input window from the prediction horizon.

denotes the middle-additive baseline that directly injects text embeddings without the low-rank constraint.

A. Toy dataset construction. We synthesize a univariate TS and pair each time step with a short natural-language description. Each description belongs to one of three categories:

- 1) **Matching:** The description correctly reflects the current trend of the TS (*e.g.*, "The value is rising steadily"). This text provides useful information and should be incorporated by the model.
- 2) **Contradicting:** The description contradicts the actual trend (*e.g.*, "The value is declining" when the series is rising). Injecting such text without filtering is expected to degrade forecast quality.
- 3) **Irrelevant:** The description is unrelated to the TS (*e.g.*, a sentence about an unrelated domain). This text contains no useful signal and should ideally be ignored.

We construct a dataset ($N = 1{,}000$) in which all three text types coexist, with 70% used for training, 10% for validation, and 20% for testing. To illustrate the dataset, Figure F.1 shows example TS segments paired with each type of textual description.

B. Model and horizon. We use the Nonstationary Transformer [24] as the TS backbone with an input length of $L = 8$ and a prediction horizon of $T = 8$.

C. Analyses. We examine the effect of the low-rank bottleneck from three perspectives:

- **Performance comparison** (Section F.1): MSE per text type.
- **Representation analysis** (Section F.2): Bottleneck activation norms and text-contribution ratios.
- **TS visualization** (Section F.3): Predictions for matched vs. contradicting text.

Table F.2: Performance on the synthetic dataset. Results are reported for CFA w/ and w/o bottleneck across three categories of text descriptions.

Text type	w/o bottleneck	w/ bottleneck	Improv. (%)
Matching	0.1683	**0.1477**	+ 12.19
Contradicting	0.1635	**0.1560**	+ 4.59
Irrelevant	0.1851	**0.1480**	+ 20.04

F.1 Analysis 1: Performance Comparison

Table F.2 reports the MSE on the test split for case w/ bottleneck (CFA) and w/o bottleneck (middle-additive) across three categories of text descriptions.

From Table F.2, three observations follow as below:

(i) CFA improves performance across all text types. CFA (w/ bottleneck) achieves lower MSE than the middle-additive baseline (w/o bottleneck) for **matching**, **contradicting**, and **irrelevant** descriptions, *indicating that the low-rank bottleneck consistently improves multimodal fusion.*

(ii) CFA effectively suppresses irrelevant textual signals. For **irrelevant** descriptions, which contain no useful forecasting information, the middle-additive baseline still injects the text into the TS backbone, introducing noise into the representations. In contrast, the *low-rank bottleneck largely filters out such inputs*, yielding the largest MSE reduction (+20.04%).

(iii) CFA better distinguishes helpful and harmful text. Without the low-rank adapter, **contradicting** text surprisingly yields lower MSE than **matching** text, suggesting that *the baseline fails to properly utilize the semantic content of the descriptions.* In contrast, With the low-rank adapter, the expected ordering emerges, where **matching** descriptions are most beneficial, while **contradicting** descriptions remain the most challenging ($\text{MSE}_{\text{Matching}} < \text{MSE}_{\text{Irrelevant}} < \text{MSE}_{\text{Contradicting}}$).

F.2 Analysis 2: Representation Analysis

To investigate how CFA selectively filters text, we measure the **text-contribution ratio** at the output of the low-rank adapter. For each test sample, we compute $r = \frac{\|\mathbf{o}\|_2}{\|\bar{\mathbf{e}}\|_2}$, where $\mathbf{o} \in \mathbb{R}^{d_{\text{model}}}$ is the adapter output added to the TS representation, and $\bar{\mathbf{e}}$ is the pooled text embedding before the adapter. Intuitively, r quantifies *how much of the original text signal survives the bottleneck*: higher r indicates stronger injection, while lower r indicates suppression. In this analysis, we focus on the first encoder layer of the Nonstationary Transformer and report r by text category (*Matching* vs. *Contradicting*).

Table F.1 and Figure F.3 summarize the distribution of r for **matching** and **contradicting** text, where values are $(r - 0.25745) \times 10^6$ for readability. Matching text yields a higher mean value (33.50) than contradicting text (31.56), and the difference is statistically significant ($t = 4.03$, $p < 0.001$, Cohen's $d = 0.58$). This suggests that the low-rank bottleneck *suppresses contradictory text while preserving matching information*, providing controlled guidance to the TS backbone.

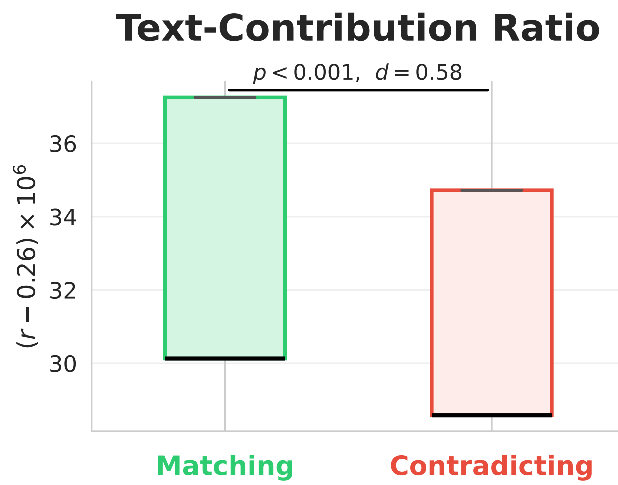

Figure F.3: Text-contribution ratio.

F.3 Analysis 3: TS Visualization

Figure F.2 provides a qualitative comparison of the forecast trajectories for a representative matching (left) and contradicting (right) test sample from the AB dataset.

Matching text. When the injected text correctly describes the trend, both w/ bottleneck and w/o bottleneck produce reasonable forecasts that follow the ground truth. The CFA prediction (w/ bottleneck) tracks the ground truth slightly more closely, suggesting that *the low-rank bottleneck preserves useful information while absorbing the helpful signal.*

Contradicting text. The contrast is clearer for the contradicting-text sample, where the ground truth descends during the forecast horizon, while the injected text suggests an upward movement. The baseline (w/o bottleneck) is misled by this conflicting signal and its prediction rises in the early forecast steps, deviating from the ground truth. CFA (w/ bottleneck), in contrast, disregards the misleading text and predicts a downward trajectory that closely follows the ground truth. This qualitative contrast visualizes the filtering capability of the low-rank bottleneck, as the low-rank constraint *prevents harmful text from corrupting the forecast even when the text signal is strongly contradictory.*

G Details of Constrained Fusion Strategies

In this section, we provide formal descriptions and mathematical formulations for the three constrained fusion strategies introduced in Section 2.2. We adopt the notation defined in Section 2: TS embeddings $\mathbf{Z}_{\text{TS}} = [\mathbf{z}_{\text{TS},1}, \ldots, \mathbf{z}_{\text{TS},L}]$, text embeddings $\mathbf{Z}_{\text{Text}} = [\mathbf{z}_{\text{Text},1}, \ldots, \mathbf{z}_{\text{Text},L}]$.

G.1 Gating Mechanism

The gating mechanism determines the relevance of textual information at each time step using a learned gate. Formally, let $\mathbf{z}_{\text{TS},t} \in \mathbb{R}^D$ denote the TS embedding at time step t, and $\mathbf{z}_{\text{Text},t} \in \mathbb{R}^D$ the text embedding. A gate $\mathbf{g}_t \in [0,1]^D$ is computed as:

$$\mathbf{g}_t = \sigma(\mathbf{W}_g[\mathbf{z}_{\text{TS},t}; \mathbf{z}_{\text{Text},t}] + \mathbf{b}_g),$$

where σ is the sigmoid function, $[\cdot;\cdot]$ denotes concatenation, and $\mathbf{W}_g, \mathbf{b}_g$ are learnable parameters. The fused embedding is then:

$$\mathbf{z}_{\text{fused},t} = \mathbf{z}_{\text{TS},t} + \mathbf{g}_t \odot \mathbf{z}_{\text{Text},t}.$$

G.2 FiLM (Feature-wise Linear Modulation)

FiLM modulates TS embeddings based on text embeddings by applying feature-wise scaling and shifting as:

$$\mathbf{z}_{\text{fused},t} = \boldsymbol{\gamma}(\mathbf{z}_{\text{Text},t}) \odot \mathbf{z}_{\text{TS},t} + \boldsymbol{\beta}(\mathbf{z}_{\text{Text},t}),$$

where $\boldsymbol{\gamma}(\cdot), \boldsymbol{\beta}(\cdot)$ are learned functions (e.g., MLPs) that generate scaling and shifting parameters from the text embedding. This preserves the temporal structure of TS embeddings while modulating each feature dimension according to textual context.

G.3 Orthogonal Fusion

Orthogonal fusion projects the text embedding onto the orthogonal complement of the TS embedding to avoid overwriting temporal information:

$$\mathbf{z}^{\perp}_{\text{Text},t} = \mathbf{z}_{\text{Text},t} - \frac{\mathbf{z}^{\top}_{\text{TS},t}\mathbf{z}_{\text{Text},t}}{\|\mathbf{z}_{\text{TS},t}\|^2}\mathbf{z}_{\text{TS},t},$$

$$\mathbf{z}_{\text{fused},t} = \mathbf{z}_{\text{TS},t} + \mathbf{z}^{\perp}_{\text{Text},t}.$$

This ensures that only components of the text embedding orthogonal to the TS embedding are integrated, preserving the original temporal information.

G.4 Controlled Fusion Adapter (CFA)

Controlled Fusion Adapter (CFA) integrates textual information into TS embeddings through a lightweight residual adapter with a low-dimensional bottleneck. Unlike direct additive or multiplicative fusion, CFA first transforms the text embedding into a compact latent space and then projects it back to the original dimension before residual addition. This design preserves the TS backbone representation while allowing text to provide directional guidance with minimal parameter overhead.

Formally, for each time step t, the text embedding $\mathbf{z}_{\text{Text},t} \in \mathbb{R}^D$ is first projected to a reduced bottleneck space:

$$\mathbf{z}_{\text{Adapter},t} = \mathbf{W}_{\text{down}}\mathbf{z}_{\text{Text},t} \in \mathbb{R}^{D/r},$$

where r is the reduction ratio controlling parameter efficiency. The intermediate representation is then normalized and activated:

$$\mathbf{z}'_{\text{Adapter},t} = \phi\big(\text{LayerNorm}(\mathbf{z}_{\text{Adapter},t})\big),$$

where $\phi(\cdot)$ denotes a non-linear activation function (e.g., ReLU). Finally, the representation is projected back to the original dimension and added as a residual to the TS embedding:

$$\mathbf{z}_{\text{fused},t} = \mathbf{z}_{\text{TS},t} + \mathbf{W}_{\text{up}}\mathbf{z}'_{\text{Adapter},t}.$$

Here, $\mathbf{W}_{\text{down}} \in \mathbb{R}^{\frac{D}{r}\times D}$ and $\mathbf{W}_{\text{up}} \in \mathbb{R}^{D\times\frac{D}{r}}$ are learnable parameters. The residual structure ensures that the original TS embedding is preserved, while the bottleneck controls the magnitude and complexity of textual influence. In practice, initializing $\mathbf{W}_{\text{up}}$ near zero helps stabilize early training by preventing excessive perturbation of the TS backbone.

H Theoretical Perspective on Low-Rank Text Fusion

CFA injects textual signals into TS embeddings through a low-rank adapter. Following the formulation in Section 2.3, the injected signal is given by

$$\mathbf{z}''_{\text{Adapter},t} = \mathbf{W}_{\text{up}}\,\phi\big(\text{LayerNorm}(\mathbf{W}_{\text{down}}\mathbf{z}_{\text{Text},t})\big), \tag{3}$$

which is added to the TS embedding as

$$\tilde{\mathbf{z}}_{\text{TS},t} = \mathbf{z}_{\text{TS},t} + \mathbf{z}''_{\text{Adapter},t}. \tag{4}$$

Since $\mathbf{W}_{\text{up}} \in \mathbb{R}^{D\times D/r}$, its column space has dimension at most D/r. For any intermediate vector $\mathbf{v} \in \mathbb{R}^{D/r}$ obtained by applying the down-projection, LayerNorm, and non-linear activation ϕ, the final output $\mathbf{W}_{\text{up}}\mathbf{v}$ must lie in the column space of $\mathbf{W}_{\text{up}}$. Therefore the injected textual signal lies in a subspace of $\mathbb{R}^D$ whose dimension is at most D/r.

This low-rank constraint *restricts the directions in which textual signals influence TS embeddings.* As a result, the textual information modifies TS representations only *within a low-dimensional subspace.* This reduces the capacity of textual signals and suppresses irrelevant information during fusion.

I Temporal Attribution for Multimodal TS Forecasting

To analyze which past time steps the model relies on when generating forecasts, we assign an importance score to each of the L input time steps. This enables direct comparison of temporal focus across different fusion strategies.

Problem setup. Let the encoder input be $\mathbf{x} \in \mathbb{R}^{B\times L\times D}$, where B denotes the batch size, L the input horizon, and D the number of channels. The forecasting model predicts $\hat{\mathbf{y}}$ over the output horizon, and we define the loss as mean squared error

$$\mathcal{L} = \text{MSE}(\hat{\mathbf{y}}, \mathbf{y}).$$

Our goal is to quantify the contribution of each input time step $t \in \{0, \ldots, L-1\}$ to this loss.

Gradient-based temporal importance. We adopt a Gradient × Input attribution scheme. For a single sample (omitting the batch index), let $x_t^{(d)}$ denote the input value at time step t and channel d. The gradient of the loss with respect to the input is

$$g_t^{(d)} = \frac{\partial\mathcal{L}}{\partial x_t^{(d)}}.$$

The element-wise attribution is defined as

$$a_t^{(d)} = g_t^{(d)} \cdot x_t^{(d)}.$$

We aggregate over channels to obtain one importance value per time step:

$$I_t = \sum_{d=1}^{D}\left|a_t^{(d)}\right| = \sum_{d=1}^{D}\left|\frac{\partial\mathcal{L}}{\partial x_t^{(d)}} \cdot x_t^{(d)}\right|.$$

This yields an importance vector $\mathbf{I} = (I_0, \ldots, I_{L-1}) \in \mathbb{R}^L$. When the input horizon is $L = 8$, we therefore obtain exactly 8 importance values, one for each input time step.

Table J.1: Average performance (MAE, MSE) by CFA reduction rank r.

Metric	$r = 2$	$r = 4$	$r = 8$	$r = 16$	$r = 32$
MAE	1.031	**1.025**	1.029	1.035	1.030
SE	13.326	**13.290**	13.334	13.374	13.339

For visualization and comparison across samples, we optionally normalize the scores:

$$\tilde{I}_t = \frac{I_t}{\sum_{t'=0}^{L-1} I_{t'} + \epsilon},$$

where $\epsilon > 0$ ensures numerical stability.

Implementation details We compute gradients with respect to the encoder input by cloning the input tensor and enabling gradient tracking on the clone. After a forward pass and backpropagation of the MSE loss, we extract $\partial\mathcal{L}/\partial\mathbf{x}$ and compute the element-wise product with the original input values. All attribution scores are computed under the same forecasting setting used for evaluation.

For models that do not employ attention mechanisms, such as TiDE, the temporal attribution is derived solely from the gradient-based formulation above. Thus, the number of importance values always equals the input horizon L, ensuring consistent interpretation across backbones.

J Sensitivity Analysis

We examine the robustness of the CFA to the reduction ratio r across datasets and TS models. The results in Table J.1 show that performance remains stable for different values of r. Although $r = 4$ achieves the best average performance in several cases, we adopt $r = 8$ in our experiments considering both performance and computational efficiency.

K Comparison with Other Methods

Table K.1 presents a comparison of our method against other TS models, covering both unimodal TS models and architecture-specific multimodal TS models. We use eight Time-MMD multimodal datasets [23], excluding the Environment dataset due to reproducibility issues with the baseline methods.[3] The results are based on SpecTF [27], which is concurrent with our work (2026.02). We apply our approach to three representative TS backbones: a Transformer-based model (Nonstationary Transformer [24]), a Linear/MLP-based model (TiDE [6]), and other architectures (Koopa [26]).

L Full Results of Main Experiments

We report the full results of our main experiments across all 14 TS backbones, paired with each of the 4 text models (BERT, GPT-2, Llama-3, Doc2Vec).

[3]The reproducibility issue with Environment arises in MM-TSF [23], which corresponds to the last-additive setting in our experiments; the reported results differ from those obtained in our runs.

Table J.2: Average MAE per model by CFA reduction ratio r.

Model	$r = 2$	$r = 4$	$r = 8$	$r = 16$	$r = 32$
Autoformer [36]	1.026	1.021	1.031	1.039	**1.018**
Crossformer [41]	1.125	1.134	1.127	1.137	**1.118**
DLinear [40]	**0.969**	**0.969**	**0.969**	**0.969**	0.970
FEDformer [45]	0.967	**0.963**	0.970	0.978	0.981
FiLM [46]	**0.963**	**0.963**	**0.963**	**0.963**	0.963
Informer [43]	1.217	**1.190**	1.211	1.217	1.208
Koopa [26]	**0.944**	**0.944**	**0.944**	**0.944**	0.945
Nonstationary Transformer [24]	0.904	0.909	**0.899**	0.916	0.910
PatchTST [28]	0.948	**0.943**	0.948	0.948	0.951
Reformer [16]	1.151	**1.136**	1.167	1.179	1.162
TSMixer [3]	**1.123**	**1.123**	**1.123**	**1.123**	**1.123**
TiDE [6]	0.988	0.979	**0.974**	0.981	0.986
Transformer [33]	1.149	1.134	**1.128**	1.162	1.145
iTransformer [25]	0.953	0.943	0.950	**0.940**	0.944

Table J.3: Average MSE per model by CFA reduction ratio r.

Model	$r = 2$	$r = 4$	$r = 8$	$r = 16$	$r = 32$
Autoformer [36]	12.947	**12.744**	13.107	13.203	12.805
Crossformer [41]	14.302	14.345	14.135	14.291	**14.088**
DLinear [40]	**12.613**	**12.613**	**12.613**	**12.613**	**12.613**
FEDformer [45]	**12.597**	12.732	12.748	12.955	12.887
FiLM [46]	**12.766**	**12.766**	**12.766**	**12.766**	12.766
Informer [43]	14.829	14.851	14.861	14.897	**14.813**
Koopa [26]	**12.420**	**12.420**	**12.420**	**12.420**	12.421
Nonstationary Transformer [24]	12.247	12.208	**12.185**	12.276	12.274
PatchTST [28]	12.615	**12.580**	12.632	12.613	12.584
Reformer [16]	**14.038**	14.165	14.387	14.447	14.394
TSMixer [3]	**14.693**	**14.693**	**14.693**	**14.693**	**14.693**
TiDE [6]	12.974	**12.756**	12.779	12.797	13.051
Transformer [33]	14.797	14.714	14.733	**14.691**	14.698
iTransformer [25]	12.727	**12.471**	12.621	12.568	12.654

Table J.4: Average MAE per dataset by CFA reduction ratio r.

Dataset	$r = 2$	$r = 4$	$r = 8$	$r = 16$	$r = 32$
Agriculture	0.2534	**0.2452**	0.2508	0.2515	0.2560
Climate	0.8680	0.8655	**0.8648**	0.8669	0.8666
Economy	0.2679	**0.2364**	0.2610	0.2825	0.2518
Energy	0.3927	**0.3894**	0.3908	0.3896	0.3939
Environment	**0.5156**	0.5192	0.5190	0.5188	0.5190
Public	0.7976	0.7941	**0.7931**	0.8001	0.7946
Security	5.4168	**5.4129**	5.4218	5.4441	5.4309
SocialGood	0.4584	0.4577	**0.4532**	0.4642	0.4545
Traffic	0.3046	0.3054	0.3041	**0.3019**	0.3054

Table J.5: Average MSE per dataset by CFA reduction ratio r.

Dataset	$r = 2$	$r = 4$	$r = 8$	$r = 16$	$r = 32$
Agriculture	0.1483	**0.1446**	0.1473	0.1501	0.1526
Climate	1.1596	**1.1520**	1.1537	1.1576	1.1540
Economy	0.1602	**0.1278**	0.1540	0.1790	0.1390
Energy	0.2813	**0.2781**	0.2800	0.2794	0.2838
Environment	**0.4836**	0.4877	0.4875	0.4856	0.4848
Public	1.4135	1.4161	**1.4055**	1.4173	1.4062
Security	115.1568	**114.8712**	115.2570	115.5611	115.3047
SocialGood	0.9195	0.9183	0.9121	0.9215	**0.9115**
Traffic	0.2114	0.2125	0.2112	**0.2108**	0.2113

Table K.1: Comparison with other methods, including architecture-specific multimodal TS forecasting models. Red bold: best, blue underline: second best.

Dataset	H	SpecTF [27]	TaTS [20]	MM-TSF [23]	TimeXer [35]	FreTS [39]	Time-LLM [13]	ChatTime [34]	**CFA** (Ours)		
									Transformer [24]	+ Linear/MLP [6]	Others [26]
Agriculture	6	0.064	0.075	0.084	0.088	0.082	0.092	0.193	**0.053**	0.060	0.056
	8	0.084	0.097	0.112	0.109	0.101	0.151	0.264	**0.069**	0.082	0.076
	10	0.110	0.127	0.133	0.144	0.125	0.176	0.345	**0.091**	0.103	0.100
	12	0.152	0.167	0.165	0.187	0.172	0.210	0.418	**0.116**	0.135	0.128
	Avg	0.103	0.112	0.123	0.132	0.120	0.157	0.305	**0.082**	0.095	0.090
Climate	6	0.904	0.990	1.074	1.027	**0.286**	1.126	1.490	1.073	1.258	1.253
	8	0.927	0.998	1.067	1.059	**0.283**	1.165	1.530	1.250	1.267	1.258
	10	0.965	1.010	1.100	1.067	**0.294**	1.200	1.519	1.176	1.259	1.247
	12	0.960	1.012	1.101	1.058	**0.293**	1.210	1.570	1.163	1.274	1.232
	Avg	**0.938**	1.002	1.053	1.053	1.289	1.175	1.528	1.166	1.265	1.248
Economy	6	0.0084	**0.0080**	0.0116	0.0133	0.0150	0.0307	0.478	0.017	0.017	0.017
	8	0.0086	**0.0083**	0.0117	0.0140	0.0149	0.0310	0.056	0.020	0.018	0.018
	10	0.0085	**0.0083**	0.0126	0.0143	0.0155	0.0323	0.056	0.019	0.017	0.017
	12	0.0086	**0.0084**	0.0125	0.0148	0.0154	0.0336	0.059	0.020	0.017	0.018
	Avg	0.0085	**0.0083**	0.0096	0.0096	0.0152	0.0319	0.0547	0.019	0.017	0.018
Energy	12	**0.096**	0.103	0.117	0.137	0.127	0.105	0.135	0.101	0.112	0.107
	24	0.199	0.206	0.210	0.242	0.245	0.216	0.238	**0.186**	0.220	0.205
	36	**0.282**	0.313	0.307	0.324	0.337	0.307	0.328	0.306	0.300	0.299
	48	0.406	0.433	0.447	0.447	0.487	0.427	0.435	0.404	0.408	**0.402**
	Avg	**0.246**	0.264	0.270	0.288	0.299	0.264	0.284	0.249	0.260	0.253
Health	12	0.985	0.979	1.196	1.181	1.141	1.308	1.382	**0.724**	1.106	1.008
	24	1.256	1.297	1.440	1.402	1.546	1.724	1.758	**1.032**	1.425	1.410
	36	1.395	1.442	1.669	1.455	1.691	1.869	1.904	**1.371**	1.602	1.625
	48	1.470	1.519	1.755	1.538	1.790	1.895	1.930	**1.269**	1.740	1.715
	Avg	1.276	1.340	1.508	1.394	1.542	1.699	1.730	**1.099**	1.468	1.440
Security	6	106.364	108.460	113.759	106.859	126.132	106.535	113.701	**99.239**	107.5	104.5
	8	106.947	110.180	115.563	109.134	129.167	108.205	117.083	**105.3**	109.4	105.5
	10	109.767	111.352	116.793	110.484	129.848	109.566	123.805	**107.8**	111.9	108.7
	12	110.567	112.405	117.897	111.411	130.346	110.865	190.503	109.7	111.7	**109.4**
	Avg	108.4	110.6	116.0	109.5	128.9	108.8	136.273	**105.5**	110.1	107.0
Social Good	6	0.907	0.943	1.088	0.924	1.008	0.888	1.193	**0.793**	0.843	0.849
	8	0.939	1.012	1.183	0.978	1.017	0.916	1.117	**0.897**	0.947	0.914
	10	0.962	0.996	1.198	1.018	1.145	1.039	1.241	**0.928**	1.068	0.994
	12	1.040	1.058	1.264	1.089	1.174	1.492	1.189	**1.020**	1.147	1.079
	Avg	0.962	1.012	1.183	1.002	1.086	1.084	1.185	**0.910**	1.001	0.959
Traffic	6	0.169	0.182	0.186	**0.166**	0.200	0.271	0.255	0.172	0.233	0.196
	8	0.169	0.184	0.190	**0.167**	0.199	0.276	0.257	0.180	0.224	0.207
	10	**0.173**	0.190	0.195	0.176	0.205	0.279	0.259	0.187	0.229	0.209
	12	**0.175**	0.213	0.217	0.197	0.215	0.333	0.261	0.243	0.289	0.269
	Avg	**0.171**	0.192	0.197	0.176	0.205	0.289	0.258	0.196	0.244	0.220

Table L.1: Comparison of multimodal fusion strategies with Nonstationary Transformer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Nonstationary Transformer	Agriculture	6	0.051	0.053	0.052	0.052	0.060	0.055	3.611	0.051	0.054	0.056	0.053
		8	0.071	**0.069**	**0.071**	**0.067**	0.072	**0.071**	1.243	0.072	0.071	0.073	**0.069**
		10	0.092	0.100	**0.089**	**0.088**	0.098	**0.090**	0.398	**0.091**	**0.090**	**0.091**	**0.091**
		12	0.116	0.121	0.119	**0.109**	0.121	0.120	0.353	0.118	0.128	0.119	0.116
	Climate	6	1.205	1.305	1.310	**1.172**	**1.124**	1.235	1.233	1.289	**1.185**	1.272	**1.073**
		8	1.240	**1.225**	**1.124**	**1.219**	**1.231**	1.300	**1.064**	1.289	**1.238**	**1.202**	1.250
		10	1.283	1.296	**1.275**	**1.240**	**1.217**	**1.172**	**1.059**	**1.245**	**1.224**	1.296	**1.176**
		12	1.262	**1.233**	**1.199**	**1.205**	**1.257**	**1.239**	**1.069**	**1.219**	**1.202**	**1.203**	**1.163**
	Economy	6	0.016	0.021	0.018	0.017	**0.016**	**0.016**	8.469	0.017	0.017	0.017	0.017
		8	0.018	0.020	0.019	0.020	**0.017**	0.018	8.968	**0.018**	0.019	0.019	0.020
		10	0.020	0.020	**0.019**	0.023	0.020	**0.019**	1.101	0.021	**0.019**	0.023	**0.019**
		12	0.020	0.022	**0.019**	0.022	0.022	**0.020**	1.087	0.021	0.021	**0.019**	**0.020**
	Energy	12	0.106	0.106	**0.102**	**0.099**	**0.086**	**0.100**	0.181	**0.102**	**0.094**	**0.099**	**0.101**
		24	0.159	0.205	0.210	0.206	0.207	0.188	0.555	0.208	0.166	0.179	0.186
		36	0.333	**0.312**	**0.315**	**0.324**	**0.304**	**0.282**	0.496	**0.311**	**0.304**	**0.287**	**0.306**
		48	0.391	0.461	**0.379**	0.408	0.413	0.412	0.499	**0.365**	**0.354**	**0.338**	0.404
	Environment	48	0.430	**0.428**	0.433	0.433	0.432	0.436	0.451	**0.427**	**0.425**	**0.428**	0.439
		96	0.433	0.482	**0.428**	0.434	**0.419**	0.455	0.452	0.457	0.434	0.457	0.439
		192	0.443	0.499	**0.438**	**0.442**	**0.420**	0.473	0.455	**0.430**	**0.432**	0.475	**0.436**
		336	0.438	0.472	**0.434**	**0.431**	**0.435**	0.450	0.477	0.454	0.458	**0.430**	**0.408**
	Public Health	12	0.841	**0.816**	**0.828**	0.999	**0.817**	0.911	1.209	0.858	**0.796**	**0.716**	**0.724**
		24	1.160	1.248	**0.948**	1.247	**1.102**	1.236	1.866	1.186	1.351	1.222	**1.032**
		36	1.247	1.442	**1.205**	1.298	1.432	1.442	1.619	1.361	**1.201**	1.340	1.371
		48	1.593	1.622	**1.408**	**1.301**	1.614	**1.241**	1.749	**1.541**	**1.531**	**1.343**	**1.269**
	Security	6	103.4	**102.3**	**102.0**	**100.3**	**101.3**	**101.3**	123.2	**100.6**	**100.8**	**102.3**	**99.239**
		8	104.9	106.7	105.3	105.6	106.1	105.0	123.6	**104.5**	**103.5**	**104.3**	105.3
		10	107.8	107.9	108.5	108.0	**107.5**	107.9	122.1	**107.8**	108.3	107.9	**107.8**
		12	109.3	109.7	110.0	110.2	109.5	109.4	119.5	**109.2**	**109.0**	109.4	109.7
	Social Good	6	0.790	0.811	0.811	**0.763**	0.817	**0.771**	4.397	0.810	0.828	0.799	0.793
		8	0.909	0.951	**0.880**	0.912	0.944	**0.883**	2.817	0.951	0.911	**0.899**	**0.897**
		10	1.018	**0.963**	**0.979**	**0.947**	1.045	**0.983**	1.095	1.071	**0.933**	**0.987**	**0.928**
		12	1.073	1.165	**1.038**	**0.997**	1.075	1.150	**1.071**	1.169	1.102	1.098	**1.020**
	Traffic	6	0.182	0.183	**0.171**	**0.180**	**0.178**	**0.171**	0.876	0.186	0.187	**0.174**	**0.172**
		8	0.185	**0.184**	0.188	0.194	0.202	0.191	0.622	0.190	**0.185**	**0.185**	**0.180**
		10	0.187	0.191	**0.187**	0.191	0.198	0.189	0.223	0.189	0.189	0.191	0.187
		12	0.243	0.254	0.253	0.251	**0.240**	**0.240**	0.269	0.251	0.243	**0.242**	**0.243**

Table L.2: Comparison of multimodal fusion strategies with Koopa (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Koopa	Agriculture	6	0.059	**0.056**	**0.058**	**0.058**	5.693	3.044	3.044	0.060	0.067	**0.055**	**0.056**
		8	0.077	0.078	**0.072**	**0.072**	0.173	0.108	0.108	**0.076**	0.092	**0.073**	**0.076**
		10	0.099	**0.091**	**0.090**	**0.090**	0.426	0.624	0.624	0.100	0.127	**0.091**	0.100
		12	0.129	**0.119**	**0.117**	**0.117**	1.032	1.233	1.233	0.131	0.155	**0.117**	**0.128**
	Climate	6	1.251	6.593	1.258	1.258	4.140	**1.219**	**1.219**	1.277	**1.069**	1.253	1.253
		8	1.264	1.499	**1.261**	**1.261**	**1.192**	**1.122**	**1.122**	1.291	**1.057**	**1.262**	**1.258**
		10	1.247	3.355	1.254	1.254	1.404	**1.045**	**1.045**	1.296	**1.112**	**1.243**	1.247
		12	1.232	1.254	1.252	1.252	**1.187**	**1.191**	**1.191**	1.260	**1.070**	1.242	1.232
	Economy	6	0.021	0.033	0.027	0.027	13.556	16.346	16.346	0.028	0.044	0.026	**0.017**
		8	0.017	0.018	0.020	0.020	0.628	0.540	0.540	0.024	0.072	0.018	0.018
		10	0.017	0.022	0.027	0.027	3.752	3.152	3.152	0.027	0.064	0.018	**0.017**
		12	0.018	0.028	0.028	0.028	0.304	15.139	15.139	0.027	0.085	0.022	0.018
	Energy	12	0.107	2140.3	0.108	0.108	56.945	0.156	0.156	0.117	0.109	0.110	0.107
		24	0.216	0.256	**0.209**	**0.209**	283.8	0.384	0.384	0.234	0.216	**0.199**	**0.205**
		36	0.300	**0.284**	**0.296**	**0.296**	1.199	0.553	0.553	0.310	**0.296**	**0.296**	**0.299**
		48	0.388	4008.7	0.397	0.397	2.901	1.672	1.672	0.428	0.410	0.392	0.402
	Environment	48	0.482	271860512.0	**0.455**	**0.455**	53946020.0	**0.451**	**0.451**	0.488	**0.449**	**0.476**	**0.481**
		96	0.526	488845344.0	**0.492**	**0.492**	3337.4	**0.484**	**0.484**	0.538	**0.454**	**0.490**	0.536
		192	0.567	1306404992.0	**0.524**	**0.524**	284732.7	**0.490**	**0.490**	**0.565**	**0.483**	**0.510**	**0.564**
		336	0.525	82270.4	0.535	0.535	80511.4	**0.496**	**0.496**	0.530	**0.490**	**0.523**	0.528
	Public Health	12	1.029	1297.5	**0.995**	**0.995**	36.918	**1.015**	**1.015**	1.269	1.233	**0.915**	**1.008**
		24	1.402	**1.145**	**1.152**	**1.152**	1.983	**1.242**	**1.242**	1.546	**1.379**	**1.188**	1.410
		36	1.614	**1.287**	**1.259**	**1.259**	2.083	**1.532**	**1.532**	1.762	**1.311**	**1.283**	1.625
		48	1.728	**1.478**	**1.378**	**1.378**	1.793	1.950	1.950	1.871	**1.455**	**1.362**	**1.715**
	Security	6	105.1	**97.736**	**103.4**	**103.4**	136.4	140.4	140.4	**104.9**	109.3	**103.5**	**104.5**
		8	109.1	**106.4**	111.6	111.6	110.4	110.4	110.4	113.7	113.0	**107.2**	**105.5**
		10	108.8	**100.8**	**108.8**	**108.8**	117.7	118.3	118.3	110.6	111.6	108.8	**108.7**
		12	111.3	**109.4**	**110.3**	**110.3**	158.4	149.1	149.1	113.0	116.9	**110.2**	**109.4**
	Social Good	6	0.849	0.854	0.869	0.869	3.863	3.757	3.757	**0.847**	**0.739**	**0.793**	0.849
		8	0.931	1.195	**0.911**	**0.911**	**0.929**	0.962	0.962	0.939	**0.849**	**0.877**	**0.914**
		10	0.985	1.145	1.005	1.005	1.291	1.245	1.245	0.998	**0.859**	**0.895**	0.994
		12	1.078	**1.045**	**1.059**	**1.059**	3.136	2.738	2.738	**1.060**	**0.889**	**1.020**	1.079
	Traffic	6	0.226	0.280	**0.221**	**0.221**	1.695	1.863	1.863	0.245	0.238	0.232	**0.196**
		8	0.214	**0.213**	0.225	0.225	**0.204**	**0.213**	**0.213**	0.227	0.219	**0.211**	**0.207**
		10	0.216	0.223	0.224	0.224	0.653	0.498	0.498	0.224	0.218	0.221	**0.209**
		12	0.274	0.337	0.285	0.285	2.742	1.386	1.386	0.280	0.277	0.283	**0.269**

Table L.3: Comparison of multimodal fusion strategies with DLinear (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
DLinear	Agriculture	6	0.114	0.127	0.134	0.132	0.575	0.320	0.454	0.135	0.233	0.133	**0.085**
		8	0.324	**0.182**	**0.185**	**0.181**	0.973	2.019	1.390	**0.206**	**0.217**	**0.223**	**0.099**
		10	0.163	0.203	0.204	0.204	0.481	0.419	0.199	0.178	0.208	0.205	**0.127**
		12	0.217	0.239	0.240	0.242	0.428	0.350	0.326	**0.162**	0.410	**0.180**	**0.183**
	Climate	6	1.198	1.277	1.229	1.203	1.308	1.252	1.219	1.306	**1.084**	1.241	**1.090**
		8	1.364	**1.318**	**1.267**	**1.247**	**1.250**	**1.064**	**1.162**	**1.328**	**1.071**	**1.241**	**1.090**
		10	1.166	1.312	1.333	1.285	1.181	**1.101**	**1.105**	1.289	**1.105**	1.305	**1.116**
		12	1.174	1.343	1.321	1.289	**1.156**	**1.117**	**1.122**	1.290	**1.096**	1.257	**1.098**
	Economy	6	0.090	0.092	0.098	0.097	18.033	13.749	13.121	0.107	0.345	0.109	**0.024**
		8	0.233	**0.129**	**0.143**	**0.143**	12.672	12.211	12.812	**0.131**	0.274	**0.153**	**0.025**
		10	0.086	0.123	0.130	0.131	2.683	2.407	2.495	0.102	0.260	0.151	**0.051**
		12	0.109	0.128	0.130	0.129	1.884	1.555	2.258	**0.064**	0.576	**0.091**	**0.060**
	Energy	12	0.115	0.193	0.155	0.140	0.224	0.170	0.154	0.132	**0.113**	0.131	**0.096**
		24	0.219	0.283	0.259	0.259	0.793	0.287	0.280	0.262	0.299	0.225	**0.201**
		36	0.303	0.347	0.322	0.322	0.585	0.346	0.341	0.322	0.365	0.369	**0.284**
		48	0.415	0.474	0.438	0.458	0.674	0.693	0.679	0.439	0.460	0.458	**0.391**
	Environment	48	0.490	**0.433**	**0.438**	**0.439**	**0.466**	**0.447**	**0.444**	0.495	**0.442**	**0.443**	**0.489**
		96	0.568	**0.506**	**0.492**	**0.473**	**0.539**	**0.493**	**0.494**	0.570	**0.461**	**0.478**	0.572
		192	0.583	**0.516**	**0.501**	**0.495**	**0.571**	0.589	0.614	0.585	**0.528**	**0.502**	0.587
		336	0.538	**0.511**	**0.488**	**0.484**	**0.518**	**0.483**	**0.487**	**0.536**	**0.490**	**0.481**	0.538
	Public Health	12	1.330	1.360	1.403	1.340	1.527	1.552	1.482	1.545	1.334	1.430	**1.228**
		24	1.578	**1.505**	1.654	**1.571**	2.005	1.709	1.663	1.677	1.690	**1.527**	1.589
		36	1.619	1.637	1.676	1.657	2.112	1.689	1.644	1.740	1.691	1.662	1.622
		48	1.691	1.714	1.749	1.734	1.963	1.822	1.779	1.765	1.727	**1.612**	**1.674**
	Security	6	104.4	105.1	104.9	**104.3**	189.4	169.6	167.0	105.7	105.9	104.6	104.8
		8	109.2	109.7	**107.8**	**107.8**	153.0	151.1	147.8	110.6	**107.9**	**108.1**	**109.0**
		10	110.5	113.3	111.8	111.3	113.2	112.8	113.0	110.6	111.2	**110.4**	**109.7**
		12	112.0	114.9	113.3	112.5	113.3	113.3	113.2	113.0	114.6	112.8	**111.7**
	Social Good	6	0.817	0.895	0.907	0.874	2.990	1.969	1.903	0.893	0.928	0.853	**0.779**
		8	0.885	1.146	1.009	1.142	2.403	2.138	2.032	0.942	0.946	0.913	**0.870**
		10	1.026	1.050	1.090	**1.012**	1.074	**0.954**	**0.959**	1.141	**0.983**	1.121	**0.966**
		12	1.010	1.136	1.133	1.071	1.144	**1.003**	1.031	1.068	1.040	1.082	**1.003**
	Traffic	6	0.254	0.289	0.313	0.294	2.952	2.158	2.659	0.285	0.367	0.290	**0.227**
		8	0.322	0.322	0.349	0.327	2.278	2.012	2.147	**0.270**	0.324	0.339	**0.224**
		10	0.243	0.323	0.345	0.331	0.646	0.316	0.568	0.264	0.315	0.341	**0.219**
		12	0.287	0.342	0.381	0.368	0.549	0.545	0.364	0.307	0.365	0.319	**0.261**

Table L.4: Comparison of multimodal fusion strategies with iTransformer (+ BERT).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
iTransformer	Agriculture	6	0.059	0.060	0.061	**0.058**	0.062	**0.058**	1.273	**0.059**	0.060	0.059	**0.059**
		8	0.076	0.078	0.081	**0.072**	**0.076**	0.077	1.097	0.081	0.080	0.079	**0.076**
		10	0.097	0.103	0.101	**0.090**	0.097	0.099	0.347	0.101	0.103	0.098	0.098
		12	0.128	0.129	0.129	**0.118**	0.128	0.131	0.390	0.128	0.131	0.129	**0.127**
	Climate	6	1.100	1.189	1.140	1.128	1.130	1.141	1.326	1.141	1.130	1.150	1.115
		8	1.178	1.204	1.203	1.193	**1.162**	1.193	**1.158**	1.202	1.231	1.197	1.227
		10	1.186	1.200	1.201	1.188	**1.174**	1.248	**1.038**	1.200	1.204	1.226	1.206
		12	1.176	**1.174**	**1.163**	1.181	1.197	1.182	**1.035**	**1.154**	1.191	1.198	1.183
	Economy	6	0.015	**0.015**	**0.015**	0.020	**0.015**	0.015	15.774	**0.015**	0.016	**0.015**	**0.014**
		8	0.015	0.016	**0.015**	0.021	**0.015**	0.016	10.479	0.015	0.016	0.016	**0.015**
		10	0.015	0.016	**0.015**	0.017	**0.015**	0.016	1.191	**0.015**	**0.015**	0.016	**0.015**
		12	0.016	**0.016**	**0.016**	0.018	**0.015**	**0.016**	1.192	**0.016**	**0.016**	**0.016**	**0.016**
	Energy	12	0.111	**0.108**	**0.102**	**0.111**	**0.107**	**0.111**	0.214	**0.102**	**0.107**	**0.107**	**0.111**
		24	0.228	**0.227**	0.230	**0.221**	**0.227**	**0.221**	0.672	**0.205**	**0.216**	0.228	0.231
		36	0.302	**0.283**	0.318	**0.278**	**0.274**	0.311	1.301	**0.294**	0.317	**0.295**	0.307
		48	0.408	**0.402**	**0.405**	**0.403**	**0.374**	0.414	0.709	**0.403**	**0.395**	**0.388**	**0.380**
	Environment	48	0.411	**0.401**	**0.408**	0.425	**0.404**	**0.408**	0.451	**0.410**	**0.407**	**0.405**	**0.410**
		96	0.418	**0.406**	0.429	0.446	**0.418**	0.422	0.510	0.432	0.425	**0.413**	0.420
		192	0.435	**0.432**	**0.422**	0.463	**0.421**	0.437	0.536	0.438	0.436	**0.430**	**0.430**
		336	0.418	**0.416**	0.427	0.441	**0.413**	0.422	**0.415**	0.427	0.425	0.419	0.424
	Public Health	12	1.023	**0.966**	1.044	**0.965**	1.071	**0.981**	**0.991**	1.048	**0.987**	**0.940**	1.043
		24	1.438	1.465	1.455	**1.226**	1.445	**1.433**	1.599	1.453	1.464	1.448	**1.437**
		36	1.637	1.647	**1.625**	**1.291**	1.676	**1.620**	1.883	**1.623**	**1.635**	**1.627**	**1.628**
		48	1.738	1.749	**1.737**	**1.457**	1.790	**1.711**	1.906	**1.735**	1.749	1.751	1.747
	Security	6	104.9	**104.2**	**102.5**	112.7	**102.7**	**103.2**	134.4	**100.8**	**104.0**	**102.8**	105.1
		8	108.7	**106.8**	**106.3**	113.1	**105.8**	**106.1**	134.6	**107.4**	**106.5**	**106.4**	108.9
		10	111.4	112.4	**107.8**	**109.6**	**109.3**	**109.0**	122.4	**108.2**	**109.1**	**108.4**	**110.8**
		12	114.0	**111.1**	**110.0**	119.3	**111.1**	**110.6**	118.6	**111.2**	**112.6**	**111.7**	**111.1**
	Social Good	6	0.830	**0.828**	0.832	**0.782**	0.832	0.859	4.210	0.832	**0.827**	**0.829**	**0.811**
		8	0.961	**0.951**	0.970	**0.893**	**0.924**	**0.960**	2.405	0.970	**0.939**	0.967	**0.945**
		10	1.061	1.066	1.062	**0.987**	1.063	**1.056**	1.128	1.062	**0.946**	**1.053**	**1.060**
		12	1.144	1.162	1.168	**1.076**	**1.130**	1.171	**1.123**	1.169	**1.139**	**1.139**	**1.125**
	Traffic	6	0.179	0.187	0.180	0.187	0.202	0.188	1.668	0.182	**0.176**	0.179	**0.176**
		8	0.185	0.188	0.187	0.197	0.189	0.202	1.946	0.187	**0.184**	**0.178**	0.189
		10	0.195	**0.195**	**0.194**	0.199	**0.194**	0.196	0.411	**0.188**	**0.191**	**0.187**	0.197
		12	0.249	**0.248**	0.251	0.255	0.250	0.251	0.265	0.252	0.252	**0.232**	**0.238**

Table L.5: Comparison of multimodal fusion strategies with PatchTST (+ BERT).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
PatchTST	Agriculture	6	0.058	0.059	0.060	**0.056**	0.059	0.060	1.357	0.059	0.060	0.060	0.058
		8	0.078	0.078	0.080	**0.074**	0.078	0.079	0.816	**0.078**	0.079	0.079	**0.077**
		10	0.100	**0.098**	0.101	**0.093**	**0.098**	0.101	0.382	0.101	0.101	0.101	0.100
		12	0.132	**0.129**	**0.129**	**0.122**	**0.129**	**0.128**	0.371	**0.129**	**0.131**	**0.127**	**0.129**
	Climate	6	1.257	**1.234**	**1.238**	**1.235**	**1.234**	**1.253**	1.332	**1.238**	**1.248**	**1.215**	**1.230**
		8	1.265	**1.255**	**1.224**	**1.257**	**1.255**	**1.249**	**1.183**	**1.224**	**1.252**	**1.233**	**1.236**
		10	1.274	1.276	**1.256**	**1.264**	1.276	**1.267**	**1.092**	**1.256**	**1.262**	**1.248**	1.276
		12	1.239	1.248	1.242	1.254	1.248	1.255	**1.090**	1.242	1.264	1.240	1.251
	Economy	6	0.016	0.016	0.017	0.020	0.016	0.017	17.735	0.016	0.017	0.017	0.016
		8	0.017	**0.017**	0.019	0.019	**0.017**	**0.017**	10.180	0.019	0.017	0.017	0.017
		10	0.017	0.017	0.017	0.021	0.017	0.017	1.351	0.017	0.017	0.017	0.017
		12	0.017	0.018	0.018	0.019	0.018	0.017	1.250	0.018	0.018	0.018	0.018
	Energy	12	0.105	**0.102**	0.110	0.109	**0.102**	0.108	0.193	0.110	0.112	0.108	0.113
		24	0.226	0.227	**0.222**	**0.219**	0.227	**0.223**	0.606	**0.222**	**0.224**	**0.215**	**0.213**
		36	0.310	**0.302**	**0.306**	**0.299**	**0.302**	0.317	1.074	**0.305**	0.319	0.316	**0.305**
		48	0.414	0.430	0.424	**0.409**	0.430	0.415	0.557	0.424	0.417	0.419	0.415
	Environment	48	0.459	0.461	**0.457**	**0.451**	0.461	**0.459**	0.469	0.462	**0.456**	**0.454**	0.462
		96	0.504	**0.496**	**0.503**	**0.486**	**0.496**	0.508	0.563	**0.459**	**0.493**	**0.471**	**0.475**
		192	0.542	**0.541**	**0.531**	**0.494**	**0.541**	**0.540**	0.604	**0.539**	**0.539**	**0.519**	**0.507**
		336	0.509	**0.500**	0.511	**0.507**	**0.500**	0.512	**0.476**	**0.507**	0.513	**0.503**	**0.479**
	Public Health	12	0.913	**0.891**	0.914	**0.849**	**0.891**	0.919	1.089	0.914	**0.908**	**0.881**	**0.901**
		24	1.391	**1.316**	**1.289**	**1.158**	**1.316**	**1.349**	1.720	**1.379**	1.400	**1.330**	**1.364**
		36	1.623	**1.620**	**1.606**	**1.362**	**1.620**	1.624	**1.463**	**1.605**	**1.611**	**1.616**	**1.607**
		48	1.724	1.727	1.730	**1.473**	1.727	**1.718**	1.799	1.730	1.724	1.727	1.743
	Security	6	104.5	**104.3**	**102.9**	105.5	**104.3**	**103.3**	142.8	**103.2**	104.6	104.7	**104.5**
		8	110.1	**109.6**	**105.8**	**104.7**	**109.6**	**106.3**	137.9	**106.8**	**108.1**	**107.3**	**107.2**
		10	113.3	**109.9**	**108.8**	**110.5**	**109.9**	**108.8**	119.7	**108.1**	**109.8**	**108.9**	**110.8**
		12	109.8	111.4	110.1	111.0	111.4	111.7	119.3	110.1	110.6	112.1	113.7
	Social Good	6	0.800	0.802	**0.787**	**0.764**	0.802	**0.785**	4.051	**0.788**	0.802	**0.792**	**0.770**
		8	0.894	**0.891**	**0.886**	**0.840**	**0.891**	**0.881**	2.800	**0.885**	0.909	0.899	**0.880**
		10	1.030	1.031	1.051	**0.960**	1.031	1.051	1.090	1.051	**1.014**	1.046	**1.010**
		12	1.126	**1.118**	**1.087**	**1.014**	**1.118**	**1.077**	**1.089**	**1.085**	**1.105**	**1.076**	**1.059**
	Traffic	6	0.184	**0.181**	0.184	**0.179**	**0.181**	0.188	1.819	**0.183**	0.188	**0.172**	**0.171**
		8	0.181	**0.178**	0.185	0.193	**0.178**	0.190	1.937	**0.178**	0.185	**0.181**	**0.177**
		10	0.189	**0.188**	**0.184**	0.201	**0.188**	0.201	0.443	0.191	**0.188**	**0.183**	**0.182**
		12	0.238	0.244	0.253	0.253	0.244	0.245	0.434	**0.235**	0.241	0.242	0.257

Table L.6: Comparison of multimodal fusion strategies with FEDformer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FEDformer	Agriculture	6	0.060	0.063	0.064	**0.058**	0.062	**0.058**	1.314	0.063	**0.057**	0.061	**0.054**
		8	0.072	0.075	0.074	0.076	0.079	**0.068**	1.026	0.072	0.073	**0.071**	**0.069**
		10	0.099	**0.096**	**0.090**	**0.091**	0.104	**0.096**	0.278	**0.089**	**0.089**	**0.089**	**0.090**
		12	0.117	**0.113**	0.120	0.118	0.124	0.119	0.435	0.118	0.120	0.123	0.117
	Climate	6	1.116	1.155	**1.093**	1.141	**1.071**	**1.085**	1.242	**1.093**	**1.066**	**1.055**	**1.058**
		8	1.082	**1.071**	**1.057**	**1.078**	**1.077**	**1.050**	**1.052**	**1.057**	**1.049**	**1.076**	**1.044**
		10	1.105	1.109	1.124	**1.102**	**1.054**	1.112	**0.898**	1.124	1.113	**1.094**	**1.068**
		12	1.084	1.116	1.104	1.106	1.134	**1.061**	**0.924**	1.106	1.114	1.094	1.092
	Economy	6	0.039	0.060	0.047	**0.027**	0.041	0.045	7.623	**0.026**	**0.030**	**0.033**	0.046
		8	0.047	0.053	0.051	0.055	**0.029**	0.049	7.812	**0.045**	**0.045**	**0.046**	**0.040**
		10	0.037	0.051	0.047	0.039	0.052	**0.034**	1.619	0.047	0.040	0.053	0.044
		12	0.044	0.046	**0.040**	0.054	0.045	**0.038**	1.455	**0.040**	**0.042**	**0.034**	**0.041**
	Energy	12	0.097	0.103	**0.091**	**0.097**	0.111	**0.095**	0.131	**0.091**	**0.097**	**0.092**	**0.093**
		24	0.177	0.184	0.181	0.177	0.183	0.179	1.130	0.181	**0.175**	**0.175**	0.179
		36	0.254	0.296	0.263	**0.251**	0.346	**0.254**	0.726	0.256	**0.253**	0.254	0.254
		48	0.367	0.384	0.404	**0.363**	0.416	**0.357**	1.225	0.451	**0.366**	**0.365**	**0.356**
	Environment	48	0.484	**0.471**	**0.472**	**0.463**	**0.481**	**0.430**	**0.473**	**0.483**	**0.475**	**0.450**	**0.459**
		96	0.488	0.514	0.517	0.501	0.498	**0.482**	**0.419**	0.516	0.536	0.518	0.493
		192	0.482	0.513	0.528	0.497	0.528	0.549	**0.476**	0.528	0.505	0.505	0.502
		336	0.466	0.470	**0.466**	0.481	**0.463**	**0.464**	**0.438**	0.469	0.477	0.477	**0.445**
	Public Health	12	1.050	1.068	1.084	1.089	1.168	**1.024**	1.071	1.087	1.089	1.063	1.063
		24	1.488	**1.449**	**1.311**	**1.348**	1.529	**1.367**	**1.449**	**1.379**	**1.383**	**1.409**	**1.385**
		36	1.419	1.568	1.554	1.518	1.492	1.492	1.927	1.435	1.421	1.493	1.466
		48	1.499	1.599	1.582	1.602	1.736	1.521	1.564	1.543	1.617	1.512	**1.481**
	Security	6	105.9	110.0	106.1	**102.3**	106.1	107.9	170.2	**104.4**	**103.8**	110.1	107.3
		8	109.1	**108.0**	109.6	**108.7**	110.3	109.8	142.9	109.7	110.0	**107.4**	**106.8**
		10	113.8	**112.3**	**111.6**	**110.9**	**112.4**	116.2	**113.7**	**111.6**	**113.3**	**108.2**	**113.3**
		12	117.2	**116.9**	**114.8**	**114.8**	**114.7**	117.4	**116.7**	**114.8**	**115.6**	**111.2**	**114.3**
	Social Good	6	0.874	0.886	**0.807**	**0.822**	**0.861**	**0.862**	1.783	**0.806**	**0.773**	**0.793**	**0.839**
		8	0.919	**0.857**	**0.884**	**0.857**	**0.900**	**0.855**	1.962	**0.883**	**0.873**	**0.883**	**0.853**
		10	0.914	0.931	**0.895**	0.919	1.044	0.934	0.961	**0.895**	**0.903**	0.919	0.927
		12	1.015	**0.977**	**0.994**	**0.960**	1.108	**1.000**	1.117	**0.993**	**0.973**	**0.986**	**0.977**
	Traffic	6	0.149	0.156	0.151	0.158	**0.146**	0.153	2.007	0.161	0.155	0.150	0.153
		8	0.152	0.158	**0.151**	0.160	**0.144**	0.158	1.351	**0.151**	0.154	0.154	0.159
		10	0.166	0.173	**0.163**	**0.166**	**0.146**	**0.160**	0.292	**0.164**	**0.162**	**0.159**	**0.157**
		12	0.224	0.229	0.229	0.240	**0.213**	**0.213**	0.428	0.232	**0.223**	**0.221**	0.230

Table L.7: Comparison of multimodal fusion strategies with FiLM (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FiLM	Agriculture	6	0.061	0.103	0.062	0.064	2.776	0.062	4.712	0.064	0.064	0.061	0.063
		8	0.082	0.200	**0.081**	**0.080**	2.550	0.087	1.179	**0.080**	**0.080**	**0.080**	**0.078**
		10	0.105	0.182	**0.105**	**0.100**	0.149	0.109	0.337	0.105	0.107	**0.103**	**0.103**
		12	0.143	**0.142**	**0.133**	**0.123**	1.022	**0.136**	0.465	**0.133**	**0.136**	**0.136**	**0.132**
	Climate	6	1.305	**1.274**	**1.282**	**1.268**	1.427	**1.266**	1.320	**1.270**	**1.287**	**1.233**	**1.254**
		8	1.282	**1.273**	**1.268**	**1.268**	**1.069**	1.292	**1.099**	1.313	**1.263**	**1.255**	**1.264**
		10	1.278	9.623	**1.274**	1.280	7.707	1.290	**1.097**	1.286	1.285	**1.272**	**1.273**
		12	1.280	10.115	**1.280**	1.289	1.882	1.291	**1.110**	1.301	1.281	1.311	**1.264**
	Economy	6	0.017	0.065	0.026	0.035	23.248	0.021	20.595	0.019	0.018	0.019	0.017
		8	0.018	0.048	0.020	0.020	14.450	0.020	13.853	**0.017**	**0.017**	**0.018**	0.018
		10	0.019	0.039	0.020	0.019	0.039	0.020	2.648	**0.019**	**0.018**	**0.018**	**0.018**
		12	0.018	7.453	0.023	0.045	1.776	0.021	2.441	**0.018**	**0.018**	0.018	**0.018**
	Energy	12	0.119	2575.9	**0.117**	0.121	0.402	0.133	0.178	**0.104**	**0.103**	**0.108**	**0.102**
		24	0.229	0.340	0.250	0.259	0.747	0.252	0.791	**0.211**	**0.216**	**0.228**	**0.206**
		36	0.302	0.382	0.333	0.328	1.555	0.339	1.447	0.303	0.318	0.315	**0.300**
		48	0.435	0.483	**0.431**	0.453	0.673	0.481	0.645	**0.419**	**0.430**	0.437	**0.429**
	Environment	48	0.488	177523232.0	**0.479**	**0.471**	0.498	**0.477**	0.515	0.490	**0.444**	**0.448**	0.490
		96	0.546	36514.0	0.547	**0.490**	0.582	**0.537**	0.608	0.546	**0.542**	**0.480**	**0.540**
		192	0.574	985353600.0	0.576	**0.542**	0.587	**0.561**	0.615	**0.573**	**0.569**	**0.573**	**0.570**
		336	0.529	0.599	**0.514**	**0.519**	0.539	0.531	**0.481**	**0.526**	**0.500**	**0.528**	**0.527**
	Public Health	12	1.155	2890.2	1.191	**1.142**	2.007	1.271	1.219	**1.117**	**1.130**	**1.122**	**1.106**
		24	1.492	**1.435**	1.496	**1.339**	2.784	1.643	1.841	**1.453**	1.494	**1.474**	**1.432**
		36	1.635	1.779	**1.632**	1.838	2.019	1.681	2.346	1.873	1.658	1.660	1.685
		48	1.722	2.053	1.796	2.035	1.998	1.780	1.824	**1.722**	1.746	1.761	1.739
	Security	6	124.2	**105.9**	**102.1**	**100.9**	208.1	**103.5**	191.0	**102.8**	**101.6**	**102.3**	**107.1**
		8	113.8	116.7	**106.5**	116.5	151.0	**105.7**	163.2	**109.3**	**105.1**	**106.3**	**105.1**
		10	117.0	135.0	**109.3**	133.5	**97.995**	**108.1**	**111.9**	**109.4**	**108.3**	**109.1**	**114.0**
		12	119.0	134.6	**110.0**	**108.1**	**96.776**	**110.3**	**113.2**	132.4	**113.1**	**110.9**	**113.8**
	Social Good	6	0.900	49.855	**0.831**	**0.822**	3.632	**0.840**	3.854	**0.820**	**0.798**	**0.835**	**0.818**
		8	0.994	1.101	0.998	1.049	2.161	**0.971**	2.346	1.000	**0.953**	**0.945**	**0.967**
		10	1.119	114.0	**1.031**	1.191	123.0	**1.107**	**1.115**	**1.014**	1.137	**1.059**	1.123
		12	1.216	280.3	**1.087**	**1.090**	90.555	**1.185**	**1.080**	1.248	1.237	**1.159**	**1.165**
	Traffic	6	0.229	0.285	0.234	0.252	4.318	0.235	3.520	0.256	0.233	0.234	0.236
		8	0.223	0.226	**0.220**	**0.221**	0.682	0.230	2.414	0.230	0.228	**0.219**	0.233
		10	0.216	0.224	0.217	**0.215**	0.396	0.219	0.557	0.241	0.228	0.217	**0.215**
		12	0.253	0.515	0.261	0.270	0.269	0.267	0.526	0.283	0.262	0.271	**0.251**

Table L.8: Comparison of multimodal fusion strategies with TiDE (+ BERT).

TS Model	Dataset	*H*	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TiDE	Agriculture	6	0.071	**0.069**	0.082	**0.069**	1.152	**0.065**	1.159	**0.063**	**0.063**	**0.062**	**0.060**
		8	0.091	**0.090**	0.092	**0.091**	1.226	0.093	1.179	**0.082**	**0.082**	**0.080**	**0.082**
		10	0.112	7.192	**0.110**	0.112	11.723	0.120	0.435	**0.103**	**0.104**	**0.104**	**0.103**
		12	0.160	8.039	**0.144**	**0.135**	14.564	**0.150**	0.405	**0.135**	**0.134**	**0.134**	**0.135**
	Climate	6	1.456	1.577	1.606	1.576	1.491	**1.418**	**1.363**	**1.252**	**1.244**	**1.239**	**1.258**
		8	1.469	1.555	1.481	**1.446**	**1.048**	1.532	**1.172**	**1.264**	**1.274**	**1.258**	**1.267**
		10	1.419	11.502	1.467	1.477	2.938	1.561	**1.184**	**1.274**	**1.272**	**1.259**	**1.259**
		12	1.467	3.924	**1.395**	**1.449**	2.043	1.508	**1.154**	**1.255**	**1.278**	**1.264**	**1.274**
	Economy	6	0.034	0.051	0.039	0.049	20.604	0.044	20.206	**0.017**	**0.017**	**0.017**	**0.017**
		8	0.049	**0.040**	**0.035**	**0.041**	13.386	**0.031**	13.664	**0.017**	**0.018**	**0.017**	**0.018**
		10	0.029	5.048	0.031	0.040	10.335	0.040	2.467	**0.018**	**0.017**	**0.017**	**0.017**
		12	0.033	5.311	**0.031**	0.035	4.536	0.038	2.391	**0.018**	**0.018**	**0.019**	**0.017**
	Energy	12	0.135	2110.5	0.139	**0.133**	740.5	**0.134**	0.199	**0.115**	**0.115**	**0.108**	**0.112**
		24	0.240	0.353	0.244	0.262	0.725	0.243	0.752	**0.212**	**0.210**	**0.217**	**0.220**
		36	0.323	5843.1	0.333	**0.321**	2234.7	0.332	1.525	**0.294**	**0.307**	**0.305**	**0.300**
		48	0.442	0.468	0.443	**0.430**	0.624	**0.442**	0.631	**0.403**	**0.414**	**0.407**	**0.408**
	Environment	48	0.483	0.955	0.485	**0.442**	0.502	0.485	0.519	0.485	0.483	0.485	0.484
		96	0.543	**0.513**	**0.542**	**0.512**	0.576	**0.539**	0.636	**0.541**	**0.539**	**0.539**	**0.540**
		192	0.576	13991.8	0.578	0.586	13866.6	0.577	0.689	0.577	0.577	0.577	**0.576**
		336	0.533	22627.6	0.534	**0.507**	4743.0	0.533	**0.482**	0.534	0.533	0.533	0.534
	Public Health	12	1.300	182.9	1.320	**1.295**	240.6	1.329	1.396	**1.076**	**1.128**	**1.113**	**1.106**
		24	1.520	2.213	**1.499**	1.605	1.908	1.567	1.901	**1.432**	**1.434**	**1.448**	**1.425**
		36	1.670	2374.3	**1.668**	1.731	1646.7	**1.669**	2.276	**1.605**	**1.619**	**1.617**	**1.602**
		48	1.787	1.970	**1.756**	1.822	2.018	1.788	1.910	**1.724**	**1.723**	**1.726**	**1.740**
	Security	6	146.1	**123.9**	**134.9**	**124.6**	201.4	**122.2**	191.0	**105.2**	**107.2**	**107.6**	**107.5**
		8	129.7	137.7	132.5	137.5	154.3	**128.9**	156.5	**108.3**	**108.9**	**112.4**	**109.4**
		10	132.3	147.6	135.2	133.5	**96.384**	135.4	**117.7**	**112.7**	**110.6**	**114.6**	**111.9**
		12	145.3	**144.8**	**139.2**	**138.9**	**107.5**	**142.4**	**120.8**	**112.7**	**112.3**	**112.3**	**111.7**
	Social Good	6	0.955	**0.928**	1.036	**0.943**	3.995	0.970	3.955	**0.835**	**0.836**	**0.823**	**0.843**
		8	1.037	1.100	**1.013**	1.098	2.476	1.044	2.711	**0.950**	**0.940**	**0.950**	**0.947**
		10	1.210	134.7	**1.097**	**1.168**	70.622	1.243	**0.982**	**1.071**	**1.070**	**1.109**	**1.068**
		12	1.415	156.6	**1.186**	**1.298**	57.431	**1.205**	**1.075**	**1.162**	**1.252**	**1.183**	**1.147**
	Traffic	6	0.293	0.317	**0.285**	0.317	3.595	0.301	3.130	**0.236**	**0.235**	**0.236**	**0.233**
		8	0.309	**0.306**	**0.277**	**0.301**	0.962	**0.272**	2.299	**0.236**	**0.236**	**0.234**	**0.224**
		10	0.251	11.396	**0.245**	0.320	6.953	0.302	0.641	**0.224**	**0.231**	**0.225**	**0.229**
		12	0.319	13.832	**0.308**	0.328	8.802	0.334	0.585	**0.288**	**0.290**	**0.284**	**0.289**

Table L.9: Comparison of multimodal fusion strategies with Autoformer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Autoformer	Agriculture	6	0.072	**0.072**	**0.065**	**0.063**	**0.071**	**0.062**	1.291	**0.065**	**0.068**	**0.066**	**0.061**
		8	0.083	**0.082**	0.094	**0.080**	0.089	**0.070**	1.244	**0.082**	0.094	**0.079**	0.089
		10	0.112	**0.106**	**0.105**	**0.097**	**0.109**	**0.096**	0.393	**0.104**	**0.110**	**0.100**	**0.097**
		12	0.136	0.140	0.139	**0.129**	0.141	**0.134**	0.505	**0.125**	**0.132**	**0.128**	**0.130**
	Climate	6	1.240	1.278	1.248	**1.222**	**1.168**	**1.192**	1.266	1.244	1.248	**1.206**	**1.225**
		8	1.200	1.234	1.265	**1.199**	**1.180**	**1.168**	**1.122**	1.241	**1.162**	**1.132**	**1.179**
		10	1.247	1.250	**1.218**	1.249	1.291	**1.169**	**1.025**	**1.210**	**1.208**	**1.211**	**1.211**
		12	1.177	1.208	1.199	1.265	**1.134**	1.188	**0.965**	1.249	1.201	1.195	1.178
	Economy	6	0.060	0.069	0.061	**0.058**	0.080	**0.055**	14.606	0.066	**0.053**	0.071	0.066
		8	0.070	**0.066**	**0.059**	**0.055**	**0.067**	**0.063**	10.478	**0.059**	**0.064**	**0.051**	**0.040**
		10	0.060	0.064	**0.056**	**0.033**	0.075	**0.047**	1.743	**0.043**	**0.058**	0.062	0.062
		12	0.061	0.067	**0.053**	**0.058**	0.072	**0.060**	1.573	0.061	**0.058**	**0.052**	**0.045**
	Energy	12	0.165	**0.145**	**0.142**	**0.148**	0.181	**0.125**	0.370	**0.153**	**0.163**	0.170	**0.159**
		24	0.292	0.299	0.308	0.302	0.301	0.317	1.273	0.309	0.316	0.309	0.323
		36	0.356	0.390	0.389	0.379	0.399	**0.337**	1.634	0.364	0.394	0.358	**0.349**
		48	0.485	**0.478**	**0.434**	0.495	0.495	**0.479**	1.258	**0.483**	**0.462**	**0.467**	0.490
	Environment	48	0.524	0.534	**0.522**	0.538	0.528	**0.510**	**0.482**	**0.521**	**0.498**	0.524	**0.472**
		96	0.549	0.554	**0.511**	0.564	0.560	**0.540**	**0.515**	**0.500**	**0.538**	**0.531**	**0.509**
		192	0.588	0.618	**0.535**	**0.570**	**0.562**	**0.568**	**0.574**	**0.551**	**0.535**	0.593	**0.523**
		336	0.572	**0.514**	**0.531**	**0.525**	**0.474**	**0.498**	**0.457**	**0.555**	**0.554**	**0.479**	**0.516**
	Public Health	12	1.668	**1.661**	**1.471**	1.740	**1.363**	**1.477**	**1.505**	**1.571**	**1.666**	**1.473**	**1.668**
		24	1.987	**1.953**	**1.795**	1.990	**1.945**	**1.854**	**1.693**	**1.852**	**1.921**	**1.850**	**1.787**
		36	1.920	1.977	2.004	**1.836**	2.123	1.975	**1.747**	**1.900**	2.041	1.920	1.961
		48	1.856	1.987	2.054	1.925	1.875	**1.775**	1.930	1.966	1.983	1.938	1.955
	Security	6	106.1	107.9	117.2	106.8	**105.7**	111.6	148.2	117.1	107.7	108.3	111.6
		8	110.7	112.1	**101.7**	112.5	110.9	112.5	137.2	**110.1**	113.4	**109.3**	**106.7**
		10	115.7	**115.2**	116.1	**115.2**	**111.7**	**111.3**	116.2	116.1	**112.2**	**111.7**	**113.0**
		12	117.8	**117.2**	**112.3**	**115.3**	**115.5**	**114.0**	118.3	**112.3**	**113.9**	**116.4**	**112.5**
	Social Good	6	0.838	0.888	**0.835**	0.853	**0.838**	0.863	4.334	**0.835**	0.874	0.905	0.842
		8	0.953	0.960	1.004	**0.949**	0.990	0.982	2.646	0.957	**0.938**	**0.947**	**0.909**
		10	1.058	**1.039**	1.058	**0.933**	1.097	**1.043**	1.123	**1.047**	1.062	**1.024**	**0.972**
		12	1.052	1.089	1.130	1.058	1.184	1.060	1.174	1.101	1.086	1.129	1.104
	Traffic	6	0.172	0.193	**0.170**	0.183	0.194	**0.168**	1.256	0.174	0.174	0.180	0.183
		8	0.206	**0.200**	**0.198**	**0.197**	0.219	**0.179**	1.718	0.211	**0.175**	**0.186**	**0.190**
		10	0.191	0.214	0.201	0.202	**0.184**	**0.176**	0.448	**0.187**	**0.189**	0.203	0.201
		12	0.239	0.266	**0.236**	0.251	0.267	**0.226**	0.414	**0.238**	0.246	**0.226**	**0.230**

Table L.10: Comparison of multimodal fusion strategies with Crossformer (+ BERT).

TS Model	Dataset	*H*	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Crossformer	Agriculture	6	0.088	0.132	0.146	0.115	**0.088**	0.152	0.210	0.159	0.184	0.213	0.166
		8	0.207	**0.194**	0.227	0.235	1.212	0.265	0.318	**0.171**	0.238	**0.167**	0.247
		10	0.252	0.301	**0.215**	0.376	**0.186**	0.300	0.470	**0.229**	**0.186**	0.255	0.260
		12	0.311	0.325	**0.225**	0.366	0.404	0.411	0.365	0.387	**0.301**	0.318	0.393
	Climate	6	1.039	1.054	1.083	1.065	1.057	1.042	1.051	1.062	1.063	**1.012**	1.119
		8	1.080	**1.070**	**1.047**	**1.066**	1.112	**1.072**	1.102	1.095	**1.074**	1.080	1.090
		10	1.088	1.117	1.090	**1.083**	**1.084**	**1.072**	1.099	**1.062**	**1.080**	1.099	1.113
		12	1.090	1.118	**1.082**	1.108	1.134	**1.076**	**1.086**	**1.083**	**1.085**	**1.086**	1.105
	Economy	6	0.468	**0.315**	**0.320**	**0.166**	**0.282**	0.508	0.499	**0.248**	**0.340**	**0.289**	**0.157**
		8	0.123	0.602	0.380	0.642	6.145	0.492	0.761	0.638	0.349	0.285	0.588
		10	0.122	0.700	0.382	0.673	0.554	0.866	0.686	0.693	0.424	0.445	0.365
		12	0.323	0.968	**0.299**	0.876	0.603	1.041	1.269	0.746	0.448	0.472	0.406
	Energy	12	0.145	**0.133**	**0.136**	**0.135**	0.169	0.165	**0.144**	**0.122**	**0.130**	**0.140**	0.155
		24	0.252	0.256	0.256	**0.239**	0.281	**0.225**	0.257	**0.234**	**0.243**	0.253	0.261
		36	0.345	0.357	**0.340**	**0.337**	**0.338**	0.354	**0.322**	**0.326**	0.345	**0.334**	**0.338**
		48	0.445	0.453	**0.429**	0.446	**0.419**	**0.430**	**0.383**	0.460	0.452	0.448	**0.427**
	Environment	48	0.492	0.499	**0.473**	0.500	**0.476**	**0.474**	**0.471**	0.500	**0.485**	**0.483**	**0.448**
		96	0.589	**0.536**	**0.529**	**0.529**	**0.584**	**0.492**	**0.557**	**0.561**	**0.521**	**0.535**	**0.513**
		192	0.551	0.585	0.571	0.574	**0.532**	0.587	0.600	**0.497**	0.572	0.578	**0.508**
		336	0.527	0.539	0.556	**0.494**	**0.499**	0.539	0.538	**0.522**	0.533	**0.527**	**0.511**
	Public Health	12	1.089	1.102	**1.080**	1.138	1.174	**1.053**	1.103	1.108	**1.082**	1.131	**1.044**
		24	1.305	1.320	1.352	1.375	1.394	1.415	1.440	1.424	1.328	**1.286**	1.333
		36	1.321	1.366	1.383	1.336	1.374	1.361	1.393	1.364	1.374	1.330	1.378
		48	1.440	1.479	**1.439**	1.447	1.456	1.452	1.476	1.528	1.473	1.470	1.497
	Security	6	118.2	122.5	120.1	120.2	120.9	118.4	124.9	119.6	121.7	119.7	**116.4**
		8	121.3	126.7	123.8	123.5	133.2	122.5	127.1	123.5	123.3	123.5	122.2
		10	125.3	126.2	**125.2**	125.5	**123.9**	128.6	125.6	**125.1**	126.2	125.6	**125.0**
		12	123.3	127.3	127.2	127.6	130.2	129.3	129.1	128.0	127.0	126.8	125.6
	Social Good	6	0.755	**0.743**	**0.743**	**0.745**	**0.732**	**0.745**	**0.727**	**0.744**	**0.734**	0.770	**0.744**
		8	0.813	0.827	**0.797**	**0.813**	1.868	**0.808**	0.817	0.814	**0.809**	0.843	0.842
		10	0.885	0.890	0.914	0.890	0.927	0.898	**0.874**	**0.871**	**0.863**	**0.878**	**0.872**
		12	0.941	0.942	**0.894**	0.957	0.970	**0.905**	**0.914**	0.961	**0.911**	**0.910**	**0.899**
	Traffic	6	0.215	**0.211**	0.219	**0.210**	0.229	**0.213**	0.225	**0.213**	0.223	**0.203**	0.217
		8	0.208	0.215	**0.205**	**0.208**	1.090	0.220	**0.202**	0.215	0.213	0.237	0.234
		10	0.211	0.227	0.225	0.228	0.226	0.224	0.228	0.220	0.220	0.219	**0.209**
		12	0.254	**0.247**	**0.250**	**0.244**	0.280	**0.244**	**0.252**	**0.251**	**0.242**	**0.248**	**0.246**

Table L.11: Comparison of multimodal fusion strategies with Reformer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Reformer	Agriculture	6	0.194	0.222	0.319	0.203	0.231	**0.182**	0.308	**0.132**	**0.142**	0.198	**0.183**
		8	0.254	0.383	0.323	**0.244**	**0.234**	0.375	0.406	0.325	**0.218**	0.391	**0.231**
		10	0.215	0.519	0.323	0.339	0.529	0.299	0.701	0.322	0.363	0.379	0.295
		12	0.467	0.490	0.518	**0.435**	0.644	0.588	**0.384**	0.551	**0.437**	0.479	**0.242**
	Climate	6	1.025	1.036	**1.012**	1.092	1.056	1.060	**0.967**	**1.010**	1.047	1.028	1.074
		8	1.066	1.070	**1.042**	**1.051**	**1.037**	1.101	**1.053**	**1.041**	1.070	1.088	1.079
		10	1.057	1.098	1.127	1.066	1.122	1.097	**0.913**	1.134	1.085	1.120	1.073
		12	1.075	1.109	**1.061**	**1.033**	1.103	1.103	**1.048**	**1.063**	1.095	**1.071**	1.108
	Economy	6	0.199	0.443	0.507	0.271	0.737	**0.151**	0.786	0.343	0.341	0.632	0.477
		8	0.337	0.720	0.342	**0.307**	0.802	0.814	0.993	0.337	0.409	0.372	**0.146**
		10	0.176	1.155	0.721	0.596	0.844	1.078	1.696	0.680	0.292	1.083	0.558
		12	0.144	1.249	1.342	0.748	1.324	1.318	0.854	1.341	0.972	0.728	0.483
	Energy	12	0.205	0.221	0.250	0.236	0.253	0.281	**0.203**	**0.135**	**0.138**	**0.177**	**0.190**
		24	0.423	**0.387**	**0.383**	**0.385**	**0.346**	0.458	**0.336**	**0.366**	**0.356**	0.438	**0.351**
		36	0.509	**0.475**	**0.493**	**0.484**	**0.437**	**0.490**	**0.443**	**0.387**	0.522	**0.461**	**0.419**
		48	0.574	**0.533**	**0.570**	**0.568**	0.596	**0.529**	**0.508**	**0.556**	**0.530**	**0.572**	**0.532**
	Environment	48	0.407	**0.404**	0.445	0.420	0.435	0.430	0.429	0.433	**0.401**	0.418	0.421
		96	0.447	**0.409**	0.461	**0.433**	**0.408**	0.458	0.450	**0.436**	**0.410**	**0.386**	**0.436**
		192	0.419	**0.411**	0.458	0.443	**0.411**	0.483	0.432	0.423	**0.390**	0.438	0.431
		336	0.473	**0.411**	**0.435**	**0.437**	**0.399**	**0.433**	**0.472**	**0.411**	**0.418**	**0.383**	**0.413**
	Public Health	12	1.157	**1.111**	**1.142**	**1.148**	**1.137**	**1.096**	**1.085**	**1.131**	**1.048**	**1.106**	**1.071**
		24	1.231	1.417	1.320	1.293	1.445	1.395	1.500	1.335	1.339	1.350	1.288
		36	1.307	1.331	**1.288**	1.492	1.407	**1.292**	1.409	**1.289**	**1.285**	1.366	1.365
		48	1.356	1.431	1.416	1.430	1.609	1.404	1.475	**1.267**	**1.331**	1.406	**1.330**
	Security	6	118.3	120.0	123.7	124.1	118.5	118.6	122.4	123.7	125.2	125.4	123.6
		8	121.6	**121.1**	121.8	124.5	122.7	123.8	125.0	121.8	123.1	124.0	123.4
		10	126.2	**125.7**	**124.5**	**125.4**	129.0	**122.6**	126.7	**124.5**	**125.0**	**125.5**	**125.3**
		12	128.0	**122.1**	**125.6**	**125.9**	**126.7**	**124.7**	**126.0**	**125.6**	**126.1**	**125.1**	**125.9**
	Social Good	6	0.802	0.819	0.836	**0.775**	0.874	0.823	**0.771**	0.836	0.861	**0.800**	**0.787**
		8	0.846	0.918	0.911	0.852	0.909	0.893	0.849	0.900	0.862	0.887	0.865
		10	0.948	**0.929**	0.968	**0.914**	1.021	1.017	**0.903**	0.967	0.968	**0.905**	0.989
		12	1.023	1.097	1.052	**0.963**	**1.016**	**1.023**	1.029	**0.921**	**0.966**	**1.013**	**0.973**
	Traffic	6	0.208	0.268	0.229	0.255	0.250	0.303	0.259	0.229	0.233	0.257	0.242
		8	0.224	0.237	0.225	0.225	0.226	0.279	0.230	0.225	0.229	0.237	0.253
		10	0.261	0.273	0.309	0.269	**0.242**	0.297	**0.225**	0.298	**0.235**	0.278	**0.246**
		12	0.245	0.253	0.256	0.275	0.252	0.280	0.249	0.259	0.266	0.274	0.252

Table L.12: Comparison of multimodal fusion strategies with Transformer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Transformer	Agriculture	6	0.133	**0.119**	0.177	0.137	0.159	**0.119**	0.217	0.188	0.165	0.140	0.153
		8	0.147	0.334	**0.143**	0.243	0.210	0.174	0.433	0.163	0.161	0.211	0.182
		10	0.177	0.524	0.282	0.273	**0.133**	0.210	0.666	0.203	**0.172**	0.178	**0.158**
		12	0.247	0.312	0.254	0.325	**0.174**	0.286	0.485	0.264	**0.240**	0.254	**0.244**
	Climate	6	0.985	1.032	0.989	1.022	**0.875**	0.990	**0.983**	0.989	1.024	1.055	**0.984**
		8	1.058	**1.055**	**0.989**	**1.055**	1.086	1.091	**0.990**	**0.989**	**1.032**	**1.054**	**1.053**
		10	1.068	1.091	**1.056**	1.072	**1.066**	**1.003**	**1.016**	**1.056**	**1.021**	1.083	1.085
		12	1.102	**0.991**	**1.029**	**1.094**	1.122	**1.078**	**1.073**	**1.029**	**1.056**	**1.063**	**1.018**
	Economy	6	0.267	**0.245**	**0.059**	0.287	**0.239**	**0.267**	0.610	**0.143**	**0.061**	**0.092**	0.275
		8	0.287	0.566	**0.283**	**0.154**	**0.282**	0.320	0.571	0.390	0.506	0.515	0.327
		10	0.258	1.063	0.315	0.676	**0.069**	**0.110**	1.294	0.417	0.262	**0.250**	**0.247**
		12	0.362	1.067	0.420	**0.113**	**0.050**	0.544	0.706	**0.052**	**0.237**	**0.279**	**0.044**
	Energy	12	0.122	**0.111**	**0.091**	0.130	**0.109**	0.137	**0.101**	**0.100**	**0.105**	**0.081**	**0.121**
		24	0.289	0.295	**0.179**	**0.247**	**0.225**	**0.149**	0.318	**0.237**	**0.240**	**0.228**	**0.209**
		36	0.261	0.414	0.326	0.350	0.380	0.272	0.310	0.319	0.318	0.293	0.373
		48	0.450	**0.445**	**0.348**	0.525	**0.390**	**0.409**	**0.390**	**0.352**	0.480	**0.367**	**0.402**
	Environment	48	0.429	0.461	**0.428**	**0.426**	**0.412**	**0.405**	0.436	**0.405**	**0.420**	**0.413**	**0.419**
		96	0.462	0.482	**0.450**	**0.449**	**0.445**	**0.449**	0.467	**0.447**	**0.432**	**0.423**	**0.439**
		192	0.450	0.535	0.474	**0.446**	0.454	**0.437**	0.511	0.474	**0.445**	**0.427**	0.466
		336	0.451	0.485	0.459	**0.439**	0.465	**0.445**	0.452	**0.424**	**0.436**	**0.421**	0.469
	Public Health	12	1.124	1.137	1.201	**1.121**	**1.026**	**1.037**	**1.054**	**1.102**	**0.859**	**1.104**	**1.021**
		24	1.370	**1.278**	**1.263**	1.388	**1.121**	**1.220**	**1.331**	**1.263**	**1.256**	**1.340**	**1.286**
		36	1.317	1.330	**1.295**	**1.308**	1.438	**1.284**	1.351	**1.295**	**1.293**	**1.258**	1.330
		48	1.389	1.450	**1.316**	1.479	1.420	**1.378**	1.443	1.415	1.438	**1.309**	1.482
	Security	6	124.0	127.2	126.3	**123.0**	**122.4**	127.0	**123.1**	126.3	125.1	124.9	125.9
		8	124.8	130.8	127.0	128.7	125.9	129.5	127.9	127.1	128.8	128.6	128.1
		10	129.7	131.4	130.6	131.5	**125.0**	**128.5**	**129.5**	**128.6**	132.8	**129.7**	**129.0**
		12	130.3	**117.9**	131.2	**128.6**	**127.3**	132.0	131.5	131.2	130.4	130.6	**127.1**
	Social Good	6	0.731	0.784	0.774	0.763	0.787	**0.718**	0.769	0.758	0.792	0.744	0.740
		8	0.763	0.792	0.894	0.828	0.884	0.896	0.807	0.889	0.836	0.826	0.791
		10	0.828	**0.788**	0.925	0.845	0.965	0.918	**0.806**	0.952	0.913	0.884	0.864
		12	0.832	0.854	0.903	**0.828**	0.946	0.915	0.926	0.903	0.934	0.907	0.921
	Traffic	6	0.167	0.172	**0.157**	**0.162**	0.175	0.170	**0.153**	**0.157**	**0.156**	0.172	**0.153**
		8	0.159	**0.156**	0.175	0.174	0.192	0.175	0.175	0.175	**0.158**	0.164	0.187
		10	0.181	0.217	0.182	**0.171**	0.202	0.206	0.182	0.181	0.183	**0.178**	0.194
		12	0.214	0.243	**0.207**	**0.212**	0.246	0.239	**0.206**	**0.207**	**0.211**	**0.199**	0.221

Table L.13: Comparison of multimodal fusion strategies with TSMixer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TSMixer	Agriculture	6	0.083	0.105	0.142	0.117	0.154	0.142	0.111	0.103	0.158	0.113	0.092
		8	0.125	0.220	0.217	0.180	0.278	0.182	0.165	0.185	0.217	0.174	0.136
		10	0.428	0.515	1.135	**0.390**	**0.380**	1.077	**0.240**	**0.323**	1.309	0.619	**0.204**
		12	0.834	1.352	1.080	1.080	1.496	**0.458**	**0.386**	**0.397**	1.398	1.012	**0.281**
	Climate	6	1.054	1.061	1.061	1.080	1.085	1.083	1.101	1.065	**1.054**	1.069	1.070
		8	1.088	**1.073**	1.097	**1.084**	1.100	**1.085**	1.096	1.111	1.108	1.091	1.095
		10	1.105	1.116	1.177	1.143	1.106	1.106	**1.097**	1.115	1.123	1.124	1.113
		12	1.106	1.168	1.132	1.153	1.148	**1.106**	1.112	1.141	1.136	1.132	1.106
	Economy	6	0.074	0.112	0.099	0.108	**0.065**	0.091	0.082	0.096	**0.067**	0.075	**0.050**
		8	0.063	0.411	0.405	0.158	0.622	0.245	0.154	0.201	0.219	0.117	0.080
		10	0.109	1.445	1.748	0.709	**0.107**	1.900	0.136	0.373	2.045	1.239	0.155
		12	0.874	2.445	2.292	2.204	2.545	**0.603**	**0.523**	1.225	2.047	2.154	**0.208**
	Energy	12	0.142	0.161	0.164	**0.140**	0.157	0.149	0.146	0.162	0.152	0.163	**0.115**
		24	0.286	**0.274**	**0.278**	0.303	**0.255**	**0.237**	**0.282**	**0.238**	**0.272**	**0.261**	**0.264**
		36	0.360	**0.347**	0.362	0.360	0.369	**0.359**	**0.341**	**0.315**	**0.356**	**0.347**	0.360
		48	0.456	**0.436**	0.504	0.470	**0.449**	0.470	**0.418**	**0.416**	0.488	**0.446**	**0.445**
	Environment	48	0.542	**0.505**	**0.509**	**0.487**	**0.461**	**0.479**	**0.493**	**0.525**	**0.438**	**0.488**	**0.502**
		96	0.606	**0.495**	**0.518**	**0.489**	**0.515**	**0.449**	**0.549**	**0.592**	**0.478**	**0.474**	**0.556**
		192	0.660	**0.645**	**0.537**	**0.500**	**0.607**	**0.583**	**0.531**	**0.641**	**0.504**	**0.498**	**0.619**
		336	0.581	**0.576**	**0.580**	**0.555**	**0.561**	**0.559**	**0.530**	0.587	**0.534**	**0.560**	**0.558**
	Public Health	12	1.150	**0.991**	**1.099**	**1.137**	1.160	**1.102**	**1.065**	**1.090**	1.195	**1.095**	**1.086**
		24	1.393	1.551	1.407	1.415	**1.372**	1.413	1.462	**1.308**	1.480	1.452	1.444
		36	1.500	1.721	1.587	**1.472**	1.536	1.562	1.503	**1.362**	1.505	1.525	**1.466**
		48	1.687	**1.608**	1.738	**1.627**	**1.618**	1.742	**1.599**	**1.586**	1.700	**1.635**	**1.625**
	Security	6	128.0	**127.8**	**128.0**	128.9	**125.4**	**127.4**	129.6	**126.7**	128.6	**127.6**	**124.4**
		8	127.4	**124.2**	128.3	128.8	**125.6**	**119.5**	133.6	128.0	**126.0**	127.5	**126.4**
		10	128.2	131.5	130.5	132.6	128.6	128.5	128.7	134.2	128.8	129.7	128.2
		12	130.7	133.2	133.3	133.5	132.4	**127.2**	**130.7**	133.0	132.3	132.5	131.3
	Social Good	6	0.778	0.812	**0.764**	0.827	0.783	**0.756**	**0.751**	0.805	0.826	**0.774**	**0.742**
		8	0.862	0.939	1.034	0.940	**0.791**	0.929	0.884	0.883	0.900	0.876	**0.819**
		10	0.867	0.945	1.103	0.935	0.881	0.924	0.955	0.993	1.112	1.045	**0.832**
		12	0.902	0.977	1.134	0.969	0.973	0.939	**0.890**	1.025	1.064	1.100	**0.873**
	Traffic	6	0.203	0.226	0.230	0.205	0.221	0.222	0.233	0.221	0.237	0.231	**0.190**
		8	0.216	0.248	0.228	0.234	0.276	0.251	0.255	0.287	0.249	0.228	**0.185**
		10	0.229	0.326	0.424	0.320	0.238	0.450	0.238	0.269	0.388	0.255	**0.207**
		12	0.303	0.527	0.544	0.396	0.512	**0.283**	**0.280**	0.362	0.477	0.506	**0.266**

Table L.14: Comparison of multimodal fusion strategies with Informer (+ BERT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Informer	Agriculture	6	0.212	0.373	0.283	0.319	0.308	**0.194**	0.228	**0.189**	0.395	0.293	**0.198**
		8	0.315	0.415	**0.251**	0.346	**0.204**	**0.280**	0.322	**0.193**	0.392	0.352	0.348
		10	0.417	**0.236**	**0.386**	0.440	0.578	**0.353**	**0.381**	**0.321**	**0.352**	**0.311**	**0.403**
		12	0.565	**0.405**	0.621	0.593	**0.320**	0.648	0.597	0.581	**0.436**	**0.365**	**0.453**
	Climate	6	1.070	**1.066**	1.111	**1.058**	**1.019**	**1.034**	**1.022**	**1.046**	**1.031**	**1.061**	**1.040**
		8	1.081	**1.065**	1.083	**1.073**	**0.916**	1.087	**1.073**	**1.047**	**1.073**	**1.049**	1.108
		10	1.060	1.074	1.081	1.067	**0.988**	1.072	1.060	1.074	1.106	1.075	1.104
		12	1.050	1.086	1.097	1.073	**0.916**	**1.036**	1.067	1.095	1.085	1.095	1.096
	Economy	6	0.497	0.765	**0.272**	0.724	0.597	**0.372**	0.737	**0.406**	0.532	**0.368**	0.691
		8	0.529	1.003	0.596	0.848	**0.337**	1.153	1.026	0.541	**0.461**	**0.432**	**0.467**
		10	0.761	1.011	**0.709**	1.001	1.135	**0.231**	0.804	**0.374**	0.833	**0.624**	1.208
		12	1.113	1.216	**0.595**	**1.036**	**0.803**	1.501	1.141	**0.062**	**0.777**	**0.914**	**0.768**
	Energy	12	0.137	0.154	0.212	0.169	0.185	0.172	0.171	0.217	0.155	0.189	0.155
		24	0.316	**0.296**	**0.302**	**0.316**	**0.291**	0.340	0.338	**0.249**	**0.299**	**0.308**	**0.300**
		36	0.411	**0.372**	0.444	**0.375**	0.430	**0.374**	**0.355**	0.430	**0.317**	**0.387**	**0.367**
		48	0.483	**0.464**	0.488	0.546	**0.466**	0.495	**0.442**	0.498	**0.478**	0.491	0.528
	Environment	48	0.424	**0.422**	0.428	0.438	0.440	**0.415**	0.442	0.447	0.437	0.440	**0.409**
		96	0.437	**0.437**	0.448	0.446	0.446	**0.437**	0.443	**0.408**	**0.412**	**0.405**	**0.416**
		192	0.449	0.508	**0.399**	0.463	**0.427**	0.468	**0.419**	**0.398**	**0.428**	**0.414**	**0.410**
		336	0.464	**0.464**	0.473	0.469	**0.435**	0.466	0.485	**0.443**	**0.410**	**0.401**	0.468
	Public Health	12	1.236	**1.054**	**1.075**	**1.066**	**1.011**	**0.997**	**1.056**	**1.016**	**1.084**	**1.002**	**1.131**
		24	1.373	**1.175**	1.383	1.376	**1.267**	**1.321**	**1.286**	**1.339**	**1.255**	1.426	**1.252**
		36	1.540	**1.349**	**1.449**	**1.442**	**1.200**	**1.431**	**1.473**	**1.434**	**1.441**	1.544	**1.406**
		48	1.643	**1.551**	1.659	**1.637**	**1.310**	**1.596**	**1.569**	**1.524**	**1.625**	1.670	**1.633**
	Security	6	124.8	127.2	126.3	128.0	**124.0**	127.6	126.3	**124.3**	126.4	127.4	127.6
		8	126.7	130.4	128.9	129.9	**126.4**	127.2	**126.7**	**125.5**	**125.4**	**126.3**	**125.6**
		10	127.8	**126.6**	**126.7**	**126.1**	130.8	130.0	128.3	129.2	130.8	131.2	129.1
		12	131.1	132.6	131.2	131.8	**128.0**	131.9	**130.5**	132.1	**130.2**	**128.0**	131.3
	Social Good	6	0.726	**0.706**	0.729	**0.723**	0.779	0.750	0.733	0.747	0.730	0.726	0.753
		8	0.787	0.803	**0.781**	0.808	0.867	0.816	0.825	0.817	0.792	0.795	**0.778**
		10	0.825	0.847	0.833	0.866	**0.820**	0.878	0.835	0.909	0.849	**0.815**	0.873
		12	0.833	0.879	**0.830**	0.858	0.929	0.877	0.858	0.939	0.868	0.918	0.872
	Traffic	6	0.164	0.172	0.173	**0.149**	**0.158**	**0.163**	**0.150**	0.178	**0.152**	**0.150**	0.170
		8	0.161	0.191	**0.158**	0.169	0.187	0.163	0.163	0.181	0.169	0.162	0.167
		10	0.198	**0.187**	**0.195**	**0.182**	0.205	**0.181**	**0.179**	**0.177**	**0.174**	**0.173**	**0.182**
		12	0.225	0.228	**0.207**	**0.220**	**0.203**	**0.215**	**0.219**	**0.211**	**0.205**	**0.203**	**0.222**

Table L.15: Comparison of multimodal fusion strategies with Nonstationary Transformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Nonstationary Transformer	Agriculture	6	0.055	0.061	**0.050**	**0.052**	0.062	**0.054**	1.746	**0.051**	**0.053**	0.058	**0.053**
		8	0.071	0.073	**0.070**	**0.068**	0.073	**0.070**	1.026	**0.070**	**0.070**	0.074	**0.067**
		10	0.092	0.102	**0.090**	**0.088**	0.100	**0.091**	0.367	**0.092**	**0.092**	**0.090**	**0.092**
		12	0.116	0.121	0.119	**0.110**	0.127	0.120	0.428	0.121	0.126	0.118	0.116
	Climate	6	1.206	1.316	1.302	**1.192**	**1.106**	1.237	1.296	1.304	**1.179**	1.226	**1.084**
		8	1.240	1.301	**1.128**	**1.232**	1.248	1.302	**1.154**	1.286	**1.238**	**1.203**	1.246
		10	1.283	1.296	**1.281**	**1.224**	**1.248**	**1.150**	**1.078**	**1.246**	**1.211**	1.297	**1.192**
		12	1.262	**1.237**	**1.205**	**1.193**	**1.257**	**1.231**	**1.083**	**1.221**	**1.203**	**1.203**	**1.156**
	Economy	6	0.016	0.018	0.018	0.017	0.017	**0.016**	7.850	0.018	0.017	0.018	0.017
		8	0.018	0.019	0.019	0.020	0.020	0.019	8.342	0.018	0.019	0.019	0.019
		10	0.020	0.020	**0.019**	0.023	0.021	0.021	1.054	0.021	0.020	0.023	**0.019**
		12	0.020	0.022	0.022	**0.020**	0.023	0.020	1.001	0.020	**0.020**	0.021	**0.020**
	Energy	12	0.106	0.115	**0.104**	**0.093**	**0.085**	**0.094**	0.178	**0.102**	**0.104**	**0.098**	**0.105**
		24	0.159	0.202	0.177	0.209	0.207	0.220	0.595	0.195	0.209	0.206	0.231
		36	0.333	**0.297**	**0.303**	**0.313**	**0.297**	**0.292**	0.927	**0.298**	**0.295**	**0.273**	**0.299**
		48	0.391	0.459	0.441	0.413	0.420	0.402	0.586	**0.366**	**0.362**	0.398	**0.342**
	Environment	48	0.430	0.436	0.446	0.437	0.448	0.432	0.448	0.436	**0.426**	0.431	0.430
		96	0.433	0.477	0.457	0.441	**0.422**	0.461	0.451	0.455	0.446	0.441	0.438
		192	0.445	0.500	0.454	**0.444**	0.462	0.488	0.461	**0.434**	**0.431**	0.479	**0.423**
		336	0.438	0.499	**0.430**	**0.427**	0.455	**0.431**	0.484	**0.436**	0.440	**0.437**	0.476
	Public Health	12	0.841	**0.793**	**0.819**	0.940	**0.821**	0.891	1.143	**0.830**	**0.800**	**0.714**	**0.714**
		24	1.160	1.174	**0.954**	1.214	**1.108**	1.294	1.662	1.181	1.374	1.212	**1.030**
		36	1.247	**1.208**	**1.241**	1.292	1.456	1.461	1.473	1.380	1.515	1.339	1.276
		48	1.593	1.720	**1.552**	**1.258**	1.697	**1.312**	**1.584**	**1.549**	**1.449**	**1.347**	**1.323**
	Security	6	103.4	**102.4**	105.9	105.6	**101.3**	106.0	121.3	**101.4**	**100.7**	**102.6**	**100.3**
		8	104.9	105.7	107.5	106.9	106.0	**104.7**	124.7	**104.5**	**103.5**	**104.1**	**104.8**
		10	107.8	108.0	107.9	108.2	**107.5**	108.0	122.5	**107.7**	108.4	108.3	108.5
		12	109.3	109.5	109.8	**109.0**	109.5	109.5	117.3	**109.2**	**108.7**	109.6	109.6
	Social Good	6	0.790	0.806	0.791	**0.750**	0.832	**0.770**	4.429	0.801	0.829	0.793	0.798
		8	0.908	0.945	**0.884**	0.911	1.021	**0.871**	2.870	0.953	**0.905**	**0.884**	**0.893**
		10	0.996	**0.966**	**0.969**	**0.925**	1.060	**0.973**	1.092	1.072	**0.928**	**0.952**	**0.926**
		12	1.073	**1.045**	**1.027**	**0.988**	1.089	**1.025**	**1.056**	1.147	**1.068**	**1.072**	**1.022**
	Traffic	6	0.182	**0.173**	**0.182**	0.191	0.186	**0.172**	0.616	0.185	0.188	**0.175**	**0.173**
		8	0.185	0.190	0.188	0.201	0.195	0.186	0.546	0.191	0.186	**0.184**	**0.185**
		10	0.187	**0.186**	**0.182**	0.192	0.190	**0.177**	0.252	0.190	**0.182**	0.192	0.188
		12	0.243	0.255	0.251	0.257	**0.235**	**0.240**	0.262	0.244	0.248	**0.242**	**0.242**

Table L.16: Comparison of multimodal fusion strategies with Koopa (+ GPT).

TS Model	Dataset	*H*	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Koopa	Agriculture	6	0.059	**0.057**	**0.058**	**0.058**	3.581	1.539	1.539	0.061	0.072	**0.057**	**0.056**
		8	0.077	**0.070**	**0.071**	**0.071**	0.188	0.187	0.187	0.077	0.129	**0.074**	**0.076**
		10	0.099	**0.092**	**0.090**	**0.090**	1.280	0.406	0.406	0.100	0.118	**0.091**	0.100
		12	0.129	**0.118**	**0.118**	**0.118**	0.799	0.662	0.662	0.130	0.174	**0.117**	**0.129**
	Climate	6	1.251	14.469	1.255	1.255	6.592	**1.219**	**1.219**	1.268	**1.079**	**1.246**	1.253
		8	1.264	1.541	1.267	1.267	**1.195**	**1.114**	**1.114**	1.320	**1.072**	1.268	**1.258**
		10	1.247	3.619	1.254	1.254	1.426	**1.053**	**1.053**	1.299	**1.115**	**1.246**	1.247
		12	1.232	1.248	1.251	1.251	**1.195**	**1.202**	**1.202**	1.249	**1.084**	1.249	1.232
	Economy	6	0.021	0.037	0.026	0.026	11.634	11.957	11.957	0.030	0.054	0.023	**0.017**
		8	0.017	0.019	0.019	0.019	0.739	0.796	0.796	0.023	0.034	0.018	0.018
		10	0.017	0.025	0.021	0.021	4.070	3.392	3.392	0.028	0.053	**0.017**	**0.017**
		12	0.018	0.030	0.029	0.029	13.558	14.694	14.694	0.029	0.063	0.025	0.018
	Energy	12	0.107	7203.5	**0.107**	**0.107**	195.3	0.162	0.162	0.115	0.111	0.110	0.107
		24	0.216	0.296	**0.205**	**0.205**	988.7	0.394	0.394	0.218	**0.213**	**0.196**	**0.205**
		36	0.300	**0.299**	**0.293**	**0.293**	0.681	0.504	0.504	0.314	0.309	**0.297**	**0.299**
		48	0.388	22512.6	0.404	0.404	31.815	1.075	1.075	0.434	0.414	**0.385**	0.402
	Environment	48	0.482	1124061696.0	**0.457**	**0.457**	237790768.0	**0.442**	**0.442**	0.487	**0.462**	**0.464**	**0.481**
		96	0.526	1906434688.0	**0.473**	**0.473**	0.954	**0.444**	**0.444**	0.539	**0.456**	**0.484**	0.533
		192	0.567	4849368576.0	**0.526**	**0.526**	39476484.0	**0.498**	**0.498**	**0.567**	**0.498**	**0.526**	**0.564**
		336	0.528	1709358592.0	0.531	0.531	593.9	**0.495**	**0.495**	0.529	**0.515**	**0.510**	0.528
	Public Health	12	1.029	1956.1	**0.940**	**0.940**	113.8	**0.941**	**0.941**	1.343	1.301	**0.908**	**1.008**
		24	1.395	**1.190**	**1.139**	**1.139**	1.827	**1.221**	**1.221**	1.582	**1.380**	**1.164**	1.410
		36	1.614	**1.243**	**1.285**	**1.285**	2.072	1.626	1.626	1.738	**1.302**	**1.272**	1.625
		48	1.729	**1.530**	**1.374**	**1.374**	2.099	1.736	1.736	1.885	**1.487**	**1.362**	**1.715**
	Security	6	104.9	**97.303**	**103.8**	**103.8**	136.5	138.2	138.2	**103.0**	108.8	**103.6**	**104.5**
		8	109.1	120.2	**108.8**	**108.8**	**108.2**	110.5	110.5	112.9	114.3	**104.6**	**105.5**
		10	108.8	**105.3**	**107.6**	**107.6**	117.7	116.7	116.7	109.8	111.0	**108.7**	**108.7**
		12	111.3	**109.8**	**110.1**	**110.1**	158.0	160.8	160.8	114.6	113.1	**109.7**	**109.4**
	Social Good	6	0.847	0.848	0.871	0.871	3.168	3.427	3.427	0.881	**0.753**	**0.830**	0.851
		8	0.931	1.019	0.939	0.939	0.975	0.962	0.962	1.011	**0.859**	**0.876**	**0.912**
		10	0.998	1.058	1.015	1.015	1.368	1.243	1.243	**0.996**	**0.862**	**0.938**	**0.994**
		12	1.081	**1.057**	**1.077**	**1.077**	3.208	2.754	2.754	1.085	**0.889**	**1.027**	**1.079**
	Traffic	6	0.226	0.278	0.246	0.246	0.570	0.486	0.486	0.251	0.239	0.242	**0.196**
		8	0.214	0.225	0.223	0.223	**0.200**	**0.204**	**0.204**	0.224	0.218	0.221	**0.207**
		10	0.216	0.229	0.227	0.227	0.275	0.241	0.241	0.229	0.226	0.221	**0.209**
		12	0.274	0.293	0.283	0.283	0.679	0.534	0.534	0.293	**0.271**	0.286	**0.264**

Table L.17: Comparison of multimodal fusion strategies with iTransformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
iTransformer	Agriculture	6	0.059	0.060	0.062	**0.057**	0.060	**0.058**	1.036	0.060	0.060	0.060	**0.059**
		8	0.077	0.079	0.082	**0.072**	**0.077**	0.080	1.057	0.081	0.079	0.081	**0.076**
		10	0.096	0.104	0.103	**0.090**	0.101	0.102	0.301	0.103	0.101	0.103	0.099
		12	0.128	0.131	0.134	**0.117**	0.131	0.133	0.303	**0.127**	0.132	0.129	**0.125**
	Climate	6	1.096	1.185	1.174	1.131	1.122	1.212	1.326	1.123	1.168	1.151	1.121
		8	1.178	1.207	1.232	1.202	**1.169**	1.215	1.187	1.231	1.258	1.203	1.236
		10	1.186	1.211	1.223	1.188	**1.182**	1.249	**1.050**	1.225	1.223	1.231	1.212
		12	1.176	**1.175**	**1.155**	1.179	**1.155**	1.180	**1.037**	**1.149**	1.211	1.177	1.187
	Economy	6	0.015	0.015	**0.015**	0.018	**0.015**	0.015	15.914	**0.015**	0.016	0.015	**0.014**
		8	0.015	**0.015**	**0.015**	0.019	**0.014**	0.016	10.060	0.015	0.016	0.016	0.016
		10	0.015	0.016	**0.015**	0.016	**0.015**	0.016	0.884	**0.015**	0.016	0.016	**0.015**
		12	0.016	**0.016**	**0.016**	0.019	**0.015**	**0.016**	1.016	**0.016**	**0.016**	**0.016**	**0.016**
	Energy	12	0.111	**0.104**	**0.103**	0.115	**0.102**	**0.110**	0.224	**0.103**	**0.108**	**0.108**	0.112
		24	0.228	**0.217**	**0.226**	**0.207**	**0.194**	**0.217**	0.732	**0.225**	**0.227**	**0.203**	**0.222**
		36	0.302	**0.282**	0.311	0.306	**0.257**	0.305	1.241	0.312	**0.295**	**0.301**	**0.295**
		48	0.408	**0.398**	**0.369**	**0.400**	**0.401**	**0.384**	0.663	**0.394**	**0.405**	**0.393**	**0.393**
	Environment	48	0.411	0.427	**0.411**	0.422	0.412	0.430	0.510	0.411	**0.411**	**0.405**	0.416
		96	0.418	0.426	0.426	0.445	0.444	0.431	0.647	0.433	0.425	0.421	0.438
		192	0.435	**0.434**	**0.420**	0.460	0.437	0.451	0.570	**0.433**	0.443	**0.432**	0.439
		336	0.418	0.420	0.422	0.442	**0.417**	0.422	**0.414**	0.425	0.422	0.420	0.428
	Public Health	12	1.023	**0.969**	1.036	**0.942**	1.058	**0.976**	**1.007**	1.039	**0.972**	**0.953**	**0.975**
		24	1.438	1.465	1.452	**1.209**	1.446	**1.435**	1.550	1.449	1.462	1.440	1.460
		36	1.637	1.667	**1.619**	**1.290**	1.677	**1.617**	1.877	**1.617**	**1.631**	**1.626**	**1.628**
		48	1.738	1.747	**1.735**	**1.468**	1.795	**1.721**	**1.733**	**1.733**	1.749	1.748	1.752
	Security	6	104.9	**104.2**	**102.5**	**102.1**	**103.0**	**103.6**	133.0	**102.7**	**104.7**	**102.9**	**104.0**
		8	108.7	**106.8**	**106.3**	114.0	**106.4**	**105.7**	134.6	**107.0**	**106.1**	**106.3**	108.9
		10	111.4	**111.4**	**107.9**	**109.5**	**109.3**	**108.4**	120.8	**108.1**	**109.5**	**108.3**	**110.6**
		12	114.0	**111.4**	**109.8**	119.7	**110.9**	**110.7**	118.2	**111.1**	**111.9**	**111.1**	**111.8**
	Social Good	6	0.825	0.826	**0.823**	**0.782**	0.841	**0.820**	4.269	**0.823**	**0.817**	**0.823**	**0.804**
		8	0.961	**0.958**	0.966	**0.895**	**0.923**	**0.948**	2.482	0.968	**0.941**	**0.947**	**0.921**
		10	1.061	1.065	**1.058**	**0.986**	1.077	**1.042**	1.128	**1.057**	**1.051**	**1.039**	**1.047**
		12	1.144	1.152	1.166	**1.103**	**1.127**	1.166	**1.124**	**1.046**	**1.134**	**1.139**	**1.048**
	Traffic	6	0.179	0.191	**0.170**	0.190	0.186	**0.163**	0.574	**0.177**	**0.173**	**0.163**	**0.173**
		8	0.185	**0.182**	0.192	0.198	0.195	**0.181**	1.358	0.186	**0.180**	**0.175**	0.189
		10	0.195	0.196	**0.183**	0.203	0.198	**0.191**	0.252	**0.185**	**0.181**	**0.185**	**0.186**
		12	0.249	**0.238**	**0.240**	0.255	0.251	0.254	0.251	**0.242**	**0.236**	**0.241**	**0.235**

Table L.18: Comparison of multimodal fusion strategies with DLinear (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
DLinear	Agriculture	6	0.114	0.120	0.132	0.132	0.455	0.802	0.392	**0.112**	0.235	0.133	**0.085**
		8	0.324	**0.173**	**0.175**	**0.183**	1.168	1.372	1.182	**0.206**	**0.232**	**0.221**	**0.099**
		10	0.163	0.198	0.203	0.209	0.532	0.445	0.436	0.197	0.221	0.216	**0.127**
		12	0.217	0.241	0.243	0.242	0.446	0.364	0.426	**0.162**	0.348	**0.180**	**0.183**
	Climate	6	1.198	1.292	1.255	1.226	1.312	1.241	1.226	1.312	**1.080**	1.285	**1.090**
		8	1.364	**1.329**	**1.288**	**1.264**	**1.240**	**1.172**	**1.160**	**1.318**	**1.084**	1.368	**1.090**
		10	1.166	1.326	1.336	1.306	1.193	**1.125**	**1.122**	1.281	**1.109**	1.314	**1.116**
		12	1.174	1.350	1.356	1.337	**1.164**	**1.131**	**1.129**	1.336	**1.087**	1.281	**1.098**
	Economy	6	0.090	0.092	0.097	0.098	18.050	15.149	13.841	0.107	0.431	0.109	**0.024**
		8	0.233	**0.133**	**0.141**	**0.143**	11.973	10.792	11.650	**0.131**	**0.184**	**0.154**	**0.025**
		10	0.086	0.120	0.130	0.130	2.488	2.169	2.265	0.139	0.148	0.145	**0.051**
		12	0.109	0.119	0.130	0.131	1.543	1.613	1.759	**0.065**	0.230	**0.092**	**0.060**
	Energy	12	0.115	0.211	0.165	0.150	0.228	0.191	0.166	0.140	0.160	0.138	**0.096**
		24	0.219	0.297	0.277	0.258	0.710	0.284	0.286	0.270	0.290	0.240	**0.201**
		36	0.303	0.357	0.344	0.328	1.065	0.349	0.345	0.338	0.355	0.344	**0.284**
		48	0.415	0.440	0.471	0.429	0.679	0.705	0.673	0.443	0.445	0.473	**0.391**
	Environment	48	0.490	**0.462**	**0.460**	**0.452**	0.499	**0.472**	**0.462**	0.507	**0.435**	**0.461**	**0.489**
		96	0.568	**0.467**	**0.473**	**0.459**	**0.537**	**0.491**	**0.476**	**0.565**	**0.474**	**0.466**	0.572
		192	0.583	**0.526**	**0.519**	**0.510**	**0.574**	**0.567**	**0.563**	0.587	**0.582**	**0.518**	0.587
		336	0.538	**0.507**	**0.505**	**0.497**	**0.502**	**0.475**	**0.486**	0.539	**0.508**	**0.495**	0.538
	Public Health	12	1.330	1.457	1.465	1.381	**1.286**	**1.309**	**1.186**	1.664	1.414	1.364	**1.228**
		24	1.578	**1.539**	**1.397**	**1.445**	1.784	1.653	1.605	1.688	1.695	**1.452**	1.589
		36	1.619	1.671	1.688	1.648	2.247	1.750	1.679	1.787	1.843	1.635	1.629
		48	1.691	1.749	1.725	1.724	1.842	1.837	1.809	1.804	1.775	**1.616**	**1.674**
	Security	6	104.4	105.8	105.0	104.5	192.5	176.2	170.7	105.8	110.3	104.6	104.8
		8	109.2	110.0	**108.8**	**108.3**	151.3	149.4	147.6	110.2	**107.0**	**108.6**	**109.0**
		10	110.5	112.5	110.9	110.8	113.0	112.2	112.9	111.0	**106.1**	110.8	**109.7**
		12	112.0	114.5	114.4	113.3	113.4	112.8	113.4	113.3	**111.2**	113.2	**111.7**
	Social Good	6	0.817	0.941	0.949	0.918	3.033	2.072	1.869	0.922	0.931	0.878	**0.779**
		8	0.885	1.055	1.029	1.004	2.522	2.304	2.139	0.958	0.960	0.966	**0.870**
		10	1.026	1.158	1.142	1.108	1.103	**0.962**	**0.951**	1.180	**0.987**	1.131	**0.966**
		12	1.010	1.232	1.155	1.240	1.054	1.011	**1.004**	1.089	1.045	1.128	**1.003**
	Traffic	6	0.254	0.302	0.328	0.309	0.673	0.677	0.618	0.313	0.371	0.313	**0.227**
		8	0.322	0.337	0.359	0.341	1.617	2.183	1.528	**0.269**	0.332	0.359	**0.224**
		10	0.243	0.334	0.354	0.341	0.511	0.297	0.358	0.294	0.314	0.357	**0.219**
		12	0.287	0.363	0.390	0.379	0.562	0.375	0.525	0.327	0.316	0.332	**0.261**

Table L.19: Comparison of multimodal fusion strategies with PatchTST (+ GPT).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
PatchTST	Agriculture	6	0.059	0.060	0.062	**0.057**	0.060	0.061	0.639	0.062	**0.059**	0.060	**0.059**
		8	0.078	0.079	0.081	**0.076**	0.079	0.080	0.814	0.081	0.079	0.079	**0.077**
		10	0.100	**0.099**	0.101	**0.097**	**0.099**	0.102	0.342	0.101	0.102	0.101	0.100
		12	0.129	**0.129**	**0.129**	**0.120**	**0.129**	0.129	0.394	**0.128**	**0.129**	0.130	**0.129**
	Climate	6	1.257	**1.234**	**1.240**	**1.237**	**1.234**	1.259	1.352	**1.240**	1.263	**1.224**	**1.225**
		8	1.265	**1.255**	**1.226**	**1.263**	**1.255**	**1.250**	**1.135**	**1.226**	**1.257**	**1.230**	**1.253**
		10	1.274	1.276	**1.261**	1.281	1.276	**1.272**	**1.093**	**1.261**	**1.271**	**1.250**	1.276
		12	1.239	1.248	1.246	1.260	1.248	1.257	**1.095**	1.246	1.269	1.242	1.253
	Economy	6	0.016	0.016	**0.016**	0.017	0.016	0.018	16.300	0.017	0.018	0.017	0.016
		8	0.017	**0.017**	0.018	0.019	**0.017**	**0.017**	9.731	0.018	0.018	0.018	0.017
		10	0.017	0.017	**0.017**	0.019	0.017	0.017	1.014	**0.017**	0.018	0.017	0.017
		12	0.017	0.018	**0.017**	0.022	0.018	0.018	1.012	0.018	0.018	0.018	0.018
	Energy	12	0.105	**0.102**	0.111	0.112	**0.102**	0.107	0.226	0.111	0.106	0.111	0.113
		24	0.226	0.227	**0.213**	**0.213**	0.227	**0.216**	0.639	**0.213**	**0.208**	**0.213**	**0.215**
		36	0.310	**0.302**	**0.310**	**0.290**	**0.302**	**0.290**	1.382	**0.310**	**0.309**	**0.301**	**0.306**
		48	0.414	0.430	0.417	**0.392**	0.430	0.419	0.644	0.416	**0.405**	0.416	0.418
	Environment	48	0.459	0.461	**0.458**	**0.455**	0.461	**0.451**	0.514	**0.458**	**0.452**	0.462	**0.447**
		96	0.504	0.511	**0.450**	**0.476**	0.511	**0.486**	0.690	**0.465**	**0.439**	**0.457**	**0.449**
		192	0.548	**0.536**	**0.443**	**0.519**	**0.536**	**0.494**	0.657	**0.445**	**0.456**	**0.452**	**0.438**
		336	0.497	0.500	**0.437**	0.519	0.500	**0.452**	**0.471**	**0.457**	**0.458**	**0.447**	**0.433**
	Public Health	12	0.913	**0.891**	0.926	**0.774**	**0.891**	0.948	1.011	0.932	**0.869**	**0.912**	**0.907**
		24	1.299	1.316	1.389	**1.163**	1.316	1.381	1.689	1.331	1.334	1.326	1.301
		36	1.623	**1.620**	**1.607**	**1.366**	**1.620**	**1.618**	**1.480**	**1.607**	**1.605**	**1.613**	**1.596**
		48	1.724	1.727	1.731	**1.474**	1.727	1.724	**1.709**	1.731	1.727	**1.724**	1.754
	Security	6	104.5	**104.3**	**102.5**	**104.2**	**104.3**	**103.3**	140.4	**102.4**	105.0	**102.9**	104.5
		8	110.1	**109.6**	**105.3**	**107.9**	**109.6**	**106.3**	138.0	**105.1**	**108.1**	**107.3**	**107.4**
		10	112.5	**109.9**	**108.9**	**109.7**	**109.9**	**108.3**	118.2	**107.6**	**110.2**	**109.3**	**110.7**
		12	110.8	111.4	**110.2**	**110.3**	111.4	112.2	118.4	**110.7**	**110.7**	112.7	113.7
	Social Good	6	0.794	0.802	**0.782**	**0.764**	0.802	**0.774**	3.867	**0.782**	**0.786**	**0.793**	**0.772**
		8	0.903	**0.896**	**0.881**	**0.845**	**0.896**	**0.900**	2.718	**0.881**	**0.898**	**0.901**	**0.881**
		10	0.991	1.051	1.046	**0.964**	1.051	1.049	1.102	1.046	1.017	1.032	**0.980**
		12	1.133	**1.113**	**1.063**	**0.988**	**1.113**	**1.070**	**1.091**	**1.062**	**1.057**	**1.088**	**1.047**
	Traffic	6	0.183	**0.181**	**0.182**	0.185	**0.181**	**0.179**	0.363	**0.179**	**0.177**	**0.180**	**0.173**
		8	0.185	**0.178**	0.194	0.197	**0.178**	**0.180**	1.920	0.188	**0.182**	**0.184**	0.192
		10	0.189	**0.188**	**0.183**	0.203	**0.188**	0.194	0.306	**0.186**	**0.185**	**0.180**	**0.183**
		12	0.240	0.244	0.246	0.255	0.244	**0.236**	0.385	0.241	**0.236**	**0.235**	0.257

Table L.20: Comparison of multimodal fusion strategies with FiLM (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FiLM	Agriculture	6	0.061	0.083	0.063	0.066	2.706	0.065	1.955	0.063	0.064	0.061	0.063
		8	0.082	0.087	**0.081**	**0.082**	1.423	0.088	0.816	**0.080**	0.083	**0.081**	**0.078**
		10	0.105	21.529	**0.104**	**0.099**	0.149	0.106	0.362	0.107	0.106	**0.102**	**0.103**
		12	0.143	**0.139**	**0.133**	**0.122**	0.973	**0.136**	0.449	**0.133**	**0.137**	**0.137**	**0.132**
	Climate	6	1.305	**1.263**	**1.280**	**1.260**	1.559	**1.264**	**1.299**	**1.219**	**1.293**	**1.237**	**1.254**
		8	1.282	**1.273**	**1.277**	**1.269**	**1.034**	1.317	**1.155**	1.310	**1.269**	**1.270**	**1.264**
		10	1.278	10.976	1.305	1.280	14.518	1.297	**1.106**	1.284	1.287	**1.272**	**1.273**
		12	1.280	21.682	1.280	1.288	9.379	1.285	**1.112**	1.308	1.281	1.318	**1.264**
	Economy	6	0.017	0.037	0.027	0.033	21.352	0.021	18.802	0.019	0.018	0.018	0.017
		8	0.018	0.047	0.021	0.021	11.280	0.023	13.157	**0.018**	**0.017**	0.018	0.018
		10	0.019	0.040	0.019	**0.018**	0.553	0.022	2.364	**0.018**	**0.018**	**0.018**	**0.018**
		12	0.018	36.534	0.020	0.043	1.685	0.021	2.238	**0.018**	0.018	**0.018**	**0.018**
	Energy	12	0.119	9874.3	0.120	0.132	0.321	0.148	0.199	**0.105**	**0.107**	**0.109**	**0.102**
		24	0.229	0.358	0.256	0.266	0.725	0.252	0.725	**0.215**	**0.219**	0.233	**0.206**
		36	0.302	34795.4	0.320	0.335	1.481	0.323	1.351	**0.300**	0.315	0.309	**0.300**
		48	0.435	0.486	0.443	0.443	0.699	0.506	0.673	**0.419**	**0.430**	0.448	**0.429**
	Environment	48	0.488	218219.0	**0.482**	**0.486**	0.499	**0.488**	0.500	0.491	**0.477**	**0.466**	0.490
		96	0.546	35537.8	**0.512**	**0.494**	0.579	**0.483**	0.604	0.546	**0.531**	**0.494**	**0.540**
		192	0.574	3251248128.0	**0.542**	**0.546**	0.604	**0.498**	0.671	0.575	**0.549**	**0.514**	**0.570**
		336	0.529	2551701760.0	**0.478**	**0.522**	58696568.0	**0.499**	**0.486**	**0.527**	**0.481**	**0.500**	**0.527**
	Public Health	12	1.155	3605.6	1.195	1.184	2.073	1.481	1.249	**1.121**	**1.138**	**1.129**	**1.106**
		24	1.492	**1.417**	1.496	**1.371**	3.481	1.646	**1.450**	**1.450**	**1.482**	**1.425**	**1.432**
		36	1.635	1.686	1.658	1.853	2.602	1.668	2.357	1.719	1.692	1.642	1.685
		48	1.722	2.066	1.775	2.052	2.202	1.790	1.850	1.728	1.806	1.776	1.739
	Security	6	124.2	**106.8**	**102.1**	**100.9**	210.4	**103.4**	189.5	**102.8**	**101.6**	**102.0**	**107.1**
		8	113.8	116.8	**106.0**	116.4	148.3	**105.5**	164.3	**110.8**	**106.3**	**106.2**	**105.1**
		10	117.0	136.7	**109.0**	133.4	**95.991**	**107.9**	**111.8**	**109.4**	**108.2**	**108.8**	**114.0**
		12	119.0	128.9	**109.8**	**108.2**	**98.285**	**111.2**	**113.1**	**112.2**	**113.6**	**111.6**	**113.8**
	Social Good	6	0.900	193.9	**0.854**	**0.827**	4.318	**0.848**	4.221	**0.819**	**0.810**	**0.815**	**0.818**
		8	0.994	1.363	1.005	1.027	2.158	1.055	2.760	1.002	**0.964**	**0.944**	**0.967**
		10	1.119	397.3	**1.040**	1.202	423.6	**1.106**	**1.096**	**1.014**	**1.112**	**1.046**	1.123
		12	1.216	1045.6	**1.074**	**1.071**	320.6	**1.182**	**1.081**	1.218	**1.191**	**1.154**	**1.165**
	Traffic	6	0.229	0.298	0.234	0.252	1.395	0.235	0.606	0.268	**0.229**	0.239	0.236
		8	0.223	**0.218**	**0.220**	**0.221**	2.319	0.229	1.438	0.230	0.226	**0.220**	0.233
		10	0.216	0.227	0.217	**0.215**	0.300	0.218	0.423	0.240	0.220	0.217	**0.215**
		12	0.253	1.605	**0.252**	0.270	**0.242**	0.268	0.326	0.285	0.258	0.274	**0.251**

Table L.21: Comparison of multimodal fusion strategies with TiDE (+ GPT).

TS Model	Dataset	H	Unimodal	Additive First	Additive Middle	Additive Last	Concat First	Concat Middle	Concat Last	Constrained Orthogonal	Constrained FiLM	Constrained Gating	Constrained **CFA**
TiDE	Agriculture	6	0.073	**0.068**	0.082	**0.068**	1.720	**0.065**	1.699	**0.063**	**0.063**	**0.062**	**0.060**
		8	0.088	0.091	0.092	0.092	1.005	0.093	0.826	**0.082**	**0.082**	**0.080**	**0.082**
		10	0.112	17.163	**0.110**	0.112	19.212	0.120	0.419	**0.103**	**0.104**	**0.104**	**0.103**
		12	0.160	20.607	**0.144**	**0.124**	29.733	**0.150**	0.353	**0.135**	**0.134**	**0.134**	**0.135**
	Climate	6	1.515	1.601	1.606	1.600	**1.496**	**1.418**	**1.379**	**1.252**	**1.244**	**1.239**	**1.258**
		8	1.486	1.567	**1.481**	**1.458**	**1.081**	1.532	**1.184**	**1.264**	**1.274**	**1.258**	**1.267**
		10	1.408	14.350	1.467	1.486	5.718	1.561	**1.197**	**1.274**	**1.272**	**1.259**	**1.259**
		12	1.468	10.739	**1.395**	1.480	3.521	1.508	**1.164**	**1.255**	**1.278**	**1.264**	**1.271**
	Economy	6	0.033	0.052	0.039	0.053	19.510	0.044	19.047	**0.017**	**0.017**	**0.017**	**0.017**
		8	0.043	**0.042**	**0.035**	**0.041**	12.450	**0.031**	12.775	**0.017**	**0.018**	**0.017**	**0.018**
		10	0.030	24.102	0.031	0.039	47.478	0.040	1.857	**0.018**	**0.017**	**0.017**	**0.017**
		12	0.033	27.894	**0.031**	0.037	57.638	0.038	1.946	**0.018**	**0.018**	**0.019**	**0.017**
	Energy	12	0.135	8167.2	0.139	0.135	2692.9	**0.134**	0.214	**0.115**	**0.115**	**0.108**	**0.112**
		24	0.241	0.389	0.244	0.262	0.779	0.243	0.784	**0.212**	**0.210**	**0.217**	**0.220**
		36	0.330	26003.6	0.333	**0.328**	8011.0	0.332	1.382	**0.294**	**0.307**	**0.305**	**0.300**
		48	0.443	0.467	0.443	**0.439**	0.684	**0.442**	0.692	**0.403**	**0.414**	**0.407**	**0.408**
	Environment	48	0.484	0.808	0.485	**0.475**	**0.472**	0.485	**0.483**	0.485	**0.483**	0.485	**0.484**
		96	0.541	**0.512**	0.542	**0.513**	0.570	**0.539**	0.630	0.541	**0.539**	**0.539**	**0.540**
		192	0.577	8866.8	0.578	**0.561**	5217.4	**0.577**	0.612	**0.577**	**0.577**	**0.577**	**0.576**
		336	0.533	7686.4	0.534	**0.510**	977.9	0.533	**0.494**	0.534	0.533	0.533	0.534
	Public Health	12	1.299	1837.7	1.320	1.328	1131.5	1.329	**1.244**	**1.076**	**1.128**	**1.113**	**1.106**
		24	1.513	2.180	**1.499**	1.646	1.673	1.567	1.685	**1.432**	**1.434**	**1.448**	**1.425**
		36	1.676	11842.9	**1.668**	1.755	5477.2	**1.669**	2.308	**1.605**	**1.619**	**1.617**	**1.602**
		48	1.787	1.977	**1.756**	1.844	1.845	1.788	**1.773**	**1.724**	**1.723**	**1.726**	**1.721**
	Security	6	146.1	**125.0**	**134.9**	**125.0**	202.6	**122.2**	192.6	**105.2**	**107.2**	**107.6**	**107.5**
		8	129.7	138.8	132.5	138.7	154.2	**128.9**	155.8	**108.3**	**108.9**	**112.4**	**109.4**
		10	132.3	162.6	135.2	134.7	**101.0**	135.4	**116.3**	**112.7**	**110.6**	**114.6**	**111.9**
		12	145.2	149.2	**139.2**	**139.4**	**102.7**	**142.4**	**119.8**	**112.7**	**112.3**	**112.3**	**111.7**
	Social Good	6	1.012	**0.974**	1.036	**0.961**	3.988	**0.970**	3.950	**0.835**	**0.836**	**0.823**	**0.843**
		8	1.062	1.129	**1.013**	1.129	2.673	**1.044**	2.480	**0.950**	**0.940**	**0.950**	**0.947**
		10	1.250	571.2	**1.097**	**1.185**	269.0	**1.243**	**1.011**	**1.068**	**1.070**	**1.109**	**1.068**
		12	1.415	737.3	**1.186**	**1.298**	231.7	**1.205**	**1.059**	**1.162**	**1.252**	**1.183**	**1.147**
	Traffic	6	0.304	0.326	**0.285**	0.326	0.439	**0.301**	0.438	**0.236**	**0.235**	**0.236**	**0.233**
		8	0.309	0.312	**0.277**	0.310	0.469	**0.272**	0.424	**0.233**	**0.230**	**0.234**	**0.224**
		10	0.249	31.614	**0.245**	0.328	9.288	0.302	0.623	**0.224**	**0.231**	**0.225**	**0.229**
		12	0.319	39.803	**0.308**	0.336	13.868	0.334	0.404	**0.288**	**0.290**	**0.284**	**0.289**

Table L.22: Comparison of multimodal fusion strategies with FEDformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FEDformer	Agriculture	6	0.062	0.063	0.062	**0.057**	**0.061**	**0.062**	0.604	0.064	**0.062**	**0.055**	**0.059**
		8	0.071	0.076	0.074	**0.071**	0.083	0.073	0.726	0.075	0.078	**0.069**	**0.069**
		10	0.092	0.103	**0.090**	0.094	0.104	0.096	0.362	0.095	0.093	0.092	0.093
		12	0.115	0.118	0.116	0.123	0.131	0.122	0.316	0.116	0.122	0.122	0.117
	Climate	6	1.116	**1.061**	**1.098**	1.182	**1.071**	**1.086**	1.261	**1.098**	**1.095**	**1.077**	**1.060**
		8	1.082	1.091	**1.060**	1.091	**1.030**	**1.063**	**1.051**	**1.055**	1.093	**1.075**	1.101
		10	1.105	**1.102**	1.109	1.108	**1.053**	1.115	**0.896**	1.111	**1.095**	**1.098**	**1.066**
		12	1.084	1.116	1.100	1.092	1.118	**1.054**	**0.931**	1.100	1.120	1.112	1.093
	Economy	6	0.039	0.047	0.049	**0.036**	0.041	0.045	10.229	0.049	0.046	**0.029**	0.048
		8	0.047	0.053	0.053	0.050	**0.029**	**0.036**	7.842	0.052	**0.036**	0.053	**0.041**
		10	0.040	0.051	0.048	0.045	0.051	**0.035**	0.900	0.048	0.041	**0.036**	0.044
		12	0.046	**0.045**	**0.041**	0.056	0.046	**0.032**	1.095	**0.040**	**0.037**	0.047	**0.044**
	Energy	12	0.098	0.111	**0.094**	**0.096**	0.113	**0.093**	0.129	**0.094**	**0.097**	**0.091**	**0.092**
		24	0.183	0.184	0.184	**0.175**	0.184	**0.179**	0.790	0.184	**0.176**	**0.178**	**0.179**
		36	0.254	0.332	0.268	**0.251**	0.304	0.257	0.792	0.261	**0.253**	**0.253**	0.256
		48	0.375	0.403	**0.370**	**0.367**	0.474	**0.359**	0.776	**0.370**	**0.366**	**0.358**	0.386
	Environment	48	0.443	0.502	0.478	0.486	0.473	0.467	0.503	0.479	0.482	0.458	0.471
		96	0.487	0.511	**0.486**	0.527	0.513	0.518	**0.445**	**0.480**	**0.480**	0.491	**0.457**
		192	0.508	0.508	**0.505**	**0.505**	0.509	**0.499**	**0.469**	**0.508**	**0.495**	0.513	**0.503**
		336	0.449	0.485	0.458	0.486	0.463	0.484	0.454	0.460	0.466	0.470	**0.449**
	Public Health	12	1.050	1.051	1.059	1.056	1.154	1.057	1.058	1.051	1.054	1.098	1.052
		24	1.488	**1.370**	**1.353**	**1.370**	1.531	**1.422**	1.580	**1.348**	**1.407**	**1.374**	**1.350**
		36	1.422	1.552	1.579	1.554	1.504	1.493	1.924	1.544	1.487	1.537	1.502
		48	1.621	**1.568**	**1.601**	1.625	1.738	**1.501**	**1.504**	**1.541**	1.622	**1.610**	**1.502**
	Security	6	105.9	110.1	**103.6**	**102.9**	106.2	**105.7**	162.7	**105.9**	115.0	**104.6**	107.4
		8	109.1	**107.8**	109.8	**108.7**	110.3	109.6	142.9	109.4	110.1	**107.4**	109.6
		10	113.8	**112.9**	**111.6**	**111.4**	**112.3**	114.9	114.0	**111.6**	**113.0**	**110.0**	**113.3**
		12	117.2	117.5	**115.0**	**114.8**	**114.2**	**112.9**	**115.8**	**111.8**	**115.2**	**115.5**	**114.4**
	Social Good	6	0.879	**0.853**	**0.808**	**0.873**	**0.860**	**0.819**	1.825	**0.808**	**0.771**	**0.802**	**0.836**
		8	0.885	**0.873**	0.897	**0.848**	0.905	**0.852**	2.121	0.896	**0.855**	**0.848**	**0.848**
		10	0.914	0.918	**0.892**	0.920	0.982	0.940	0.984	**0.892**	**0.896**	**0.911**	**0.908**
		12	1.015	**0.987**	**0.983**	**0.954**	1.114	**1.010**	1.108	**0.981**	**0.987**	**1.001**	**0.971**
	Traffic	6	0.152	0.163	0.153	0.160	**0.144**	**0.149**	0.351	0.154	0.164	**0.150**	0.153
		8	0.153	0.160	0.156	0.169	**0.144**	0.158	0.227	0.156	0.154	0.156	0.159
		10	0.166	0.175	0.167	0.168	**0.147**	**0.161**	0.344	0.168	**0.163**	**0.161**	**0.161**
		12	0.228	0.233	0.232	0.240	**0.217**	**0.213**	0.376	0.232	0.233	**0.221**	**0.228**

Table L.23: Comparison of multimodal fusion strategies with Autoformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Autoformer	Agriculture	6	0.070	0.072	**0.066**	0.075	**0.066**	**0.066**	1.226	**0.069**	**0.069**	**0.062**	**0.068**
		8	0.090	**0.086**	**0.080**	**0.086**	0.091	**0.078**	0.483	0.094	0.097	**0.077**	0.093
		10	0.110	0.117	**0.106**	**0.107**	0.115	0.112	0.348	0.111	**0.102**	0.113	**0.094**
		12	0.128	0.144	0.135	0.139	0.141	0.134	0.446	0.131	0.139	**0.126**	0.129
	Climate	6	1.240	1.292	1.243	**1.222**	**1.182**	**1.206**	1.319	**1.228**	**1.239**	**1.206**	**1.204**
		8	1.200	1.224	1.252	1.203	1.293	**1.176**	**1.103**	1.296	**1.178**	1.221	**1.106**
		10	1.247	1.275	**1.228**	**1.211**	**1.239**	**1.190**	**1.035**	1.256	**1.206**	**1.168**	**1.197**
		12	1.177	1.181	1.216	1.247	1.207	1.192	**0.991**	1.219	1.206	1.194	**1.133**
	Economy	6	0.051	0.077	0.068	0.067	0.058	0.058	11.732	0.069	0.074	0.067	**0.050**
		8	0.058	0.069	**0.058**	**0.058**	0.065	0.065	9.985	**0.058**	0.066	0.061	0.074
		10	0.060	0.066	**0.057**	**0.049**	0.072	**0.049**	1.110	**0.057**	0.067	**0.055**	**0.055**
		12	0.061	0.074	**0.044**	**0.059**	0.074	**0.056**	1.045	**0.056**	**0.052**	**0.051**	**0.045**
	Energy	12	0.165	0.208	**0.158**	**0.158**	0.171	**0.145**	0.339	**0.140**	**0.144**	0.166	0.171
		24	0.292	0.300	0.314	0.296	0.329	0.296	0.710	0.312	0.305	0.329	**0.291**
		36	0.352	0.383	0.378	0.399	0.403	0.387	1.380	0.366	0.385	0.370	0.374
		48	0.485	**0.468**	**0.479**	**0.452**	0.500	**0.476**	0.702	**0.446**	0.491	**0.456**	**0.464**
	Environment	48	0.550	**0.507**	**0.502**	0.558	**0.532**	**0.515**	**0.481**	**0.498**	**0.541**	**0.492**	**0.485**
		96	0.520	0.567	0.524	**0.491**	0.559	**0.511**	0.536	**0.518**	0.544	**0.508**	**0.496**
		192	0.589	**0.550**	**0.547**	**0.560**	0.614	**0.531**	**0.505**	**0.541**	**0.555**	**0.553**	**0.505**
		336	0.565	**0.525**	**0.523**	**0.536**	**0.548**	**0.508**	**0.483**	**0.504**	**0.549**	**0.535**	**0.502**
	Public Health	12	1.668	**1.632**	**1.513**	**1.596**	**1.425**	**1.655**	**1.449**	**1.626**	**1.522**	**1.609**	**1.567**
		24	1.940	2.128	**1.847**	1.941	**1.773**	1.950	**1.639**	**1.845**	1.958	1.989	**1.860**
		36	1.931	1.983	**1.878**	**1.851**	2.105	1.961	2.163	**1.916**	2.008	2.005	**1.883**
		48	1.767	2.137	1.814	1.883	2.048	1.905	1.801	2.026	1.887	1.985	1.926
	Security	6	106.1	107.9	111.8	107.9	**105.7**	111.6	151.7	113.4	107.9	107.1	108.8
		8	110.7	112.2	**109.0**	112.5	111.0	112.7	140.4	**109.8**	111.4	**110.1**	112.8
		10	115.7	**115.2**	116.1	**115.1**	**111.3**	**110.4**	**115.3**	**114.6**	**112.3**	**111.6**	**113.0**
		12	117.8	**117.2**	**112.1**	**115.4**	**116.0**	118.8	**117.3**	**112.2**	**113.8**	**116.2**	**112.5**
	Social Good	6	0.891	0.900	**0.793**	**0.844**	**0.868**	**0.841**	4.417	**0.839**	**0.884**	0.895	**0.814**
		8	0.929	**0.921**	0.952	0.961	1.064	1.020	2.750	0.979	0.931	0.938	0.967
		10	1.052	**1.041**	1.088	**0.996**	1.120	**1.003**	1.125	1.060	1.059	**1.005**	**1.036**
		12	1.194	**1.117**	**1.062**	**1.047**	**1.175**	**1.077**	**1.095**	**1.104**	1.224	**1.115**	**1.151**
	Traffic	6	0.172	0.207	**0.168**	0.183	0.191	**0.166**	0.386	0.182	0.178	0.173	0.186
		8	0.207	**0.197**	0.207	**0.193**	0.222	**0.167**	0.899	0.216	**0.189**	**0.195**	**0.198**
		10	0.191	**0.189**	0.202	0.205	0.197	**0.188**	0.393	0.203	0.193	0.201	0.201
		12	0.239	0.280	**0.236**	0.249	0.265	**0.232**	0.353	**0.234**	**0.234**	**0.226**	**0.232**

Table L.24: Comparison of multimodal fusion strategies with Crossformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Crossformer	Agriculture	6	0.088	0.136	0.218	0.152	0.153	0.125	0.221	0.114	0.179	0.130	0.176
		8	0.196	0.219	0.223	0.206	0.891	**0.176**	0.347	0.248	**0.103**	0.207	0.224
		10	0.248	0.318	**0.218**	0.385	0.266	0.413	0.412	0.300	0.272	0.276	0.265
		12	0.311	0.366	**0.253**	0.411	0.602	0.410	0.484	**0.242**	0.315	0.364	0.323
	Climate	6	1.039	**1.018**	1.087	1.091	1.056	1.061	1.055	1.080	1.063	1.061	1.089
		8	1.080	**1.070**	**1.031**	1.097	1.113	1.083	1.084	1.111	1.092	1.092	1.120
		10	1.088	1.117	1.092	1.101	**1.083**	**1.075**	1.110	1.107	**1.082**	1.098	**1.087**
		12	1.090	1.118	**1.086**	1.134	1.134	**1.080**	**1.087**	1.091	1.091	**1.088**	1.117
	Economy	6	0.468	**0.444**	**0.260**	**0.409**	**0.360**	0.671	0.472	0.479	**0.120**	**0.089**	**0.149**
		8	0.123	0.612	0.299	0.641	6.351	0.452	0.911	0.554	**0.096**	0.403	0.488
		10	0.122	0.683	0.378	0.463	0.535	1.044	0.796	0.819	0.356	0.654	0.270
		12	0.323	1.084	0.727	0.773	0.641	0.966	0.615	0.339	0.535	0.851	0.379
	Energy	12	0.145	**0.130**	**0.133**	0.148	0.146	**0.138**	0.152	**0.139**	0.155	**0.130**	**0.143**
		24	0.252	**0.250**	0.258	**0.235**	0.320	**0.226**	0.270	0.256	**0.247**	0.252	**0.247**
		36	0.345	**0.334**	**0.337**	**0.336**	0.346	**0.318**	**0.328**	**0.322**	**0.328**	**0.334**	**0.337**
		48	0.445	0.455	0.446	**0.441**	**0.413**	**0.440**	**0.382**	**0.425**	0.454	0.450	**0.435**
	Environment	48	0.492	**0.444**	**0.457**	0.498	**0.444**	**0.445**	**0.442**	**0.450**	**0.456**	**0.462**	**0.439**
		96	0.589	**0.461**	**0.494**	**0.520**	**0.472**	**0.473**	**0.519**	**0.473**	**0.486**	**0.493**	**0.475**
		192	0.551	**0.482**	0.573	**0.502**	**0.526**	0.593	0.614	0.590	**0.547**	0.560	**0.497**
		336	0.527	0.553	0.555	**0.509**	**0.493**	0.588	0.542	**0.526**	0.547	0.565	**0.503**
	Public Health	12	1.089	1.113	**1.053**	1.125	1.223	**1.048**	1.095	1.100	1.150	1.116	**1.050**
		24	1.305	1.330	1.343	1.311	1.427	1.410	1.408	1.401	1.324	1.305	1.330
		36	1.321	**1.280**	1.397	1.411	1.381	1.365	1.382	1.369	1.367	1.370	**1.321**
		48	1.440	1.511	1.451	1.490	1.448	1.452	1.555	1.521	1.486	1.472	1.525
	Security	6	118.2	121.5	119.0	120.6	120.9	122.2	125.1	119.9	124.1	118.9	**117.3**
		8	121.3	124.4	125.2	124.2	130.9	**120.7**	126.1	123.7	123.8	123.5	**120.5**
		10	125.3	126.1	**125.1**	125.9	**123.9**	**124.5**	127.6	126.7	126.2	**125.3**	**124.0**
		12	123.3	128.1	126.9	127.6	129.9	129.5	129.3	128.1	127.5	127.6	125.9
	Social Good	6	0.728	0.743	0.749	0.739	0.732	**0.728**	0.747	0.747	0.730	0.765	0.750
		8	0.816	0.834	**0.800**	**0.813**	1.874	**0.805**	**0.812**	**0.810**	0.819	0.832	**0.816**
		10	0.872	0.914	0.915	0.887	**0.859**	0.881	0.872	**0.863**	**0.865**	0.883	0.880
		12	0.936	0.953	**0.897**	0.947	**0.916**	**0.893**	0.949	**0.909**	**0.913**	**0.908**	**0.933**
	Traffic	6	0.215	**0.210**	0.219	**0.213**	0.229	**0.214**	**0.211**	**0.213**	0.220	**0.210**	0.220
		8	0.208	0.215	0.209	0.210	0.353	0.221	**0.203**	0.216	0.213	0.236	0.232
		10	0.211	0.226	0.225	0.226	0.225	0.225	0.223	0.223	0.221	0.216	0.222
		12	0.254	**0.250**	**0.244**	**0.245**	0.301	**0.242**	**0.250**	**0.250**	**0.242**	**0.250**	**0.249**

Table L.25: Comparison of multimodal fusion strategies with Reformer (+ GPT).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Reformer	Agriculture	6	0.202	0.231	**0.147**	**0.152**	0.255	**0.174**	0.317	**0.150**	0.231	0.220	**0.163**
		8	0.221	0.411	0.302	0.239	0.242	0.369	0.416	0.304	**0.187**	**0.191**	0.233
		10	0.319	0.525	0.452	0.416	0.523	**0.314**	0.714	0.328	**0.251**	0.457	**0.246**
		12	0.533	**0.514**	**0.392**	**0.496**	0.615	0.721	**0.377**	**0.316**	**0.277**	**0.212**	**0.241**
	Climate	6	1.025	1.102	1.028	1.091	1.064	1.114	1.080	1.038	1.076	**1.011**	1.082
		8	1.066	1.089	1.080	1.069	**1.042**	1.099	1.075	**1.040**	**1.047**	1.085	1.087
		10	1.058	1.107	1.128	1.068	1.092	1.086	**0.892**	1.150	1.078	1.081	1.078
		12	1.076	1.122	**1.068**	**1.036**	1.108	1.103	**1.050**	**0.981**	**1.068**	**1.064**	**1.063**
	Economy	6	0.199	0.390	0.511	0.386	0.607	**0.111**	0.764	0.412	0.511	**0.113**	0.482
		8	0.337	0.460	**0.298**	**0.172**	0.561	**0.305**	1.027	**0.286**	0.679	**0.210**	**0.254**
		10	0.176	0.463	0.689	0.331	0.922	1.135	1.762	0.671	0.549	0.925	0.558
		12	0.144	0.751	1.151	0.489	1.109	1.347	1.129	1.097	1.162	0.802	0.394
	Energy	12	0.207	0.217	0.264	0.247	0.262	0.278	0.243	**0.174**	**0.168**	0.252	0.218
		24	0.423	**0.409**	**0.417**	**0.388**	0.582	**0.408**	**0.364**	**0.325**	**0.311**	**0.397**	**0.356**
		36	0.510	**0.506**	**0.478**	**0.406**	**0.457**	**0.471**	**0.440**	**0.379**	**0.423**	**0.416**	**0.463**
		48	0.575	0.579	**0.565**	**0.539**	0.877	**0.528**	**0.493**	**0.498**	**0.427**	**0.542**	**0.539**
	Environment	48	0.415	0.434	0.416	0.424	0.418	0.422	0.421	0.416	0.415	0.420	**0.397**
		96	0.460	**0.428**	0.479	**0.437**	0.485	**0.399**	0.475	**0.432**	**0.400**	**0.392**	**0.413**
		192	0.430	0.456	0.433	0.443	**0.415**	0.430	0.442	**0.423**	**0.403**	**0.413**	**0.422**
		336	0.451	**0.411**	**0.441**	**0.438**	**0.402**	**0.431**	**0.434**	**0.408**	**0.402**	**0.409**	**0.429**
	Public Health	12	1.200	**1.080**	**1.119**	**1.129**	**1.144**	**1.102**	**1.089**	**1.116**	**1.040**	1.235	**1.131**
		24	1.258	1.297	1.312	1.371	1.375	1.533	1.374	1.301	1.330	1.351	**1.243**
		36	1.321	**1.287**	**1.289**	1.480	1.365	**1.292**	1.332	**1.286**	**1.316**	1.362	**1.286**
		48	1.363	1.482	1.463	**1.346**	1.439	1.529	1.516	1.442	1.399	1.401	1.406
	Security	6	118.3	120.8	123.9	124.2	**118.1**	120.4	122.5	123.9	124.9	124.4	123.8
		8	121.6	**119.8**	121.8	124.0	122.0	125.3	124.9	121.8	123.6	124.1	122.3
		10	126.2	**125.0**	**124.6**	**123.7**	129.0	**124.3**	126.8	**124.6**	**124.9**	**125.6**	**125.4**
		12	128.0	**120.8**	**125.7**	**126.5**	**126.8**	**124.0**	**124.8**	**125.7**	**126.3**	**125.1**	**126.0**
	Social Good	6	0.775	0.843	0.853	0.793	0.836	0.870	0.796	0.880	0.887	**0.773**	0.822
		8	0.864	0.866	0.914	**0.860**	0.921	0.898	**0.850**	0.910	**0.857**	0.889	0.868
		10	0.949	0.962	1.016	**0.912**	1.029	0.971	**0.906**	0.989	**0.943**	**0.909**	0.970
		12	1.006	1.138	**0.976**	**0.953**	**1.002**	**0.988**	**0.980**	**0.974**	**0.958**	**0.961**	**0.985**
	Traffic	6	0.208	0.260	0.226	0.304	0.232	0.289	0.245	0.226	0.287	0.251	0.240
		8	0.224	0.262	**0.224**	**0.218**	0.233	0.296	0.234	**0.224**	0.231	0.237	0.234
		10	0.261	0.265	0.275	**0.246**	**0.246**	0.292	**0.224**	**0.258**	**0.219**	**0.248**	0.263
		12	0.244	0.257	0.264	0.260	0.253	0.283	0.249	0.262	0.267	0.273	0.256

Table L.26: Comparison of multimodal fusion strategies with TSMixer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TSMixer	Agriculture	6	0.083	0.135	0.141	0.089	0.105	0.181	0.098	0.139	0.108	0.114	0.108
		8	0.129	0.235	0.298	0.236	0.420	0.276	0.143	0.202	0.230	0.182	**0.122**
		10	0.428	0.934	1.301	0.486	**0.259**	1.325	**0.238**	**0.238**	1.514	0.862	**0.253**
		12	0.660	1.593	1.380	0.978	1.625	**0.588**	**0.594**	**0.590**	1.871	1.654	**0.280**
	Climate	6	1.054	1.067	1.065	1.080	1.085	1.093	1.133	1.059	1.066	1.066	1.070
		8	1.088	1.094	1.098	**1.080**	1.100	**1.086**	1.099	1.107	1.096	**1.080**	1.095
		10	1.105	1.115	1.206	1.146	1.108	1.115	1.136	1.117	1.118	1.124	1.113
		12	1.106	1.193	1.136	1.176	1.156	**1.105**	1.117	1.149	1.154	1.136	1.106
	Economy	6	0.074	0.115	0.142	0.127	0.111	0.099	0.081	0.206	0.140	0.080	**0.050**
		8	0.063	0.327	0.551	0.286	0.980	0.317	0.142	0.321	0.544	0.149	**0.044**
		10	0.109	1.853	2.252	0.929	0.260	2.339	0.172	0.203	1.349	1.855	0.155
		12	0.874	2.740	2.863	3.037	2.808	**0.863**	1.067	**0.504**	2.803	2.758	**0.208**
	Energy	12	0.142	**0.134**	0.146	0.154	0.158	0.144	0.153	**0.129**	0.154	**0.142**	**0.115**
		24	0.286	0.288	**0.276**	0.295	**0.277**	**0.245**	**0.284**	**0.275**	**0.271**	**0.259**	**0.264**
		36	0.360	**0.347**	0.371	0.369	0.380	0.408	0.383	**0.349**	0.409	**0.340**	0.360
		48	0.456	**0.456**	0.483	0.581	**0.405**	0.485	0.458	**0.456**	0.508	0.469	**0.445**
	Environment	48	0.542	**0.440**	**0.451**	**0.459**	**0.445**	**0.449**	**0.482**	**0.526**	**0.443**	**0.437**	**0.502**
		96	0.606	**0.460**	**0.479**	**0.483**	**0.437**	**0.446**	**0.478**	**0.594**	**0.472**	**0.469**	**0.556**
		192	0.660	**0.596**	**0.505**	**0.499**	**0.608**	**0.527**	**0.488**	**0.597**	**0.485**	**0.464**	**0.619**
		336	0.581	0.592	**0.529**	**0.534**	**0.574**	**0.544**	**0.499**	0.582	**0.526**	**0.502**	**0.558**
	Public Health	12	1.150	**0.996**	**1.106**	**1.142**	1.223	**1.105**	**1.145**	**1.115**	1.218	**1.087**	**1.086**
		24	1.393	1.558	1.402	1.410	**1.350**	**1.383**	1.490	**1.326**	1.499	1.445	**1.382**
		36	1.500	1.732	1.654	**1.478**	1.500	1.577	**1.477**	**1.420**	1.614	1.539	**1.466**
		48	1.687	**1.626**	1.736	**1.616**	**1.618**	1.691	**1.601**	**1.518**	**1.671**	**1.648**	**1.625**
	Security	6	128.0	128.4	129.3	129.5	**125.6**	**125.5**	129.2	**124.0**	129.9	128.2	**124.4**
		8	127.4	**124.1**	128.6	**127.2**	**126.8**	**117.2**	132.8	129.4	**127.0**	**125.6**	**126.4**
		10	128.2	131.4	131.4	132.0	128.5	130.8	130.4	133.5	129.4	130.2	128.2
		12	130.7	133.0	133.1	134.1	132.8	**127.4**	**128.9**	133.1	131.7	132.5	131.3
	Social Good	6	0.769	0.843	0.872	0.854	0.781	**0.764**	**0.730**	0.772	0.826	0.811	**0.739**
		8	0.876	0.919	0.974	0.945	**0.792**	0.944	**0.866**	**0.809**	0.946	0.938	**0.855**
		10	0.876	0.961	1.136	0.924	0.883	0.957	0.940	0.910	1.199	1.096	**0.861**
		12	0.942	1.527	1.192	1.036	1.044	0.958	**0.916**	**0.920**	1.186	1.153	**0.839**
	Traffic	6	0.203	0.233	0.232	0.207	0.234	0.223	0.226	0.230	0.298	0.234	**0.190**
		8	0.216	0.258	0.233	0.251	0.268	0.248	0.249	0.279	0.280	0.227	**0.185**
		10	0.229	0.418	0.551	0.331	0.243	0.548	0.230	0.250	0.561	0.286	**0.207**
		12	0.303	0.799	0.632	0.398	0.713	**0.289**	**0.288**	0.324	0.776	0.578	**0.266**

Table L.27: Comparison of multimodal fusion strategies with Transformer (+ GPT).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Transformer	Agriculture	6	0.133	0.133	0.165	0.223	**0.110**	**0.130**	0.275	0.174	**0.130**	0.152	0.146
		8	0.147	0.326	0.152	0.197	0.203	0.201	0.376	0.196	0.162	0.207	0.191
		10	0.177	0.505	0.226	0.266	**0.151**	**0.176**	0.703	0.234	0.177	0.185	**0.158**
		12	0.233	0.373	0.247	0.246	**0.176**	0.319	0.320	0.247	0.244	**0.207**	0.356
	Climate	6	0.985	1.086	0.988	1.043	**0.948**	1.031	1.025	0.988	1.031	1.077	**0.982**
		8	1.058	**1.056**	**0.990**	**1.049**	1.094	1.093	**1.036**	**0.990**	**1.035**	**1.041**	**1.037**
		10	1.068	1.093	**1.052**	**1.042**	1.087	**1.005**	**1.060**	**1.052**	**1.008**	1.073	1.085
		12	1.102	**0.979**	**1.032**	1.117	1.112	**1.084**	**1.063**	**1.032**	**1.050**	**1.064**	**1.026**
	Economy	6	0.267	0.394	**0.067**	0.636	**0.073**	**0.119**	0.718	**0.145**	**0.075**	**0.077**	**0.101**
		8	0.310	0.375	**0.243**	**0.187**	**0.217**	0.383	0.578	0.421	0.471	0.584	**0.245**
		10	0.258	0.678	0.273	0.494	**0.095**	**0.102**	1.304	0.278	0.429	0.312	**0.112**
		12	0.362	0.491	0.492	**0.272**	**0.072**	0.451	0.676	0.542	0.362	**0.330**	**0.086**
	Energy	12	0.122	0.123	**0.104**	0.130	**0.105**	0.143	**0.101**	**0.101**	**0.090**	**0.076**	0.134
		24	0.289	0.349	**0.251**	**0.280**	**0.200**	**0.161**	**0.168**	**0.206**	**0.204**	**0.144**	**0.201**
		36	0.261	0.350	0.312	0.353	0.375	**0.233**	0.319	0.306	0.264	0.283	0.342
		48	0.450	0.480	**0.437**	0.463	**0.439**	**0.389**	0.535	**0.392**	**0.447**	**0.419**	**0.432**
	Environment	48	0.429	0.441	**0.416**	0.432	**0.420**	**0.399**	0.432	**0.412**	**0.406**	**0.414**	**0.419**
		96	0.462	0.470	**0.434**	0.518	**0.438**	**0.445**	**0.444**	**0.407**	**0.441**	**0.438**	**0.425**
		192	0.450	0.503	0.473	0.481	0.462	0.477	0.511	0.463	**0.397**	**0.410**	**0.432**
		336	0.451	0.487	**0.442**	**0.445**	0.464	0.455	0.457	**0.399**	0.454	**0.409**	**0.419**
	Public Health	12	1.124	**1.084**	1.214	1.248	**0.965**	1.140	1.163	**1.099**	**0.840**	**1.103**	**1.022**
		24	1.370	**1.289**	**1.219**	1.400	**1.139**	**1.233**	1.477	**1.267**	**1.297**	1.405	**1.267**
		36	1.317	1.328	1.384	1.375	**1.307**	**1.288**	1.361	1.384	**1.283**	1.364	1.324
		48	1.389	**1.359**	**1.318**	1.530	1.427	**1.364**	**1.351**	**1.365**	1.444	**1.311**	1.473
	Security	6	124.0	124.7	126.2	**123.5**	**122.9**	126.9	124.6	126.2	127.6	126.2	128.2
		8	124.8	128.8	126.7	129.8	**121.1**	128.5	127.8	125.9	130.2	128.9	128.4
		10	129.7	**124.5**	130.5	130.7	**126.4**	**128.8**	**129.3**	**128.6**	131.4	130.6	131.4
		12	130.3	**127.0**	131.3	**128.6**	**127.5**	133.0	131.4	131.3	130.4	130.5	**126.3**
	Social Good	6	0.758	**0.687**	**0.755**	**0.737**	0.797	0.759	0.774	0.779	0.772	**0.733**	**0.728**
		8	0.767	0.777	0.867	0.803	0.861	0.846	0.779	0.876	0.864	0.839	0.792
		10	0.859	0.887	0.912	**0.852**	0.883	0.924	**0.821**	0.921	0.892	0.914	0.870
		12	0.829	0.892	0.928	0.862	0.942	0.957	0.855	0.932	0.916	0.929	0.934
	Traffic	6	0.167	0.178	**0.157**	0.184	**0.160**	0.168	**0.154**	**0.157**	**0.155**	**0.165**	**0.157**
		8	0.159	0.161	0.178	0.177	0.189	0.168	0.173	0.175	0.162	0.164	0.168
		10	0.181	0.234	0.192	**0.175**	0.194	0.211	0.191	0.192	0.183	0.181	0.213
		12	0.214	0.256	**0.211**	**0.209**	0.242	0.232	**0.205**	**0.211**	0.221	**0.200**	0.219

Table L.28: Comparison of multimodal fusion strategies with Informer (+ GPT).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Informer	Agriculture	6	0.212	0.459	**0.168**	0.306	0.283	**0.139**	0.353	0.252	0.411	0.329	0.264
		8	0.347	0.411	0.441	**0.265**	**0.222**	**0.258**	**0.304**	**0.190**	**0.324**	**0.214**	0.416
		10	0.464	**0.226**	**0.400**	0.485	0.611	**0.269**	0.466	**0.273**	**0.324**	**0.285**	**0.320**
		12	0.579	0.634	**0.440**	**0.567**	**0.279**	**0.422**	**0.559**	**0.498**	**0.537**	**0.308**	**0.457**
	Climate	6	1.070	1.140	1.132	1.097	**1.016**	1.096	**1.032**	**1.056**	**1.044**	**1.037**	**1.040**
		8	1.081	**1.072**	1.112	1.092	**0.926**	1.086	1.083	**1.073**	1.086	**1.057**	**1.055**
		10	1.060	1.083	1.105	1.082	**0.930**	1.064	1.074	1.080	1.093	1.107	1.110
		12	1.050	1.069	1.055	1.075	**0.918**	1.067	1.057	1.124	1.087	1.076	1.111
	Economy	6	0.497	0.894	**0.335**	**0.435**	**0.480**	**0.215**	**0.449**	**0.329**	**0.479**	**0.335**	0.879
		8	0.529	0.945	**0.517**	0.572	**0.317**	0.854	0.699	0.535	**0.486**	0.560	0.585
		10	0.761	**0.071**	**0.624**	0.922	1.146	1.064	**0.642**	**0.413**	**0.724**	**0.662**	1.112
		12	1.113	**1.056**	**0.641**	**1.025**	**0.817**	1.310	**0.646**	**0.483**	**0.794**	**0.820**	**0.279**
	Energy	12	0.137	0.197	0.173	0.189	0.205	0.222	0.146	0.187	0.149	0.157	0.156
		24	0.316	**0.287**	**0.297**	0.319	**0.259**	0.323	0.321	**0.302**	0.324	0.350	0.337
		36	0.411	**0.367**	0.445	**0.393**	**0.374**	**0.368**	**0.386**	**0.364**	0.423	**0.392**	**0.370**
		48	0.483	0.492	0.495	0.561	**0.465**	**0.438**	**0.425**	**0.444**	**0.470**	**0.415**	**0.483**
	Environment	48	0.424	0.449	0.426	0.443	**0.424**	0.445	0.454	0.428	0.425	0.443	**0.420**
		96	0.437	0.491	0.486	0.464	0.458	0.468	0.458	**0.406**	**0.431**	**0.436**	**0.417**
		192	0.460	0.469	**0.434**	0.486	**0.444**	0.501	**0.430**	**0.427**	**0.449**	**0.431**	**0.412**
		336	0.460	0.492	0.476	0.483	**0.445**	**0.460**	0.485	0.488	**0.417**	**0.450**	**0.459**
	Public Health	12	1.236	**1.079**	**1.014**	**1.069**	**1.186**	**1.072**	**1.052**	**1.053**	**1.176**	**0.973**	**1.153**
		24	1.373	**1.269**	1.387	**1.367**	**1.354**	**1.223**	**1.213**	1.403	**1.250**	**1.233**	1.412
		36	1.540	**1.412**	1.572	**1.458**	**1.230**	**1.465**	**1.502**	**1.508**	**1.448**	1.559	**1.406**
		48	1.643	**1.606**	1.664	**1.626**	**1.333**	**1.493**	**1.590**	**1.523**	1.660	1.670	1.675
	Security	6	124.8	127.3	126.1	127.4	**124.8**	**122.7**	127.0	126.3	127.4	128.4	129.3
		8	126.7	128.4	127.6	129.2	128.0	128.0	**126.5**	**124.0**	**125.1**	**126.4**	**125.0**
		10	127.8	130.2	128.3	**127.4**	130.6	130.0	129.0	129.1	130.3	131.5	130.2
		12	131.1	132.4	131.1	131.8	**128.4**	131.9	**129.6**	132.1	**130.4**	**128.6**	**129.6**
	Social Good	6	0.726	**0.699**	0.746	0.732	0.760	0.741	0.731	0.765	0.731	0.727	0.750
		8	0.783	0.791	**0.782**	0.786	0.869	0.813	0.797	0.818	0.801	0.827	0.787
		10	0.825	**0.814**	0.866	0.872	**0.819**	**0.817**	0.839	0.886	0.860	0.844	0.900
		12	0.841	0.863	**0.831**	**0.840**	0.966	0.903	0.856	0.954	0.920	0.943	0.859
	Traffic	6	0.164	0.175	0.177	**0.154**	0.165	**0.160**	**0.149**	0.173	0.172	**0.152**	**0.164**
		8	0.161	0.195	0.186	0.166	0.176	0.167	0.167	0.176	0.184	0.170	0.179
		10	0.198	**0.185**	0.202	**0.190**	0.215	**0.183**	**0.187**	**0.176**	**0.175**	**0.176**	**0.186**
		12	0.225	0.227	**0.215**	**0.221**	**0.202**	**0.214**	**0.213**	**0.221**	**0.204**	**0.207**	**0.215**

Table L.29: Comparison of multimodal fusion strategies with Nonstationary Transformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Nonstationary Transformer	Agriculture	6	0.049	0.050	0.051	0.054	0.060	0.055	1.435	0.052	0.053	0.051	0.054
		8	0.071	0.072	0.072	**0.070**	0.074	0.071	0.501	**0.070**	0.072	0.072	**0.069**
		10	0.092	0.096	**0.091**	0.094	0.095	0.095	0.333	**0.092**	**0.091**	**0.090**	**0.090**
		12	0.116	0.118	0.120	0.118	0.120	0.119	0.359	**0.116**	**0.116**	0.118	**0.115**
	Climate	6	1.239	1.297	1.254	**1.195**	**1.067**	1.242	**1.132**	1.243	1.258	1.252	**0.998**
		8	1.244	1.314	1.292	**1.239**	**1.139**	**1.210**	**1.194**	**1.141**	**1.201**	**1.209**	1.297
		10	1.222	1.291	1.256	1.315	1.294	**1.192**	**1.061**	1.249	1.280	1.254	1.243
		12	1.273	1.299	**1.202**	**1.240**	**1.242**	**1.179**	**1.054**	**1.245**	**1.229**	**1.207**	**1.214**
	Economy	6	0.017	0.017	**0.017**	0.019	0.017	**0.016**	9.652	0.017	0.019	**0.016**	0.018
		8	0.018	0.019	0.019	0.019	0.021	**0.018**	6.299	**0.018**	0.019	**0.017**	0.020
		10	0.020	0.021	**0.019**	0.020	**0.019**	**0.020**	0.895	0.021	**0.019**	**0.020**	**0.019**
		12	0.021	**0.021**	**0.020**	0.024	**0.020**	0.022	0.882	**0.020**	**0.020**	**0.020**	**0.021**
	Energy	12	0.104	**0.096**	**0.093**	0.106	**0.090**	0.109	0.187	**0.103**	0.104	**0.083**	**0.092**
		24	0.190	0.244	0.197	0.209	**0.174**	0.199	0.663	0.197	0.209	0.192	0.206
		36	0.293	0.308	**0.282**	0.303	**0.233**	**0.292**	1.211	**0.281**	0.329	**0.289**	**0.244**
		48	0.425	0.451	0.439	**0.411**	**0.392**	0.435	0.761	**0.397**	**0.343**	**0.312**	**0.417**
	Environment	48	0.433	0.434	0.441	**0.432**	0.449	0.438	0.486	0.436	**0.433**	**0.429**	**0.430**
		96	0.440	0.466	0.467	0.452	0.449	**0.433**	0.470	0.443	0.456	0.449	0.450
		192	0.434	0.477	0.442	0.479	0.449	0.456	0.511	**0.417**	0.457	**0.422**	**0.434**
		336	0.431	0.502	**0.431**	0.450	0.438	0.449	0.463	0.444	0.438	0.438	0.435
	Public Health	12	0.781	0.873	0.782	1.050	0.927	0.904	1.104	0.887	0.817	**0.748**	0.807
		24	1.165	1.177	**1.104**	1.329	1.299	**1.151**	1.647	1.245	**0.913**	**1.067**	**1.091**
		36	1.214	1.389	**1.207**	1.215	1.400	1.300	1.750	1.371	1.244	**1.192**	1.244
		48	1.829	1.995	**1.294**	**1.431**	**1.796**	**1.358**	**1.502**	**1.482**	**1.392**	**1.337**	**1.287**
	Security	6	103.7	**101.7**	**101.3**	108.6	**101.3**	106.1	125.5	**101.6**	**100.7**	**102.3**	**101.8**
		8	105.2	105.5	111.3	107.4	105.7	**101.2**	125.4	**105.1**	**105.0**	**103.8**	**104.4**
		10	108.9	**107.9**	111.3	**107.9**	**107.8**	**107.1**	120.0	**107.8**	**107.7**	**107.2**	**107.5**
		12	109.1	109.5	110.7	109.5	109.6	**107.4**	119.9	109.8	109.5	109.5	**109.1**
	Social Good	6	0.828	**0.786**	**0.758**	**0.731**	**0.757**	**0.770**	4.342	**0.769**	**0.753**	**0.769**	**0.785**
		8	0.900	0.972	**0.851**	**0.874**	1.035	**0.879**	2.818	**0.897**	**0.893**	**0.868**	0.938
		10	1.031	**0.971**	**0.990**	**0.958**	1.099	**1.013**	1.109	**0.985**	**0.977**	**1.012**	**0.959**
		12	0.983	1.079	**0.933**	0.987	1.083	1.104	1.073	1.050	1.055	1.039	1.040
	Traffic	6	0.178	0.183	0.185	**0.178**	0.184	**0.170**	0.405	0.181	**0.177**	**0.170**	0.179
		8	0.185	0.190	**0.182**	0.188	0.194	0.192	0.319	0.187	**0.176**	**0.183**	**0.185**
		10	0.186	0.204	**0.182**	0.193	0.193	**0.181**	0.208	0.196	0.188	**0.184**	**0.185**
		12	0.234	0.246	0.256	0.261	0.247	0.253	0.265	0.253	0.258	0.246	0.246

Table L.30: Comparison of multimodal fusion strategies with PatchTST (+ LLAMA3).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
PatchTST	Agriculture	6	0.060	**0.060**	**0.059**	**0.057**	**0.060**	0.061	1.363	**0.056**	**0.058**	**0.059**	0.061
		8	0.077	0.078	0.080	**0.075**	0.078	0.078	0.719	0.080	0.080	0.079	0.078
		10	0.100	0.100	0.102	**0.100**	0.100	0.101	0.304	0.102	0.102	0.101	0.101
		12	0.130	**0.129**	0.131	**0.129**	**0.129**	0.130	0.392	0.131	0.131	0.130	**0.129**
	Climate	6	1.257	**1.229**	**1.235**	**1.232**	**1.229**	**1.251**	**1.220**	**1.235**	**1.241**	1.267	**1.240**
		8	1.248	1.252	**1.221**	1.251	1.252	1.266	1.317	**1.221**	1.257	**1.242**	**1.244**
		10	1.273	1.278	**1.257**	1.284	1.278	**1.265**	**1.109**	**1.257**	**1.250**	**1.260**	**1.262**
		12	1.241	1.251	1.250	1.263	1.251	1.257	**1.100**	1.250	1.263	**1.240**	1.249
	Economy	6	0.017	**0.016**	0.017	0.018	**0.016**	0.017	13.809	0.017	**0.016**	0.017	0.017
		8	0.017	**0.017**	0.017	0.019	**0.017**	0.018	6.810	0.017	0.017	**0.016**	0.017
		10	0.017	**0.016**	**0.017**	0.020	**0.016**	0.018	1.752	**0.017**	0.018	**0.017**	**0.017**
		12	0.018	**0.017**	0.018	0.021	**0.017**	0.018	1.664	0.018	0.018	**0.017**	**0.017**
	Energy	12	0.109	**0.106**	0.111	0.125	**0.106**	**0.108**	0.260	0.111	0.112	0.111	**0.108**
		24	0.211	**0.208**	0.217	0.242	**0.208**	0.219	0.730	0.222	0.220	0.219	0.212
		36	0.307	0.318	**0.304**	0.323	0.318	**0.301**	1.214	0.310	0.310	**0.286**	0.312
		48	0.416	**0.415**	**0.393**	0.446	**0.415**	**0.416**	0.687	**0.394**	**0.404**	0.419	0.423
	Environment	48	0.462	0.463	**0.458**	0.506	0.463	**0.451**	0.489	**0.455**	**0.454**	**0.458**	**0.453**
		96	0.508	**0.501**	**0.461**	**0.472**	**0.501**	**0.455**	0.514	**0.455**	**0.456**	**0.466**	**0.452**
		192	0.540	**0.539**	**0.450**	**0.503**	**0.539**	**0.447**	0.591	**0.458**	**0.439**	**0.465**	**0.436**
		336	0.511	**0.508**	**0.441**	0.524	**0.508**	**0.453**	**0.482**	**0.446**	**0.441**	**0.442**	**0.426**
	Public Health	12	0.926	0.947	0.937	**0.883**	0.947	0.966	**0.909**	0.949	1.007	0.945	**0.890**
		24	1.403	**1.283**	1.423	**1.191**	**1.283**	**1.298**	1.495	**1.264**	1.418	**1.287**	**1.312**
		36	1.602	1.614	1.620	**1.391**	1.614	1.628	2.030	1.621	1.631	1.619	1.662
		48	1.721	1.743	1.760	**1.547**	1.743	1.752	**1.602**	1.761	1.763	1.740	1.785
	Security	6	105.0	**104.3**	**102.8**	105.8	**104.3**	**102.6**	141.8	**103.0**	**104.2**	**103.6**	**103.7**
		8	107.8	110.1	**105.7**	**104.4**	110.1	**106.1**	141.6	**105.7**	**106.4**	**107.6**	**107.1**
		10	110.0	111.5	**108.6**	113.1	111.5	**109.2**	119.1	**109.0**	110.6	**109.8**	**108.1**
		12	111.1	**111.0**	**110.7**	111.2	**111.0**	**110.3**	118.9	111.3	111.5	**111.0**	113.1
	Social Good	6	0.790	0.794	0.795	**0.774**	0.794	0.792	4.279	0.795	0.808	**0.787**	0.813
		8	0.914	**0.907**	**0.891**	**0.845**	**0.907**	**0.893**	2.796	**0.891**	**0.912**	**0.869**	0.933
		10	1.022	1.041	**1.012**	**0.966**	1.041	1.023	1.083	**1.012**	**0.966**	1.027	1.043
		12	1.119	**1.075**	**1.052**	**1.045**	**1.095**	**1.087**	**1.057**	**1.014**	**1.099**	**1.112**	**1.088**
	Traffic	6	0.170	0.173	0.178	0.191	0.173	0.181	0.423	0.177	0.175	**0.169**	0.177
		8	0.183	**0.180**	0.183	0.189	**0.180**	0.190	0.294	0.184	0.183	0.189	0.186
		10	0.196	**0.195**	0.199	0.202	**0.195**	0.196	0.214	**0.196**	**0.189**	**0.184**	**0.190**
		12	0.242	0.243	**0.230**	0.249	0.243	0.253	**0.242**	**0.242**	**0.237**	**0.229**	0.245

Table L.31: Comparison of multimodal fusion strategies with iTransformer (+ LLAMA3).

TS Model	Dataset	*H*	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
iTransformer	Agriculture	6	0.060	**0.059**	0.060	**0.058**	0.064	**0.059**	1.286	0.060	0.060	0.060	0.060
		8	0.077	**0.077**	0.080	**0.074**	0.078	0.079	0.961	0.080	0.079	0.080	0.078
		10	0.096	0.100	0.102	0.098	0.101	0.100	0.187	0.101	0.102	0.101	0.099
		12	0.129	**0.128**	0.131	**0.126**	0.131	0.131	0.309	0.130	0.130	0.129	**0.128**
	Climate	6	1.116	**1.116**	**1.113**	1.124	1.131	1.160	1.321	**1.113**	1.117	1.145	1.125
		8	1.179	**1.173**	1.197	1.234	**1.078**	1.181	1.334	1.197	**1.179**	1.192	1.196
		10	1.233	**1.212**	**1.197**	1.240	**1.174**	**1.182**	**1.069**	**1.197**	**1.215**	**1.188**	**1.189**
		12	1.181	**1.180**	1.183	1.200	1.192	1.198	**1.055**	1.182	1.185	1.184	1.188
	Economy	6	0.015	0.015	0.015	0.019	**0.015**	0.015	10.938	**0.015**	**0.015**	**0.015**	**0.015**
		8	0.015	**0.015**	0.015	0.016	0.015	**0.015**	9.176	0.015	**0.015**	0.016	0.015
		10	0.016	0.016	0.016	0.016	**0.015**	0.016	1.473	0.016	**0.015**	**0.016**	**0.016**
		12	0.016	**0.016**	0.016	0.017	**0.016**	**0.016**	1.125	0.016	0.016	**0.016**	**0.016**
	Energy	12	0.112	**0.108**	**0.099**	**0.106**	**0.096**	0.117	0.248	**0.106**	**0.108**	0.114	0.114
		24	0.232	**0.215**	**0.207**	0.237	**0.177**	**0.208**	0.837	**0.210**	**0.225**	**0.220**	**0.218**
		36	0.286	0.323	0.298	0.326	**0.273**	0.294	1.181	0.291	0.302	**0.284**	**0.286**
		48	0.406	**0.389**	**0.376**	0.418	**0.384**	0.414	0.671	**0.376**	**0.379**	0.407	**0.398**
	Environment	48	0.407	0.420	0.415	0.429	**0.404**	0.418	0.495	0.423	0.421	0.411	0.416
		96	0.417	0.420	0.431	0.461	**0.409**	0.430	0.547	0.449	0.427	0.422	0.436
		192	0.425	0.440	0.449	0.454	0.430	0.429	0.492	0.443	0.437	0.442	0.445
		336	0.421	0.422	0.432	0.443	0.421	0.427	0.423	0.426	0.427	**0.414**	0.433
	Public Health	12	0.998	1.005	**0.892**	**0.927**	**0.931**	**0.988**	**0.997**	**0.949**	**0.956**	1.014	**0.991**
		24	1.447	1.458	1.483	**1.167**	1.468	1.447	1.451	1.479	1.516	1.448	1.448
		36	1.629	1.682	1.630	**1.333**	1.677	1.643	1.751	**1.628**	1.641	**1.624**	1.659
		48	1.749	1.759	1.754	**1.481**	1.789	**1.747**	**1.689**	1.754	1.751	**1.743**	1.777
	Security	6	104.9	**103.2**	**102.3**	113.6	**103.6**	**103.1**	141.9	**102.1**	**104.6**	**102.7**	**104.4**
		8	109.0	**107.6**	**105.3**	113.8	**105.9**	**106.0**	138.4	**105.1**	**106.8**	**107.7**	**106.1**
		10	111.8	**110.1**	**107.8**	116.9	**110.2**	**108.7**	121.6	**106.7**	**110.4**	**108.7**	**111.4**
		12	114.5	**110.1**	**110.0**	114.7	**110.9**	**110.4**	118.3	**109.9**	**110.5**	**110.8**	**111.6**
	Social Good	6	0.836	**0.830**	**0.820**	**0.784**	0.845	0.838	4.297	**0.820**	**0.822**	**0.822**	**0.827**
		8	0.958	0.967	**0.949**	**0.929**	**0.932**	**0.940**	2.814	**0.949**	**0.930**	**0.905**	0.964
		10	1.057	1.060	**1.043**	**1.053**	1.072	**1.047**	1.105	**1.043**	1.073	**0.993**	1.066
		12	1.138	1.165	**1.130**	1.164	**1.098**	**1.127**	**1.136**	**1.109**	1.149	1.157	**1.099**
	Traffic	6	0.177	**0.176**	0.181	0.186	**0.173**	0.186	0.444	0.181	**0.173**	0.179	**0.174**
		8	0.184	0.194	0.196	0.197	0.201	0.188	0.376	0.191	**0.179**	**0.179**	**0.183**
		10	0.196	0.198	**0.187**	0.199	0.203	0.197	0.212	**0.187**	**0.180**	**0.178**	0.197
		12	0.245	0.252	0.246	0.266	0.251	**0.233**	**0.243**	0.248	**0.240**	**0.229**	0.247

Table L.32: Comparison of multimodal fusion strategies with Koopa (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Koopa	Agriculture	6	0.058	0.068	0.065	0.065	1.282	1.889	1.889	0.058	0.069	0.059	**0.057**
		8	0.077	0.100	0.092	0.092	0.141	0.095	0.095	0.078	0.121	0.078	**0.076**
		10	0.099	**0.093**	**0.091**	**0.091**	1.348	0.508	0.508	0.100	0.135	**0.097**	0.099
		12	0.128	0.137	0.133	0.133	0.981	1.731	1.731	0.129	0.134	0.137	**0.128**
	Climate	6	1.250	14.014	1.277	1.277	14.658	1.264	1.264	1.292	**1.104**	**1.250**	**1.248**
		8	1.290	1.492	**1.281**	**1.281**	**1.207**	**1.112**	**1.112**	1.292	**1.074**	**1.254**	**1.263**
		10	1.247	1.424	1.277	1.277	**1.215**	**1.087**	**1.087**	1.259	**1.112**	1.257	**1.246**
		12	1.236	1.250	1.275	1.275	**1.178**	1.370	1.370	1.256	**1.081**	1.262	**1.232**
	Economy	6	0.017	0.028	0.029	0.029	14.050	12.126	12.126	0.029	0.038	0.035	**0.017**
		8	0.018	0.020	0.021	0.021	0.771	0.302	0.302	0.019	0.095	0.019	**0.017**
		10	0.018	0.029	0.034	0.034	2.712	2.162	2.162	0.028	0.102	0.021	**0.018**
		12	0.018	0.031	0.025	0.025	15.161	8.553	8.553	0.025	0.053	0.032	**0.017**
	Energy	12	0.107	10830.7	0.124	0.124	448.7	0.147	0.147	0.118	**0.106**	0.116	**0.107**
		24	0.214	1093.2	0.238	0.238	2.765	0.386	0.386	0.234	0.228	0.221	**0.204**
		36	0.298	**0.281**	0.329	0.329	0.611	0.611	0.611	0.315	0.323	0.310	**0.296**
		48	0.406	0.497	0.413	0.413	2.152	0.904	0.904	0.424	**0.402**	0.434	**0.405**
	Environment	48	0.484	1961952000.0	**0.478**	**0.478**	405995840.0	**0.453**	**0.453**	0.488	**0.440**	**0.441**	0.484
		96	0.528	2833084928.0	**0.462**	**0.462**	960262208.0	**0.466**	**0.466**	0.543	**0.454**	**0.469**	0.533
		192	0.567	6696846336.0	**0.542**	**0.542**	45984964.0	**0.499**	**0.499**	0.572	**0.506**	**0.539**	**0.564**
		336	0.531	13381508096.0	0.533	0.533	138449984.0	**0.495**	**0.495**	0.534	**0.507**	**0.529**	**0.527**
	Public Health	12	1.045	5541.8	**0.961**	**0.961**	234.6	**1.026**	**1.026**	1.239	**1.011**	**0.964**	**1.027**
		24	1.396	**1.158**	**1.224**	**1.224**	1.838	**1.307**	**1.307**	1.517	1.779	**1.177**	1.400
		36	1.629	**1.319**	**1.347**	**1.347**	2.208	**1.528**	**1.528**	1.798	**1.457**	**1.306**	**1.618**
		48	1.732	2.800	**1.446**	**1.446**	**1.726**	1.803	1.803	1.869	1.760	**1.414**	**1.714**
	Security	6	104.7	105.4	**102.3**	**102.3**	135.7	144.0	144.0	**104.3**	111.3	**103.7**	**104.7**
		8	108.6	108.7	111.3	111.3	108.8	**107.4**	**107.4**	113.9	114.7	110.5	**108.5**
		10	109.1	**107.3**	**107.9**	**107.9**	117.8	118.1	118.1	110.8	117.9	109.1	**108.6**
		12	111.4	**110.3**	**109.8**	**109.8**	157.0	144.3	144.3	114.5	117.3	**108.3**	111.7
	Social Good	6	0.848	0.923	0.880	0.880	4.157	4.121	4.121	0.852	0.861	**0.842**	0.848
		8	0.925	1.207	0.947	0.947	0.968	0.931	0.931	0.946	**0.868**	**0.895**	**0.924**
		10	0.987	1.111	1.092	1.092	1.303	1.158	1.158	**0.985**	**0.856**	**0.940**	0.992
		12	1.085	1.203	**1.068**	**1.068**	3.165	3.205	3.205	**1.075**	**0.935**	1.127	**1.054**
	Traffic	6	0.224	0.231	**0.218**	**0.218**	0.355	0.449	0.449	0.236	**0.201**	**0.221**	**0.211**
		8	0.211	0.214	**0.209**	**0.209**	**0.203**	**0.204**	**0.204**	0.250	0.216	**0.207**	**0.202**
		10	0.216	0.406	0.223	0.223	0.231	0.242	0.242	0.229	0.219	**0.215**	**0.206**
		12	0.279	0.332	**0.273**	**0.273**	0.406	0.330	0.330	0.284	**0.268**	**0.268**	**0.268**

Table L.33: Comparison of multimodal fusion strategies with DLinear (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
DLinear	Agriculture	6	0.112	0.132	0.133	0.133	0.850	1.352	1.188	0.136	0.244	0.136	**0.067**
		8	0.323	**0.187**	**0.187**	**0.187**	1.371	0.884	1.336	**0.210**	0.332	**0.228**	**0.081**
		10	0.163	0.208	0.208	0.208	0.458	0.328	0.240	0.173	0.191	0.198	**0.133**
		12	0.216	0.246	0.250	0.246	0.407	0.289	0.348	**0.162**	0.540	**0.192**	**0.173**
	Climate	6	1.308	**1.307**	**1.274**	**1.231**	1.359	**1.295**	1.344	1.332	**1.160**	**1.215**	**1.075**
		8	1.222	1.345	1.305	1.265	1.310	1.277	1.248	1.268	**1.090**	1.323	**1.108**
		10	1.157	1.356	1.348	1.271	1.196	**1.132**	**1.126**	1.311	**1.083**	1.290	**1.112**
		12	1.202	1.342	1.316	1.303	**1.172**	**1.124**	**1.133**	1.206	**1.152**	1.258	**1.096**
	Economy	6	0.071	0.086	0.086	0.090	13.427	9.363	11.553	0.107	0.501	0.098	**0.027**
		8	0.233	**0.120**	**0.142**	**0.141**	9.724	8.240	9.121	**0.096**	0.412	**0.150**	**0.032**
		10	0.085	0.119	0.129	0.130	1.840	1.176	0.810	0.133	0.295	0.136	**0.047**
		12	0.109	0.129	0.129	0.129	1.582	0.894	0.694	**0.067**	0.605	**0.091**	**0.066**
	Energy	12	0.114	0.203	0.201	0.164	0.238	0.228	0.188	0.117	0.240	0.180	**0.107**
		24	0.218	0.312	0.305	0.280	0.809	0.789	0.678	0.246	0.315	0.258	**0.199**
		36	0.301	0.344	0.369	0.349	1.260	0.936	0.774	0.314	0.344	0.365	**0.282**
		48	0.410	0.427	0.420	**0.405**	0.721	0.676	0.655	0.444	0.439	0.430	**0.386**
	Environment	48	0.489	**0.449**	**0.439**	**0.439**	0.503	**0.476**	**0.482**	0.512	**0.459**	**0.446**	0.494
		96	0.573	**0.466**	**0.482**	**0.479**	**0.539**	**0.499**	**0.479**	**0.568**	**0.465**	**0.463**	**0.572**
		192	0.591	**0.507**	**0.502**	**0.508**	**0.542**	**0.554**	0.616	**0.586**	**0.576**	**0.515**	**0.582**
		336	0.537	**0.515**	**0.498**	**0.495**	**0.512**	**0.502**	**0.494**	**0.537**	**0.506**	**0.497**	**0.537**
	Public Health	12	1.337	1.468	**1.319**	**1.239**	1.341	**1.320**	**1.290**	1.645	1.857	**1.225**	**1.198**
		24	1.577	**1.553**	**1.375**	**1.345**	1.624	**1.557**	**1.568**	1.650	1.997	**1.469**	**1.535**
		36	1.622	1.763	1.627	**1.477**	2.087	1.953	1.887	1.828	1.775	1.641	**1.558**
		48	1.694	1.771	**1.687**	**1.601**	1.830	1.832	1.820	1.766	1.879	**1.618**	**1.664**
	Security	6	104.3	106.1	105.4	105.0	184.5	169.1	171.9	106.1	109.1	104.6	104.8
		8	109.2	109.9	**107.6**	**107.7**	150.5	148.0	147.8	110.4	117.9	**108.5**	**108.9**
		10	110.3	112.9	111.2	110.5	112.6	112.1	112.5	110.9	118.0	110.4	**109.8**
		12	112.0	114.5	113.3	112.6	113.4	112.9	113.4	112.7	119.9	112.6	**111.6**
	Social Good	6	0.999	**0.847**	**0.920**	**0.815**	4.191	2.636	2.642	**0.866**	**0.872**	**0.887**	**0.780**
		8	0.909	0.989	1.097	1.028	2.734	2.493	2.129	**0.906**	0.957	1.058	**0.863**
		10	0.960	1.216	1.124	1.180	1.206	1.070	1.044	1.078	1.030	1.117	0.968
		12	1.080	1.197	1.255	1.264	1.177	1.081	**1.039**	1.142	1.112	1.108	**1.000**
	Traffic	6	0.253	0.275	0.285	0.282	0.505	0.346	0.516	0.308	0.284	0.277	**0.222**
		8	0.322	0.335	0.344	0.340	0.467	0.419	0.454	**0.268**	**0.312**	0.339	**0.221**
		10	0.244	0.328	0.352	0.333	0.345	0.287	0.270	0.261	0.315	0.359	**0.219**
		12	0.289	0.350	0.371	0.360	0.315	0.309	0.301	0.293	0.299	0.317	**0.261**

Table L.34: Comparison of multimodal fusion strategies with TiDE (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TiDE	Agriculture	6	0.074	0.074	0.080	0.075	1.699	**0.069**	1.747	**0.061**	**0.065**	**0.062**	**0.061**
		8	0.094	0.099	**0.090**	**0.091**	0.901	0.100	1.004	**0.083**	**0.081**	**0.081**	**0.081**
		10	0.113	18.711	0.113	0.132	50.930	0.117	0.349	**0.103**	**0.103**	**0.103**	**0.104**
		12	0.156	23.792	**0.142**	**0.147**	61.286	**0.148**	0.432	**0.134**	**0.135**	**0.133**	**0.134**
	Climate	6	1.592	**1.589**	1.602	1.649	1.697	**1.454**	**1.475**	**1.257**	**1.244**	**1.235**	**1.249**
		8	1.468	1.536	**1.382**	1.560	**1.133**	1.580	**1.311**	**1.258**	**1.278**	**1.253**	**1.259**
		10	1.398	40.949	1.403	1.532	8.241	1.565	**1.179**	**1.275**	**1.270**	**1.256**	**1.267**
		12	1.500	11.305	**1.407**	**1.498**	3.436	**1.472**	**1.186**	**1.254**	**1.274**	**1.263**	**1.270**
	Economy	6	0.037	0.044	**0.037**	0.037	14.080	0.045	13.600	**0.017**	**0.017**	**0.017**	**0.017**
		8	0.039	0.046	**0.036**	0.040	8.610	**0.031**	9.778	**0.018**	**0.017**	**0.018**	**0.020**
		10	0.030	3.359	0.032	0.040	12.426	0.040	1.512	**0.018**	**0.017**	**0.017**	**0.018**
		12	0.033	4.545	**0.031**	0.037	1.918	0.038	2.290	**0.018**	**0.018**	**0.017**	**0.017**
	Energy	12	0.136	10055.3	0.140	0.176	3650.8	**0.135**	0.291	**0.106**	**0.108**	**0.109**	**0.106**
		24	0.241	0.409	**0.236**	0.306	0.747	**0.238**	0.747	**0.218**	**0.201**	**0.216**	**0.219**
		36	0.328	26053.8	0.332	0.398	14910.8	**0.327**	1.292	**0.295**	**0.296**	**0.296**	**0.294**
		48	0.443	0.483	**0.439**	0.452	0.684	**0.441**	0.688	**0.399**	**0.406**	**0.404**	**0.405**
	Environment	48	0.485	0.733	**0.485**	0.490	0.486	0.486	**0.477**	0.487	**0.485**	**0.485**	**0.484**
		96	0.543	0.698	**0.540**	**0.489**	0.563	0.547	**0.493**	**0.540**	**0.542**	0.543	**0.539**
		192	0.578	14630.4	**0.576**	**0.537**	26545.1	**0.577**	0.621	**0.575**	**0.577**	**0.576**	**0.577**
		336	0.533	40955.4	0.534	**0.517**	17652.0	0.534	**0.489**	**0.533**	0.535	0.534	**0.533**
	Public Health	12	1.297	1640.6	1.311	1.427	1600.4	**1.286**	**1.290**	**1.087**	**1.107**	**1.085**	**1.124**
		24	1.512	2.232	1.532	1.742	**1.500**	1.538	1.635	**1.424**	**1.427**	**1.456**	**1.466**
		36	1.688	26231.0	**1.673**	1.911	9720.8	**1.677**	2.093	**1.619**	**1.619**	**1.599**	**1.625**
		48	1.800	2.321	**1.763**	1.982	1.981	1.804	1.893	**1.732**	**1.741**	**1.700**	**1.719**
	Security	6	146.0	**125.6**	**135.0**	**125.4**	191.8	**122.1**	185.7	**104.8**	**106.9**	**107.0**	**108.0**
		8	129.6	138.3	132.5	138.6	150.1	**128.9**	155.2	**107.8**	**109.4**	**112.2**	**108.5**
		10	132.2	151.2	134.8	135.0	**104.8**	135.2	**117.6**	**113.0**	**110.2**	**113.4**	**111.6**
		12	144.9	153.1	**139.3**	**139.0**	**106.1**	**142.2**	**120.3**	**112.9**	**112.5**	**113.1**	**112.2**
	Social Good	6	0.926	0.979	1.002	1.010	4.407	0.940	4.410	**0.836**	**0.835**	**0.814**	**0.823**
		8	1.098	1.199	**1.032**	1.217	2.748	**1.076**	2.770	**0.965**	**0.952**	**0.953**	**0.956**
		10	1.129	389.2	1.183	1.257	215.8	1.290	**1.067**	**1.112**	**1.063**	**1.085**	**1.072**
		12	1.224	536.6	**1.218**	1.256	155.4	1.265	**1.161**	**1.150**	**1.143**	**1.156**	**1.143**
	Traffic	6	0.289	0.298	0.295	**0.275**	0.559	0.301	0.461	**0.237**	**0.236**	**0.236**	**0.233**
		8	0.303	0.340	**0.277**	0.310	0.451	**0.272**	0.371	**0.231**	**0.230**	**0.233**	**0.223**
		10	0.251	42.214	**0.249**	0.321	14.641	0.296	0.273	**0.224**	**0.231**	**0.225**	**0.228**
		12	0.319	58.262	**0.305**	0.333	49.699	0.329	**0.293**	**0.288**	**0.290**	**0.284**	**0.289**

Table L.35: Comparison of multimodal fusion strategies with FiLM (+ LLAMA3).

TS Model	Dataset	*H*	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FiLM	Agriculture	6	0.060	0.084	0.068	0.068	1.740	0.063	1.854	**0.060**	0.061	0.062	0.062
		8	0.082	0.108	0.091	0.087	3.002	0.089	1.176	**0.080**	**0.082**	**0.080**	**0.079**
		10	0.106	22.421	**0.104**	0.115	1.026	0.109	0.321	0.112	**0.104**	**0.103**	**0.105**
		12	0.138	20.331	0.141	**0.131**	0.307	0.144	0.418	**0.135**	**0.136**	**0.136**	0.141
	Climate	6	1.354	**1.262**	**1.306**	**1.313**	**1.313**	**1.269**	**1.286**	**1.241**	**1.288**	**1.248**	**1.231**
		8	1.283	1.456	1.286	1.292	**1.039**	1.345	**1.226**	1.283	1.296	**1.265**	**1.266**
		10	1.284	14.615	1.294	1.296	**1.168**	1.307	**1.092**	**1.276**	1.293	**1.270**	**1.273**
		12	1.276	11.715	1.284	1.329	7.656	1.287	**1.106**	1.298	1.293	1.277	**1.268**
	Economy	6	0.017	0.049	0.019	0.037	21.726	0.019	17.804	0.019	**0.016**	0.019	**0.017**
		8	0.018	0.033	0.021	0.020	11.414	0.020	10.334	**0.017**	**0.018**	**0.017**	**0.017**
		10	0.019	0.024	0.020	0.019	1.269	0.019	2.252	0.019	**0.018**	**0.018**	**0.018**
		12	0.018	3.131	0.019	0.029	0.717	0.020	2.128	**0.018**	**0.018**	**0.018**	**0.017**
	Energy	12	0.122	8155.3	0.131	0.169	0.326	0.132	0.217	**0.109**	**0.111**	0.128	**0.110**
		24	0.230	1.468	0.237	0.304	0.822	0.257	0.756	**0.217**	**0.222**	**0.228**	**0.218**
		36	0.312	0.399	0.357	0.446	1.315	0.387	1.195	0.315	0.318	0.328	**0.311**
		48	0.428	0.495	0.460	0.523	0.743	0.510	0.690	**0.419**	0.432	0.477	**0.427**
	Environment	48	0.491	949097920.0	**0.486**	**0.475**	0.518	**0.470**	0.530	**0.487**	**0.467**	**0.485**	**0.488**
		96	0.547	556371.0	**0.483**	**0.479**	0.604	**0.491**	0.566	**0.546**	**0.509**	**0.509**	**0.544**
		192	0.574	2790298624.0	**0.518**	**0.521**	1.243	**0.525**	0.642	**0.574**	**0.550**	**0.522**	**0.566**
		336	0.529	1012101632.0	0.540	**0.524**	81147368.0	**0.491**	**0.488**	**0.527**	**0.503**	**0.527**	**0.527**
	Public Health	12	1.157	2.965	1.402	1.296	2.071	1.401	**1.080**	**1.127**	**1.138**	1.311	**1.107**
		24	1.606	**1.525**	1.737	**1.354**	2.231	**1.585**	**1.599**	**1.453**	**1.488**	**1.573**	**1.453**
		36	1.618	1.774	1.810	1.908	2.315	1.698	1.838	1.894	1.704	1.671	1.644
		48	1.706	2.329	1.748	2.137	1.771	1.892	**1.659**	1.736	1.784	1.712	1.735
	Security	6	127.4	**110.9**	**102.2**	**101.1**	207.3	**103.0**	189.1	**102.8**	**103.1**	**104.6**	**107.0**
		8	113.8	117.5	**105.7**	116.5	136.6	**105.6**	161.8	115.9	**104.4**	**106.5**	**105.1**
		10	116.9	136.1	**107.9**	133.4	**101.7**	**108.0**	**111.7**	**109.4**	**111.1**	**108.9**	**115.0**
		12	119.1	137.6	**110.1**	**108.2**	**103.3**	**109.9**	**112.9**	**113.2**	**112.3**	**109.7**	**113.8**
	Social Good	6	0.867	136.5	**0.866**	**0.860**	4.180	0.873	4.340	**0.828**	**0.828**	**0.849**	**0.814**
		8	1.003	1.684	**0.937**	1.044	2.679	**0.951**	2.863	**0.991**	**0.915**	**0.956**	**0.960**
		10	1.139	599.9	**1.042**	1.222	266.7	**1.041**	**1.122**	**1.024**	**1.059**	**1.019**	**1.116**
		12	1.230	723.8	**1.115**	**1.148**	201.7	**1.120**	**1.118**	**1.223**	**1.189**	**1.066**	**1.166**
	Traffic	6	0.228	0.269	**0.227**	0.239	0.961	0.233	0.514	0.243	0.238	0.244	0.241
		8	0.223	**0.211**	**0.212**	**0.215**	2.486	0.228	0.397	0.228	**0.222**	**0.219**	0.235
		10	0.216	0.221	**0.216**	**0.209**	0.820	0.218	0.256	0.235	0.221	**0.214**	**0.216**
		12	0.253	3.208	**0.249**	0.263	1.060	0.262	**0.246**	0.283	0.260	0.273	**0.249**

Table L.36: Comparison of multimodal fusion strategies with FEDformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FEDformer	Agriculture	6	0.056	0.060	0.064	0.061	0.063	0.061	0.932	0.065	0.067	**0.056**	0.057
		8	0.073	0.078	**0.073**	0.094	0.087	**0.073**	0.969	**0.072**	**0.069**	0.082	**0.070**
		10	0.087	0.107	0.100	0.092	0.104	0.102	0.327	0.107	0.096	0.091	0.088
		12	0.111	0.131	0.127	0.143	0.133	0.121	0.460	0.127	0.122	0.134	0.113
	Climate	6	1.102	1.141	1.122	**1.057**	**1.055**	**1.069**	1.279	**1.052**	**1.096**	**1.083**	1.108
		8	1.091	**1.047**	**1.091**	1.123	**1.042**	**1.023**	1.105	1.092	**1.069**	**1.063**	**1.034**
		10	1.085	1.087	1.163	**1.072**	**1.049**	1.086	**0.915**	1.156	1.109	1.085	**1.073**
		12	1.106	**1.104**	1.115	**1.101**	**1.096**	1.151	**0.950**	1.114	**1.089**	**1.089**	**1.088**
	Economy	6	0.039	0.049	0.050	**0.036**	0.045	0.045	9.237	0.050	0.051	**0.033**	0.049
		8	0.047	**0.040**	**0.042**	0.056	**0.027**	0.051	7.025	**0.042**	**0.036**	**0.047**	0.050
		10	0.039	0.045	0.043	0.041	0.060	**0.032**	1.445	0.043	0.042	**0.036**	0.045
		12	0.055	0.059	**0.039**	0.062	**0.046**	**0.033**	1.301	**0.039**	**0.039**	**0.032**	**0.048**
	Energy	12	0.102	0.133	0.111	0.141	0.118	0.118	0.260	0.111	0.114	**0.098**	**0.094**
		24	0.182	0.199	0.237	0.303	0.248	0.187	0.767	0.227	0.244	0.190	**0.181**
		36	0.258	0.351	0.379	0.403	0.371	0.305	1.302	0.305	0.348	0.335	**0.254**
		48	0.366	0.440	0.367	0.446	0.468	0.458	0.705	0.502	0.466	0.466	0.409
	Environment	48	0.463	0.493	0.496	0.501	0.514	0.489	0.491	0.491	0.514	0.501	0.481
		96	0.489	**0.476**	**0.474**	0.498	**0.479**	**0.478**	**0.459**	0.507	0.497	0.504	**0.480**
		192	0.493	0.535	0.493	**0.481**	0.527	0.502	**0.478**	**0.485**	0.499	0.495	**0.484**
		336	0.461	0.504	0.475	0.483	0.490	0.472	**0.455**	0.480	0.482	0.489	0.481
	Public Health	12	1.142	**1.037**	**1.059**	**1.101**	1.175	**1.062**	**1.055**	**1.109**	**1.040**	**1.028**	**1.092**
		24	1.379	1.436	1.422	1.413	1.545	1.474	1.401	1.440	1.486	1.431	1.405
		36	1.438	1.660	1.558	1.530	1.710	1.474	1.639	1.464	1.491	1.551	1.452
		48	1.572	1.690	1.699	1.621	1.770	1.698	**1.496**	1.716	**1.447**	1.672	**1.542**
	Security	6	106.0	110.1	106.5	113.3	106.1	**104.8**	166.4	106.5	114.8	**101.2**	107.2
		8	111.6	**108.8**	**107.9**	**108.4**	**110.4**	**109.0**	141.3	**108.0**	**111.1**	**109.5**	**109.8**
		10	111.5	112.8	111.7	**107.6**	112.8	117.3	116.3	111.7	112.4	**107.8**	115.3
		12	117.8	**115.8**	**115.4**	**113.6**	**114.3**	**116.0**	118.1	**115.4**	**112.6**	**106.2**	**114.4**
	Social Good	6	0.883	**0.805**	**0.837**	**0.837**	**0.873**	**0.861**	4.382	**0.798**	**0.843**	**0.863**	**0.879**
		8	0.905	**0.875**	**0.874**	0.916	0.911	**0.854**	2.811	**0.890**	**0.863**	**0.888**	**0.869**
		10	0.954	0.967	**0.903**	**0.895**	1.142	**0.919**	1.140	**0.905**	**0.944**	**0.903**	**0.936**
		12	1.073	**0.991**	**1.025**	**1.061**	1.161	**0.973**	1.147	**1.028**	**1.026**	**0.963**	**1.067**
	Traffic	6	0.152	0.158	0.153	**0.151**	0.157	**0.151**	0.394	0.156	0.154	0.159	**0.149**
		8	0.156	0.163	0.158	0.162	**0.150**	0.157	0.318	0.158	0.157	**0.155**	0.158
		10	0.162	0.176	0.168	0.164	**0.148**	0.165	0.198	0.168	0.166	**0.158**	0.165
		12	0.228	0.235	0.234	0.239	**0.208**	**0.224**	**0.212**	0.230	**0.224**	**0.220**	**0.224**

Table L.37: Comparison of multimodal fusion strategies with Autoformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Autoformer	Agriculture	6	0.071	0.076	0.083	0.094	0.072	0.073	0.877	0.076	0.079	**0.071**	**0.063**
		8	0.088	**0.086**	0.089	0.091	**0.083**	0.090	1.316	0.095	0.100	**0.083**	**0.084**
		10	0.102	0.113	0.123	0.121	0.110	**0.099**	0.281	0.124	0.121	0.109	**0.101**
		12	0.132	0.137	0.163	0.151	0.136	0.144	0.201	0.163	0.148	0.145	0.134
	Climate	6	1.249	1.282	1.251	1.295	**1.190**	**1.229**	1.365	1.250	**1.247**	**1.199**	**1.204**
		8	1.186	1.239	1.303	1.217	1.252	**1.171**	1.263	1.233	1.199	**1.179**	**1.185**
		10	1.193	1.307	1.219	1.280	1.280	1.232	**0.998**	1.235	1.260	1.237	1.193
		12	1.161	1.222	1.207	1.246	1.205	1.242	**1.007**	1.174	1.246	1.231	**1.135**
	Economy	6	0.061	0.072	**0.050**	**0.059**	0.065	**0.050**	10.519	**0.050**	**0.060**	**0.054**	**0.044**
		8	0.063	0.082	0.064	**0.054**	0.066	0.073	8.158	0.064	0.075	**0.057**	0.064
		10	0.071	**0.067**	**0.052**	**0.064**	0.091	**0.052**	1.633	**0.048**	**0.065**	**0.052**	**0.039**
		12	0.076	**0.065**	**0.053**	**0.057**	**0.069**	**0.053**	1.204	**0.049**	**0.055**	**0.051**	**0.053**
	Energy	12	0.106	0.124	0.139	0.148	0.183	0.136	0.312	0.155	0.138	0.147	0.144
		24	0.278	0.322	0.298	0.318	0.330	**0.274**	0.827	0.313	0.313	0.290	0.290
		36	0.378	0.391	0.391	0.398	0.386	**0.373**	1.231	0.402	0.383	0.387	**0.377**
		48	0.481	0.484	0.485	**0.471**	**0.479**	0.487	0.711	0.494	**0.476**	0.492	**0.468**
	Environment	48	0.540	**0.523**	**0.492**	**0.507**	**0.516**	**0.499**	**0.498**	**0.510**	**0.500**	**0.507**	**0.463**
		96	0.544	0.545	**0.496**	**0.497**	**0.515**	**0.513**	**0.517**	**0.509**	**0.523**	**0.505**	**0.473**
		192	0.595	**0.565**	**0.535**	**0.524**	**0.571**	**0.516**	0.604	**0.534**	**0.537**	**0.504**	**0.501**
		336	0.512	0.548	0.534	0.526	0.539	0.542	**0.500**	0.539	0.528	0.541	0.515
	Public Health	12	1.583	**1.416**	**1.444**	**1.581**	1.768	1.704	**1.445**	**1.468**	**1.448**	1.615	**1.387**
		24	1.919	2.096	2.022	**1.896**	**1.841**	**1.832**	**1.451**	**1.862**	**1.810**	**1.800**	**1.790**
		36	1.920	2.003	**1.839**	1.974	2.121	1.925	2.019	1.940	**1.804**	2.048	1.942
		48	1.885	2.070	1.925	1.968	1.997	1.892	**1.621**	2.053	**1.855**	2.006	**1.831**
	Security	6	106.7	107.0	108.4	**105.8**	**104.9**	109.7	147.0	108.4	108.6	111.0	110.2
		8	111.0	**108.1**	**110.5**	112.0	**110.6**	112.3	139.0	**110.5**	112.9	**105.0**	**110.1**
		10	116.2	116.5	116.3	**113.4**	**111.5**	**110.8**	117.0	116.3	**115.4**	**113.0**	**112.1**
		12	117.2	**117.1**	**115.4**	**114.7**	**115.4**	118.0	118.0	**113.6**	**115.2**	**116.3**	**112.8**
	Social Good	6	0.861	0.905	**0.818**	**0.839**	**0.829**	0.883	4.404	**0.846**	0.868	**0.815**	0.873
		8	1.001	1.008	**0.982**	**0.991**	1.064	1.006	2.742	**0.994**	**0.973**	**0.955**	**0.970**
		10	1.018	1.114	1.121	1.081	1.046	1.035	1.132	1.123	1.073	1.032	**1.007**
		12	1.059	1.258	1.142	1.127	1.160	1.173	1.148	1.128	1.214	**1.026**	1.067
	Traffic	6	0.179	0.191	0.179	**0.177**	0.191	0.184	0.370	0.185	**0.161**	**0.176**	0.190
		8	0.186	**0.183**	0.193	**0.178**	0.236	**0.171**	0.298	0.195	0.202	**0.184**	0.204
		10	0.199	0.205	**0.191**	0.206	0.217	**0.188**	0.204	**0.191**	**0.186**	**0.195**	**0.188**
		12	0.261	**0.253**	**0.216**	**0.253**	**0.251**	**0.220**	**0.251**	**0.230**	**0.243**	**0.220**	0.264

Table L.38: Comparison of multimodal fusion strategies with Crossformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Crossformer	Agriculture	6	0.175	**0.154**	0.183	**0.115**	**0.141**	0.245	**0.158**	0.180	0.187	**0.118**	**0.153**
		8	0.214	**0.195**	**0.212**	0.222	0.659	0.305	**0.172**	0.245	0.245	**0.142**	0.263
		10	0.322	**0.260**	**0.248**	0.392	**0.212**	0.334	**0.316**	**0.253**	**0.304**	**0.273**	0.350
		12	0.332	0.414	**0.323**	0.420	0.486	0.455	0.527	0.414	**0.269**	0.390	**0.323**
	Climate	6	1.041	1.091	1.138	1.042	1.067	1.049	1.068	1.047	1.064	**1.020**	1.045
		8	1.066	1.081	1.095	1.081	**1.052**	1.086	1.086	1.080	1.091	1.068	**1.058**
		10	1.095	**1.090**	1.096	**1.094**	1.100	**1.084**	1.100	1.103	1.095	**1.091**	1.095
		12	1.099	1.109	**1.095**	**1.081**	1.146	**1.075**	1.100	**1.088**	1.106	**1.063**	1.109
	Economy	6	0.367	0.386	**0.293**	**0.290**	**0.211**	**0.298**	0.550	0.407	0.452	**0.208**	**0.234**
		8	0.402	0.690	0.464	0.554	5.684	0.662	0.987	0.518	**0.163**	**0.151**	**0.199**
		10	0.468	0.807	**0.447**	0.751	**0.389**	0.660	0.755	**0.358**	**0.227**	0.675	0.492
		12	0.344	0.843	0.984	0.841	0.498	0.971	0.802	0.857	0.720	0.521	**0.189**
	Energy	12	0.139	0.139	0.173	**0.137**	0.160	0.145	**0.131**	**0.137**	0.150	0.153	0.144
		24	0.225	0.226	0.254	0.276	0.272	0.277	0.264	0.255	0.264	0.258	0.250
		36	0.333	0.375	0.361	**0.325**	0.355	0.348	0.351	**0.308**	**0.332**	0.340	**0.326**
		48	0.435	0.444	**0.398**	**0.410**	**0.427**	**0.417**	**0.389**	**0.428**	**0.411**	0.438	**0.432**
	Environment	48	0.489	**0.453**	**0.466**	**0.473**	**0.436**	**0.442**	**0.483**	**0.457**	**0.443**	**0.468**	**0.448**
		96	0.536	**0.446**	**0.477**	**0.483**	**0.449**	**0.457**	**0.485**	**0.455**	**0.462**	**0.467**	**0.463**
		192	0.550	**0.509**	0.552	0.567	0.561	**0.545**	**0.537**	**0.515**	**0.491**	0.554	**0.489**
		336	0.538	**0.491**	**0.521**	**0.510**	**0.507**	0.548	0.551	**0.526**	**0.515**	0.581	**0.502**
	Public Health	12	1.070	1.136	1.071	1.074	1.465	1.132	1.086	**1.066**	**1.050**	1.097	**0.975**
		24	1.336	1.426	**1.306**	1.352	1.352	1.394	1.379	1.350	1.400	**1.314**	1.420
		36	1.390	1.411	**1.356**	**1.345**	1.409	1.455	**1.332**	**1.379**	**1.329**	**1.364**	**1.357**
		48	1.509	**1.462**	**1.451**	**1.433**	**1.505**	**1.458**	1.569	**1.438**	**1.452**	**1.421**	**1.397**
	Security	6	121.3	123.3	123.3	122.3	121.3	**119.0**	124.0	123.3	121.7	121.3	**121.0**
		8	120.7	126.5	124.5	125.9	132.4	127.0	126.8	123.6	123.3	125.2	122.1
		10	123.8	128.0	126.1	125.9	**122.2**	128.8	127.6	125.6	124.0	126.3	124.6
		12	127.3	127.8	128.6	127.3	129.4	128.5	129.3	128.5	**126.3**	127.6	**127.2**
	Social Good	6	0.754	**0.730**	**0.741**	**0.752**	0.766	**0.752**	**0.744**	0.757	**0.732**	**0.743**	**0.750**
		8	0.810	0.821	0.823	0.811	1.895	**0.803**	0.833	0.822	0.841	0.837	0.828
		10	0.898	0.964	**0.884**	**0.860**	0.933	0.904	**0.870**	**0.882**	**0.874**	**0.877**	**0.869**
		12	0.950	0.978	**0.919**	**0.937**	0.967	**0.914**	**0.947**	**0.941**	**0.938**	**0.916**	**0.943**
	Traffic	6	0.213	0.215	0.217	**0.213**	**0.209**	0.217	0.218	0.220	0.232	0.215	0.216
		8	0.203	0.214	0.220	0.223	0.311	0.223	0.212	0.209	0.218	0.213	0.218
		10	0.216	**0.213**	0.235	**0.214**	0.217	**0.200**	0.217	0.224	0.218	0.226	0.222
		12	0.239	0.240	0.242	0.261	0.271	**0.234**	0.249	0.253	0.249	0.241	0.249

Table L.39: Comparison of multimodal fusion strategies with Reformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Reformer	Agriculture	6	0.193	**0.188**	0.251	**0.174**	0.273	**0.154**	0.359	**0.185**	0.248	0.260	0.193
		8	0.248	0.338	0.328	0.280	0.347	0.415	**0.245**	0.273	**0.161**	**0.214**	0.266
		10	0.179	0.674	0.281	0.314	0.544	0.413	0.744	0.259	0.268	0.493	0.419
		12	0.474	**0.333**	**0.430**	**0.358**	0.634	**0.283**	**0.295**	**0.244**	0.599	**0.305**	**0.241**
	Climate	6	1.013	1.013	1.062	1.043	1.038	**1.008**	1.068	1.026	1.030	**1.000**	1.071
		8	1.077	**1.076**	**1.061**	1.106	**1.059**	1.084	**0.926**	**1.037**	**1.066**	**1.044**	1.079
		10	1.063	1.089	1.109	1.079	1.078	1.078	**0.993**	1.098	1.087	1.093	1.098
		12	1.098	**1.067**	**1.098**	**1.046**	1.124	**1.089**	**1.040**	1.099	1.104	**1.086**	1.101
	Economy	6	0.348	**0.226**	**0.293**	0.389	0.677	**0.331**	0.948	**0.292**	**0.336**	**0.190**	**0.264**
		8	0.212	**0.207**	0.492	**0.212**	0.420	0.836	1.061	0.493	0.445	0.575	0.289
		10	0.562	1.376	0.690	**0.120**	1.962	0.596	1.686	**0.234**	**0.388**	1.085	**0.043**
		12	0.766	1.163	**0.672**	**0.180**	1.671	1.125	**0.748**	1.113	1.135	**0.364**	0.969
	Energy	12	0.235	**0.215**	**0.221**	0.303	**0.227**	0.251	**0.226**	**0.150**	**0.167**	**0.222**	**0.217**
		24	0.401	0.424	0.409	**0.381**	0.434	**0.395**	**0.351**	**0.351**	**0.263**	**0.303**	**0.353**
		36	0.462	0.485	**0.456**	**0.459**	0.501	0.475	**0.423**	0.493	**0.442**	**0.412**	**0.408**
		48	0.485	0.564	0.536	0.525	0.740	0.509	0.584	0.538	0.495	0.532	0.507
	Environment	48	0.411	0.424	0.424	0.428	0.413	0.422	0.411	**0.407**	**0.408**	0.411	**0.409**
		96	0.473	**0.444**	**0.412**	**0.434**	**0.469**	**0.418**	**0.430**	**0.405**	**0.395**	**0.437**	**0.412**
		192	0.458	**0.439**	**0.420**	**0.451**	**0.403**	**0.444**	**0.430**	**0.433**	**0.395**	**0.422**	**0.407**
		336	0.451	**0.423**	**0.421**	**0.433**	**0.450**	**0.433**	**0.435**	**0.413**	**0.404**	**0.419**	**0.421**
	Public Health	12	1.244	**1.119**	**1.185**	**1.189**	1.420	**1.097**	**1.203**	**1.020**	**1.062**	**1.083**	**1.082**
		24	1.233	1.482	1.337	1.380	1.330	1.382	1.308	1.317	1.240	1.294	1.267
		36	1.366	1.601	1.394	1.500	**1.350**	1.436	**1.210**	**1.296**	**1.322**	**1.319**	**1.250**
		48	1.427	1.525	**1.364**	**1.324**	**1.416**	1.584	1.498	**1.364**	1.463	1.585	1.471
	Security	6	124.6	**123.6**	**123.6**	**124.2**	**118.5**	**121.7**	**122.1**	**123.6**	**124.1**	**123.7**	**123.4**
		8	123.9	**118.0**	**122.5**	124.2	**119.0**	**123.0**	125.0	**122.5**	**122.6**	124.2	125.5
		10	127.2	**124.4**	**124.6**	**122.4**	130.0	**125.5**	**127.1**	**125.8**	**123.8**	**125.1**	**125.2**
		12	123.4	126.1	126.0	126.5	125.5	125.1	126.8	126.0	125.8	126.0	126.6
	Social Good	6	0.805	**0.787**	**0.799**	0.855	0.840	0.835	0.869	**0.795**	0.831	0.818	0.824
		8	0.877	**0.842**	0.892	0.889	**0.876**	0.878	0.938	0.889	0.899	**0.849**	0.889
		10	0.936	0.960	0.990	0.956	1.018	**0.918**	0.970	0.990	0.959	0.938	**0.935**
		12	1.052	**0.955**	**1.039**	**1.004**	1.089	**1.033**	**0.989**	**1.012**	**0.954**	**1.039**	**0.988**
	Traffic	6	0.208	0.241	0.247	0.222	0.235	0.281	0.257	0.248	0.243	0.250	0.237
		8	0.236	0.288	0.269	0.247	**0.217**	0.259	**0.217**	0.268	**0.234**	0.257	**0.231**
		10	0.253	0.260	0.257	**0.231**	**0.238**	0.263	**0.236**	0.258	0.257	**0.248**	0.260
		12	0.248	0.268	0.285	0.281	0.258	0.322	**0.244**	0.282	0.275	0.282	0.284

Table L.40: Comparison of multimodal fusion strategies with Informer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Informer	Agriculture	6	0.264	0.362	0.327	0.304	**0.261**	0.289	0.270	**0.212**	**0.216**	**0.234**	**0.243**
		8	0.450	**0.386**	**0.361**	**0.376**	**0.171**	**0.414**	**0.269**	**0.272**	**0.388**	**0.195**	**0.241**
		10	0.402	0.412	0.440	**0.323**	0.574	**0.251**	**0.339**	**0.299**	**0.343**	**0.305**	0.434
		12	0.507	0.648	0.520	0.530	**0.471**	0.639	**0.494**	0.583	0.574	**0.420**	0.543
	Climate	6	0.994	1.084	1.068	1.072	1.035	1.114	1.027	1.064	1.080	1.043	1.078
		8	1.058	**0.982**	1.105	1.081	**0.923**	1.068	1.112	1.074	1.093	1.067	1.083
		10	1.084	1.101	1.100	**1.060**	**1.042**	**1.066**	1.089	**1.076**	**1.048**	1.091	1.092
		12	1.068	1.091	1.083	1.106	**0.889**	**1.014**	1.096	1.097	1.071	1.111	1.092
	Economy	6	0.707	0.869	**0.396**	**0.567**	**0.544**	**0.624**	**0.583**	**0.530**	**0.642**	**0.628**	**0.254**
		8	0.815	**0.812**	**0.756**	**0.520**	**0.275**	**0.275**	**0.781**	**0.261**	**0.143**	**0.452**	**0.648**
		10	0.807	0.824	0.999	**0.714**	1.228	1.153	1.049	**0.596**	**0.619**	**0.633**	0.832
		12	1.093	1.445	**1.031**	1.181	**0.666**	**0.179**	1.205	**0.950**	**0.616**	1.429	**0.967**
	Energy	12	0.146	0.158	0.218	0.190	0.261	0.182	0.208	0.162	0.161	0.158	0.168
		24	0.273	**0.269**	0.320	0.320	**0.256**	0.275	0.327	0.304	**0.263**	0.297	0.304
		36	0.373	**0.358**	**0.357**	0.408	0.389	**0.351**	0.425	**0.328**	**0.351**	**0.306**	**0.369**
		48	0.499	**0.489**	0.522	**0.494**	**0.410**	**0.490**	**0.429**	**0.398**	**0.402**	**0.466**	**0.433**
	Environment	48	0.430	**0.418**	0.469	0.446	0.443	0.464	0.474	0.442	0.438	0.430	0.450
		96	0.421	0.484	0.449	0.444	0.444	0.442	0.439	0.430	0.440	0.452	0.444
		192	0.467	0.489	**0.435**	0.508	**0.437**	0.509	0.478	0.498	0.493	**0.465**	**0.459**
		336	0.457	0.477	0.470	0.482	**0.427**	0.469	0.487	0.513	0.486	0.478	**0.426**
	Public Health	12	1.114	1.270	1.252	**0.982**	1.545	**1.100**	**1.010**	**1.003**	**1.103**	1.287	1.141
		24	1.272	1.621	1.303	**1.200**	1.314	1.344	**1.228**	1.382	1.278	1.369	1.302
		36	1.490	**1.465**	1.493	**1.454**	**1.313**	**1.414**	**1.438**	**1.314**	1.551	1.552	1.517
		48	1.619	**1.403**	1.755	1.659	**1.326**	1.726	**1.570**	**1.599**	1.701	**1.592**	**1.606**
	Security	6	122.5	126.0	**122.3**	123.9	125.0	126.7	122.7	125.6	**122.0**	127.5	124.8
		8	130.2	**129.3**	**129.2**	**126.2**	**129.7**	**127.0**	**128.1**	**128.9**	**128.4**	**126.8**	**126.9**
		10	130.4	130.8	**129.6**	**127.9**	130.5	**124.0**	**129.0**	**128.9**	**129.4**	**128.0**	**130.1**
		12	131.4	132.0	**127.9**	**130.8**	**128.4**	**130.0**	**129.8**	**131.1**	**130.2**	132.1	**130.3**
	Social Good	6	0.749	**0.746**	0.764	**0.728**	0.764	0.795	**0.747**	0.812	**0.748**	0.789	0.751
		8	0.793	**0.776**	0.830	0.862	0.842	0.838	0.808	0.845	0.835	0.858	0.810
		10	0.828	0.890	0.897	0.874	0.864	0.882	0.918	0.886	0.894	0.895	0.872
		12	0.980	**0.888**	**0.915**	**0.866**	1.062	**0.893**	**0.919**	**0.913**	**0.896**	**0.946**	**0.948**
	Traffic	6	0.172	0.187	**0.165**	**0.163**	**0.154**	**0.162**	**0.144**	**0.169**	**0.161**	**0.166**	**0.169**
		8	0.171	**0.161**	**0.162**	**0.160**	**0.162**	**0.167**	**0.158**	0.180	0.189	**0.163**	**0.160**
		10	0.187	0.189	0.217	0.200	**0.175**	0.189	**0.185**	**0.164**	0.204	**0.173**	0.197
		12	0.208	0.210	0.218	0.213	**0.202**	0.221	**0.204**	0.219	0.210	0.224	0.215

Table L.41: Comparison of multimodal fusion strategies with TSMixer (+ LLAMA3).

TS Model	Dataset	*H*	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TSMixer	Agriculture	6	0.102	**0.086**	0.119	0.104	0.121	**0.094**	**0.100**	0.112	0.162	**0.098**	**0.085**
		8	0.103	0.150	0.171	0.330	0.242	0.316	0.180	**0.103**	0.264	0.238	0.105
		10	0.395	0.486	0.892	0.469	**0.294**	0.937	0.497	0.481	0.778	0.422	**0.229**
		12	0.617	1.109	1.245	**0.606**	1.374	**0.562**	**0.494**	0.674	1.386	1.206	**0.337**
	Climate	6	1.069	**1.060**	1.079	1.138	1.077	1.088	1.187	**1.063**	**1.067**	**1.062**	**1.067**
		8	1.094	**1.086**	**1.080**	1.232	**1.077**	1.156	1.162	**1.089**	1.097	**1.082**	**1.083**
		10	1.102	1.158	1.186	1.204	1.108	1.127	**1.099**	1.147	1.112	1.132	**1.101**
		12	1.109	1.124	1.140	1.174	1.154	**1.094**	1.146	1.144	1.158	1.140	**1.106**
	Economy	6	0.054	0.062	0.073	0.093	0.106	0.143	0.126	0.153	0.141	0.094	0.063
		8	0.078	0.268	0.219	0.276	0.807	0.348	0.141	0.227	0.215	0.100	**0.068**
		10	0.263	1.509	1.802	1.775	0.266	1.992	0.318	0.593	1.003	1.229	**0.085**
		12	0.917	2.240	1.976	1.931	2.472	**0.672**	1.146	**0.590**	2.820	2.374	**0.173**
	Energy	12	0.142	**0.138**	**0.135**	0.159	0.151	**0.142**	0.161	0.151	**0.137**	**0.141**	0.148
		24	0.261	0.287	0.297	0.329	0.266	**0.236**	0.303	**0.250**	0.283	0.287	0.268
		36	0.355	**0.330**	0.410	0.479	**0.315**	0.360	0.363	**0.349**	0.380	**0.331**	0.372
		48	0.451	**0.412**	**0.435**	0.695	**0.428**	0.583	**0.448**	**0.416**	**0.410**	**0.444**	0.460
	Environment	48	0.542	**0.432**	**0.450**	**0.454**	**0.436**	**0.442**	**0.453**	**0.520**	**0.455**	**0.437**	**0.509**
		96	0.606	**0.456**	**0.466**	**0.485**	**0.456**	**0.457**	**0.486**	**0.581**	**0.439**	**0.471**	**0.559**
		192	0.638	**0.531**	**0.472**	**0.539**	**0.599**	**0.523**	**0.511**	**0.591**	**0.448**	**0.495**	0.656
		336	0.588	0.652	**0.452**	**0.543**	**0.522**	**0.538**	**0.512**	**0.582**	**0.496**	**0.484**	**0.580**
	Public Health	12	1.155	**1.117**	1.173	1.392	1.296	1.251	1.209	**1.155**	1.178	1.158	**1.129**
		24	1.428	1.649	**1.388**	1.483	**1.347**	1.471	1.450	**1.315**	1.667	**1.345**	**1.377**
		36	1.479	1.749	1.613	1.581	1.501	1.503	1.549	**1.474**	1.693	1.556	**1.439**
		48	1.599	**1.543**	1.777	1.633	1.607	1.687	1.673	1.625	**1.584**	1.725	**1.529**
	Security	6	128.3	**127.8**	**127.8**	**126.4**	**125.9**	**123.9**	130.0	**124.0**	**127.8**	**128.0**	**128.0**
		8	127.9	**125.8**	**127.3**	128.6	**125.2**	**122.6**	131.8	129.1	**126.3**	**127.1**	**127.0**
		10	129.3	**129.1**	132.8	131.0	**126.8**	132.4	129.3	**129.1**	131.4	131.9	**128.8**
		12	131.8	133.6	133.3	132.3	133.2	**127.9**	**131.3**	133.9	134.5	132.4	**131.6**
	Social Good	6	0.749	0.795	0.861	0.779	**0.732**	**0.731**	1.043	0.842	0.835	0.792	**0.741**
		8	0.827	0.875	0.886	0.903	0.883	0.850	0.845	0.843	0.945	**0.810**	**0.824**
		10	0.906	0.921	**0.878**	1.057	1.004	0.921	0.942	0.959	1.141	**0.878**	**0.873**
		12	1.091	**1.041**	**1.014**	**0.975**	**1.053**	**1.016**	**0.979**	**0.952**	1.265	**0.924**	**0.847**
	Traffic	6	0.203	0.219	0.222	0.239	0.221	0.216	0.224	0.259	0.255	0.252	**0.188**
		8	0.216	0.260	0.266	0.253	0.246	0.251	0.220	0.259	0.307	0.239	**0.195**
		10	0.228	0.331	0.570	0.291	0.247	0.532	0.237	0.260	0.290	0.344	**0.207**
		12	0.293	0.640	0.692	0.312	0.713	**0.281**	**0.291**	0.352	0.779	0.481	**0.249**

Table L.42: Comparison of multimodal fusion strategies with Transformer (+ LLAMA3).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Transformer	Agriculture	6	0.128	**0.090**	**0.127**	0.179	0.132	0.211	0.267	0.144	0.170	0.181	0.131
		8	0.173	0.230	0.278	**0.137**	**0.157**	0.266	0.285	0.277	0.193	0.181	**0.148**
		10	0.182	0.418	0.279	0.224	**0.130**	0.234	0.571	0.291	0.205	0.325	0.214
		12	0.238	0.293	**0.218**	0.437	**0.158**	**0.198**	0.382	**0.219**	**0.221**	0.514	0.272
	Climate	6	1.032	1.037	1.080	**1.001**	**0.955**	1.081	**0.980**	1.080	**1.009**	**1.018**	1.047
		8	1.059	1.064	1.080	1.063	**1.031**	**1.040**	**1.012**	1.079	**1.039**	**1.034**	**0.982**
		10	1.066	**1.041**	**1.064**	1.071	1.098	1.083	**0.994**	**1.064**	**1.062**	**1.030**	1.071
		12	1.035	1.103	1.081	1.071	1.098	1.062	1.042	1.082	1.102	1.067	1.081
	Economy	6	0.401	**0.283**	**0.059**	**0.338**	**0.140**	**0.226**	0.592	**0.061**	**0.202**	**0.145**	**0.127**
		8	0.076	0.413	0.403	0.103	**0.061**	0.252	0.882	0.087	**0.061**	**0.050**	0.163
		10	0.075	0.357	0.252	0.737	**0.070**	0.160	1.317	0.123	0.568	0.278	0.228
		12	0.319	**0.143**	0.432	**0.196**	**0.140**	**0.274**	0.670	**0.303**	0.416	**0.116**	**0.043**
	Energy	12	0.145	**0.108**	**0.080**	**0.142**	**0.110**	0.148	**0.112**	**0.086**	**0.114**	**0.091**	**0.100**
		24	0.259	0.299	0.261	**0.244**	**0.245**	**0.186**	0.286	**0.198**	**0.221**	**0.180**	**0.195**
		36	0.403	**0.357**	**0.314**	**0.371**	**0.351**	**0.292**	**0.323**	**0.271**	**0.352**	**0.238**	**0.333**
		48	0.479	**0.397**	**0.404**	**0.427**	**0.378**	**0.401**	0.548	**0.389**	**0.463**	**0.323**	**0.421**
	Environment	48	0.444	**0.417**	**0.414**	**0.420**	**0.425**	**0.430**	**0.430**	**0.414**	**0.435**	**0.410**	**0.404**
		96	0.472	**0.444**	**0.393**	0.485	**0.436**	**0.438**	**0.434**	**0.410**	**0.408**	**0.427**	**0.402**
		192	0.463	0.541	0.471	0.499	0.469	**0.411**	0.535	**0.407**	**0.436**	0.471	**0.409**
		336	0.458	0.502	0.470	**0.430**	0.460	**0.454**	0.472	0.460	**0.421**	**0.444**	**0.424**
	Public Health	12	0.904	1.054	1.069	1.121	0.999	1.017	1.087	1.112	1.040	1.102	1.022
		24	1.281	**1.261**	1.290	1.403	**1.192**	**1.264**	1.397	**1.201**	**1.182**	1.310	1.296
		36	1.394	1.408	**1.359**	**1.299**	**1.281**	**1.201**	**1.211**	1.443	**1.317**	**1.284**	**1.346**
		48	1.338	1.470	1.440	1.432	1.600	1.529	1.448	1.438	1.396	1.434	**1.325**
	Security	6	123.7	127.0	127.5	124.6	**122.5**	126.7	**122.6**	127.5	126.7	127.0	127.8
		8	126.6	129.5	129.7	129.2	**123.8**	128.0	126.6	129.5	**125.8**	129.1	127.3
		10	129.6	131.3	129.8	129.9	**124.6**	130.5	**129.5**	131.5	**129.3**	130.6	131.7
		12	127.2	**126.7**	132.7	130.4	127.3	129.7	130.6	131.9	130.8	130.2	130.7
	Social Good	6	0.743	0.757	0.766	0.771	0.826	0.753	0.806	0.766	0.752	0.748	0.788
		8	0.805	0.850	0.875	0.811	0.915	0.821	0.810	0.859	0.860	**0.775**	0.818
		10	0.900	**0.818**	0.934	0.909	0.933	**0.816**	0.908	0.907	**0.859**	0.916	0.909
		12	0.922	**0.884**	0.946	0.967	**0.905**	0.951	**0.878**	0.951	0.946	0.942	**0.882**
	Traffic	6	0.176	0.183	**0.172**	**0.147**	**0.172**	**0.164**	**0.158**	**0.172**	**0.161**	**0.151**	**0.152**
		8	0.186	**0.164**	**0.184**	0.219	**0.182**	**0.159**	**0.162**	**0.184**	**0.162**	**0.174**	**0.168**
		10	0.175	0.204	0.191	0.177	0.205	0.182	0.179	0.191	0.206	**0.172**	0.181
		12	0.212	0.252	0.233	0.219	0.240	0.224	**0.207**	0.233	0.214	**0.203**	0.233

Table L.43: Comparison of multimodal fusion strategies with Nonstationary Transformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Nonstationary Transformer	Agriculture	6	0.051	0.051	0.052	0.052	0.056	0.053	4.078	0.052	0.056	0.054	0.051
		8	0.068	**0.067**	0.070	**0.068**	**0.068**	0.071	2.467	**0.068**	0.072	0.072	0.072
		10	0.092	**0.090**	**0.091**	**0.085**	0.099	**0.092**	0.628	**0.092**	**0.089**	**0.089**	0.093
		12	0.120	**0.117**	**0.116**	**0.109**	**0.118**	**0.118**	0.722	**0.116**	**0.119**	**0.118**	**0.118**
	Climate	6	1.241	1.291	**1.185**	1.309	**1.162**	**1.236**	**1.237**	1.309	**1.175**	1.293	**1.089**
		8	1.300	1.323	**1.122**	**1.256**	**1.294**	**1.281**	**1.073**	**1.212**	**1.298**	**1.167**	**1.270**
		10	1.211	1.244	1.244	1.301	**1.200**	**1.189**	**1.127**	1.219	1.238	**1.189**	1.221
		12	1.219	1.246	1.232	1.232	1.263	**1.153**	**1.078**	1.255	**1.212**	1.220	**1.149**
	Economy	6	0.017	**0.016**	0.017	0.018	0.017	**0.016**	13.766	0.017	0.017	**0.016**	0.018
		8	0.018	0.018	0.018	0.019	0.020	0.022	6.984	**0.018**	**0.018**	0.021	**0.018**
		10	0.019	0.021	0.020	0.022	**0.018**	0.021	1.125	0.019	0.020	0.020	0.019
		12	0.021	0.022	0.021	0.026	0.022	**0.021**	1.040	**0.020**	**0.020**	**0.021**	**0.020**
	Energy	12	0.107	0.117	**0.104**	0.114	**0.095**	0.111	0.188	**0.101**	0.108	0.111	0.115
		24	0.198	0.234	**0.186**	0.229	**0.197**	0.220	0.627	0.233	**0.198**	**0.196**	0.203
		36	0.280	0.327	0.298	0.301	0.370	0.325	0.974	0.324	0.364	0.338	0.328
		48	0.368	0.451	0.422	**0.366**	0.443	0.455	0.712	0.385	0.401	**0.358**	0.371
	Environment	48	0.419	0.424	0.437	0.467	0.478	0.429	0.464	0.439	0.441	0.441	**0.416**
		96	0.444	0.488	0.497	0.471	0.462	0.453	**0.434**	0.462	0.458	0.460	0.465
		192	0.444	0.486	0.466	0.509	0.446	0.481	0.464	**0.436**	**0.437**	0.459	**0.444**
		336	0.437	0.458	**0.431**	0.500	0.441	0.449	0.514	**0.432**	**0.435**	0.443	0.453
	Public Health	12	0.745	0.887	0.887	0.897	**0.727**	0.890	1.062	0.969	0.843	0.784	0.858
		24	1.137	1.162	**1.103**	1.312	1.153	**1.118**	1.979	1.179	**1.065**	1.216	1.162
		36	1.418	**1.360**	**1.246**	**1.230**	**1.280**	**1.313**	1.535	**1.326**	1.467	1.517	**1.366**
		48	1.364	1.655	1.412	**1.302**	1.633	**1.331**	1.605	1.553	**1.300**	1.482	1.530
	Security	6	103.0	**99.768**	105.2	**101.7**	**101.3**	**101.6**	135.7	**101.7**	**100.6**	**101.7**	**100.3**
		8	105.3	105.7	108.7	105.6	105.6	**104.9**	126.3	**104.3**	105.7	**104.2**	**104.2**
		10	110.2	**108.3**	**109.6**	110.5	**107.6**	**107.6**	120.0	**106.7**	**107.3**	**107.4**	**108.1**
		12	110.8	**109.8**	111.3	**108.1**	**110.0**	**109.1**	113.4	**109.5**	**109.7**	**109.5**	**109.5**
	Social Good	6	0.803	**0.798**	0.835	0.836	**0.784**	**0.761**	4.209	**0.772**	**0.778**	0.887	**0.762**
		8	0.940	**0.921**	**0.859**	0.973	**0.925**	**0.871**	2.671	**0.918**	0.955	**0.878**	**0.868**
		10	1.024	1.092	1.039	**0.934**	**1.004**	**0.993**	1.251	**0.977**	**0.946**	1.028	**0.939**
		12	1.049	1.062	1.091	**1.040**	1.104	1.122	**0.976**	1.107	1.135	1.086	**1.048**
	Traffic	6	0.179	**0.177**	**0.175**	**0.171**	0.184	**0.168**	0.615	0.180	**0.170**	**0.178**	**0.179**
		8	0.187	**0.183**	**0.184**	0.198	0.201	**0.181**	0.523	**0.185**	0.195	**0.181**	**0.186**
		10	0.189	0.190	0.191	**0.184**	0.199	**0.184**	0.220	0.193	**0.185**	0.190	**0.182**
		12	0.251	**0.248**	0.252	0.253	**0.232**	**0.238**	0.251	**0.236**	**0.246**	**0.240**	**0.247**

Table L.44: Comparison of multimodal fusion strategies with iTransformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
iTransformer	Agriculture	6	0.059	**0.058**	0.060	**0.055**	0.061	0.060	4.716	0.060	0.060	**0.059**	0.060
		8	0.077	**0.076**	0.077	**0.071**	**0.076**	0.078	2.397	**0.077**	**0.076**	**0.076**	0.077
		10	0.098	**0.098**	**0.095**	**0.088**	0.099	0.100	0.906	**0.094**	**0.097**	0.098	0.099
		12	0.127	0.127	0.129	**0.116**	0.130	0.127	0.607	0.129	0.130	**0.126**	0.129
	Climate	6	1.130	1.140	**1.119**	1.144	1.151	**1.114**	1.238	**1.115**	1.148	1.149	1.135
		8	1.193	1.218	1.202	**1.163**	**1.173**	**1.173**	**1.145**	1.204	1.203	**1.192**	**1.179**
		10	1.231	**1.183**	**1.209**	**1.195**	**1.151**	**1.203**	**1.081**	**1.207**	**1.204**	**1.203**	**1.208**
		12	1.184	1.187	1.188	1.194	**1.179**	**1.165**	**1.045**	1.186	1.219	**1.180**	**1.184**
	Economy	6	0.015	**0.015**	**0.015**	0.022	**0.015**	0.015	12.723	**0.015**	0.015	**0.015**	**0.015**
		8	0.015	**0.015**	**0.015**	0.016	**0.015**	0.015	8.123	**0.015**	0.015	0.015	0.016
		10	0.016	**0.015**	**0.016**	0.017	**0.015**	0.016	1.576	**0.016**	**0.015**	**0.015**	**0.016**
		12	0.016	**0.016**	**0.016**	0.018	**0.016**	**0.016**	0.905	**0.016**	**0.016**	**0.016**	**0.016**
	Energy	12	0.116	0.119	0.124	**0.096**	**0.112**	**0.113**	0.206	0.122	0.121	0.124	0.131
		24	0.230	0.230	0.232	**0.214**	**0.224**	0.250	0.834	0.234	**0.226**	0.241	0.243
		36	0.315	**0.309**	**0.315**	**0.314**	**0.305**	0.333	1.312	0.330	0.320	0.318	0.328
		48	0.399	0.428	0.425	0.406	0.495	0.424	0.693	0.434	0.436	0.420	0.422
	Environment	48	0.413	0.427	0.416	0.512	0.425	0.418	0.490	0.422	0.421	0.422	0.421
		96	0.417	0.425	0.422	0.470	**0.415**	**0.417**	0.694	0.429	0.423	0.431	0.419
		192	0.432	0.442	0.446	0.494	**0.429**	**0.425**	0.627	**0.426**	**0.418**	**0.419**	0.436
		336	0.422	0.423	0.424	0.462	**0.419**	0.423	0.985	0.431	**0.418**	**0.416**	0.427
	Public Health	12	0.976	1.011	1.071	**0.939**	0.996	0.990	1.136	1.061	**0.950**	1.017	**0.941**
		24	1.446	1.478	1.451	**1.242**	1.499	**1.438**	1.636	**1.445**	1.473	1.448	**1.441**
		36	1.629	1.655	1.660	**1.379**	1.669	**1.620**	2.037	1.659	1.650	1.633	1.638
		48	1.741	1.747	1.757	**1.518**	1.809	1.780	1.741	1.756	1.768	1.759	1.758
	Security	6	104.7	**104.2**	**103.1**	110.6	**103.4**	**102.2**	139.8	**102.6**	**104.2**	**102.5**	**102.7**
		8	108.8	**105.8**	**105.2**	112.8	**108.1**	**106.1**	141.6	**105.2**	**106.5**	**105.5**	109.2
		10	111.9	**109.8**	**108.1**	114.6	**110.1**	**110.7**	122.7	**108.7**	**110.3**	**109.3**	**108.2**
		12	114.3	**112.6**	**111.5**	117.2	**111.5**	**109.7**	121.3	**110.7**	**111.5**	**109.2**	**111.5**
	Social Good	6	0.821	0.831	0.830	**0.775**	0.852	0.856	4.174	0.831	0.838	0.831	0.835
		8	0.960	**0.948**	**0.954**	**0.943**	**0.937**	0.963	2.762	**0.953**	**0.941**	0.961	**0.955**
		10	1.056	1.064	1.069	**1.001**	**1.054**	1.058	1.084	1.068	1.063	**1.050**	1.061
		12	1.150	**1.145**	1.153	**1.068**	**1.102**	**1.134**	**1.051**	1.153	**1.149**	**1.133**	**1.130**
	Traffic	6	0.182	**0.182**	**0.176**	0.188	0.184	**0.172**	0.458	**0.172**	**0.168**	**0.164**	**0.173**
		8	0.186	0.192	**0.183**	0.195	0.187	0.188	0.789	**0.184**	**0.179**	0.188	**0.183**
		10	0.195	**0.191**	**0.181**	0.196	**0.190**	**0.181**	0.304	**0.181**	**0.184**	**0.184**	**0.190**
		12	0.254	**0.234**	**0.228**	0.256	**0.250**	**0.251**	0.276	**0.226**	**0.225**	**0.226**	**0.242**

Table L.45: Comparison of multimodal fusion strategies with Koopa (+ Doc2Vec).

TS Model	Dataset	*H*	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Koopa	Agriculture	6	0.056	**0.056**	0.056	0.056	2.967	3.376	2.346	0.059	0.062	**0.054**	**0.056**
		8	0.078	0.090	**0.071**	**0.070**	0.177	0.331	0.297	**0.076**	0.083	**0.076**	**0.075**
		10	0.100	0.130	**0.090**	**0.090**	2.205	0.738	0.714	0.101	0.101	**0.091**	**0.100**
		12	0.129	0.133	**0.116**	**0.115**	5.842	2.913	2.581	**0.127**	0.146	**0.116**	0.129
	Climate	6	1.249	1.783	1.263	1.263	1.834	**1.216**	**1.215**	1.254	**1.017**	1.259	**1.243**
		8	1.272	**1.255**	1.277	1.279	**1.143**	**1.091**	**1.088**	1.294	**1.025**	**1.240**	**1.262**
		10	1.249	**1.240**	**1.246**	1.251	**1.195**	**1.054**	**1.054**	**1.245**	**1.046**	**1.227**	**1.244**
		12	1.242	1.244	**1.237**	**1.238**	**1.211**	**1.221**	**1.222**	1.274	**1.057**	**1.238**	**1.231**
	Economy	6	0.017	0.028	0.032	0.033	14.673	14.901	13.798	0.024	0.048	0.020	0.018
		8	0.017	0.020	0.024	0.023	1.001	1.064	1.045	0.027	0.029	0.018	**0.017**
		10	0.018	0.029	0.026	0.025	4.957	2.423	2.443	0.027	0.036	0.019	**0.017**
		12	0.018	0.040	0.025	0.021	14.385	13.308	10.977	0.020	0.047	0.023	**0.018**
	Energy	12	0.108	7.963	0.108	0.108	1.590	0.203	0.210	0.114	0.115	0.108	**0.105**
		24	0.210	0.319	0.220	0.223	4.487	0.446	0.475	0.241	0.220	0.215	0.220
		36	0.306	**0.289**	**0.297**	**0.297**	0.719	0.572	0.673	0.328	0.314	**0.292**	**0.284**
		48	0.404	34.576	0.423	0.416	1.305	0.948	0.954	0.429	**0.401**	**0.384**	0.408
	Environment	48	0.480	95645.1	0.575	1.234	24986.4	0.722	0.802	0.490	0.587	0.921	0.482
		96	0.533	58063.8	1.102	0.865	37111.5	0.980	0.934	0.535	0.757	0.731	**0.524**
		192	0.568	347050.2	0.713	0.736	3030.7	0.649	0.647	0.573	1.251	0.822	**0.567**
		336	0.530	81048.2	0.713	0.577	18262.9	1.021	0.913	**0.529**	0.547	0.613	**0.529**
	Public Health	12	1.035	7.698	**0.955**	**0.961**	3.428	**1.023**	**1.018**	1.198	1.313	**0.941**	**0.952**
		24	1.396	**1.163**	**1.166**	**1.197**	1.859	**1.235**	**1.234**	1.530	**1.391**	**1.154**	1.412
		36	1.624	**1.300**	**1.292**	**1.287**	2.163	1.624	1.686	1.806	**1.394**	**1.256**	1.629
		48	1.733	**1.406**	**1.384**	**1.390**	2.316	1.943	2.020	1.877	**1.442**	**1.372**	**1.724**
	Security	6	104.6	**97.318**	**103.5**	**103.5**	134.4	138.9	139.8	**104.2**	107.2	**103.4**	105.1
		8	109.4	116.9	111.1	111.0	111.0	112.1	112.1	**105.7**	110.2	111.0	**106.6**
		10	108.9	**107.9**	**108.8**	**108.8**	117.8	118.4	118.3	110.1	113.2	109.1	**108.5**
		12	111.0	**102.5**	**110.6**	**110.6**	139.1	137.6	137.4	115.1	114.9	**110.8**	111.2
	Social Good	6	0.852	0.955	**0.800**	**0.800**	3.409	3.506	3.506	**0.848**	**0.787**	0.869	**0.838**
		8	0.922	1.255	**0.893**	**0.892**	0.992	1.000	1.026	0.926	**0.797**	**0.879**	**0.921**
		10	0.991	1.137	**0.964**	**0.966**	1.102	1.231	1.149	**0.971**	**0.912**	**0.886**	0.992
		12	1.083	**1.011**	**0.994**	**0.994**	3.020	2.967	2.947	**1.071**	**0.898**	**0.973**	**1.080**
	Traffic	6	0.231	0.294	**0.220**	**0.221**	0.295	0.506	0.479	**0.215**	**0.218**	**0.215**	**0.202**
		8	0.212	0.216	0.214	0.214	**0.205**	0.219	0.221	0.226	**0.211**	**0.205**	**0.204**
		10	0.219	0.221	0.221	0.220	0.314	0.300	0.333	0.258	**0.200**	**0.210**	**0.209**
		12	0.274	0.321	0.279	0.279	1.013	0.515	0.613	**0.274**	**0.263**	0.278	**0.262**

Table L.46: Comparison of multimodal fusion strategies with DLinear (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
DLinear	Agriculture	6	0.094	0.129	0.132	0.120	1.911	2.861	2.080	**0.075**	0.142	0.096	**0.070**
		8	0.324	**0.167**	**0.184**	**0.185**	3.309	3.914	2.666	**0.206**	**0.174**	**0.214**	**0.088**
		10	0.164	0.195	0.205	0.203	0.312	0.280	0.276	**0.151**	**0.147**	0.191	**0.135**
		12	0.217	0.240	0.240	0.240	0.381	0.288	0.289	**0.162**	0.406	**0.178**	**0.164**
	Climate	6	1.140	1.263	1.209	1.198	1.213	1.218	1.227	1.271	**1.054**	**1.087**	**1.087**
		8	1.295	**1.283**	**1.290**	**1.273**	**1.196**	**1.074**	**1.100**	**1.277**	**1.074**	**1.108**	**1.112**
		10	1.155	1.300	1.284	1.268	**1.141**	**1.118**	**1.112**	1.330	**1.112**	1.167	**1.109**
		12	1.175	1.239	1.213	1.182	**1.115**	**1.111**	**1.107**	1.191	**1.100**	**1.137**	**1.096**
	Economy	6	0.095	**0.087**	0.097	0.097	13.039	12.557	12.846	0.107	0.097	**0.046**	**0.023**
		8	0.234	**0.102**	**0.142**	**0.144**	10.613	9.270	10.797	**0.130**	**0.105**	**0.150**	**0.038**
		10	0.086	0.115	0.132	0.130	0.493	0.468	0.482	0.140	**0.038**	0.140	**0.045**
		12	0.109	0.129	0.131	0.129	1.149	0.433	0.396	**0.062**	0.256	**0.092**	**0.054**
	Energy	12	0.116	0.141	0.144	0.132	0.150	0.142	0.143	0.126	**0.113**	0.123	**0.104**
		24	0.222	0.255	0.240	0.252	0.427	0.295	0.289	0.241	0.225	**0.210**	**0.204**
		36	0.300	0.332	0.309	0.320	0.758	0.332	0.341	0.315	0.334	0.300	**0.293**
		48	0.412	0.482	0.472	0.465	0.641	0.447	0.449	0.426	**0.389**	**0.398**	**0.407**
	Environment	48	0.491	0.940	1.113	0.777	0.773	0.592	0.577	0.494	0.833	1.290	0.492
		96	0.568	0.792	0.694	0.577	1.158	0.819	0.764	0.590	1.061	0.978	**0.568**
		192	0.592	0.682	1.314	0.730	0.886	0.782	0.649	0.608	1.252	0.900	0.592
		336	0.538	0.600	**0.523**	**0.533**	0.828	0.555	0.744	0.554	0.646	0.784	**0.537**
	Public Health	12	1.357	**1.336**	1.428	1.362	1.438	1.573	1.618	1.581	**1.350**	**1.349**	**1.249**
		24	1.593	**1.582**	1.671	1.620	1.707	1.775	1.720	1.624	**1.483**	**1.546**	**1.500**
		36	1.636	1.647	**1.531**	**1.508**	1.664	1.670	1.642	1.691	**1.596**	**1.617**	**1.595**
		48	1.683	1.708	**1.627**	**1.591**	1.864	1.745	1.753	1.734	1.686	**1.678**	**1.672**
	Security	6	104.3	104.5	104.7	104.6	167.4	165.1	165.5	105.6	104.4	104.6	104.8
		8	109.2	**108.1**	**107.6**	**107.8**	150.9	146.2	145.5	110.3	**106.5**	**108.4**	**108.9**
		10	110.5	111.6	**109.7**	**109.9**	111.4	**108.4**	111.0	**110.5**	110.9	**110.0**	**109.8**
		12	111.8	112.2	111.8	112.1	113.3	112.8	113.2	113.4	**111.3**	**111.5**	**111.6**
	Social Good	6	0.847	**0.814**	**0.828**	**0.818**	3.013	1.549	1.576	0.904	**0.821**	**0.786**	**0.785**
		8	0.878	0.912	0.897	0.897	2.101	1.804	1.926	0.889	**0.862**	**0.863**	**0.869**
		10	0.949	0.983	1.022	1.001	**0.944**	0.958	**0.936**	0.977	0.982	0.972	0.958
		12	1.015	**1.000**	1.037	**0.997**	**1.001**	**1.012**	**0.998**	**1.015**	**1.004**	1.018	**1.002**
	Traffic	6	0.252	0.262	0.299	0.261	0.472	0.507	0.461	0.296	0.345	**0.235**	**0.224**
		8	0.328	**0.291**	**0.325**	**0.301**	0.549	0.867	0.618	**0.268**	**0.292**	**0.305**	**0.223**
		10	0.238	0.267	0.315	0.289	0.349	0.270	0.263	**0.227**	0.259	0.268	**0.219**
		12	0.288	0.308	0.334	0.316	0.365	0.407	**0.277**	**0.281**	0.309	0.306	**0.262**

Table L.47: Comparison of multimodal fusion strategies with PatchTST (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
PatchTST	Agriculture	6	0.060	**0.060**	**0.058**	**0.059**	**0.060**	**0.059**	2.663	0.060	**0.058**	0.061	**0.057**
		8	0.080	**0.080**	**0.078**	**0.075**	**0.080**	**0.079**	2.320	**0.078**	**0.077**	**0.079**	**0.079**
		10	0.099	0.100	0.101	**0.093**	0.100	0.101	0.502	**0.099**	0.101	0.101	0.099
		12	0.129	0.129	0.129	**0.119**	0.129	0.130	0.589	0.129	**0.128**	0.130	**0.126**
	Climate	6	1.255	**1.237**	**1.238**	**1.238**	**1.237**	**1.238**	1.283	**1.238**	**1.205**	**1.251**	**1.234**
		8	1.261	**1.248**	**1.227**	**1.249**	**1.248**	**1.258**	**1.143**	**1.226**	**1.252**	**1.255**	**1.243**
		10	1.280	**1.263**	**1.261**	**1.263**	**1.263**	**1.242**	**1.104**	**1.260**	**1.246**	**1.277**	**1.267**
		12	1.238	1.245	1.251	1.253	1.245	1.254	**1.090**	1.251	1.260	1.246	1.248
	Economy	6	0.016	0.016	0.017	0.017	0.016	0.017	17.750	0.017	0.016	0.017	0.017
		8	0.017	**0.017**	**0.017**	0.020	**0.017**	**0.017**	9.522	0.018	**0.016**	**0.017**	**0.017**
		10	0.017	**0.017**	**0.016**	0.019	**0.017**	**0.017**	1.590	**0.016**	0.017	0.018	0.018
		12	0.018	**0.017**	**0.017**	0.020	**0.017**	0.018	1.435	**0.017**	**0.018**	**0.017**	**0.017**
	Energy	12	0.109	0.111	0.114	0.110	0.111	0.113	0.222	0.117	0.112	**0.109**	0.116
		24	0.221	**0.211**	0.222	0.225	**0.211**	**0.216**	0.606	0.232	0.231	0.228	0.231
		36	0.316	**0.313**	0.326	0.318	**0.313**	0.329	1.446	0.326	0.330	0.325	**0.314**
		48	0.401	0.406	0.444	0.421	0.406	0.426	0.575	0.445	0.439	0.441	0.429
	Environment	48	0.465	**0.463**	0.518	0.500	**0.463**	0.470	0.558	0.500	**0.462**	**0.462**	**0.462**
		96	0.494	0.497	0.501	0.795	0.497	**0.493**	0.639	0.522	0.507	0.509	0.522
		192	0.543	0.545	**0.517**	0.603	0.545	**0.541**	0.837	**0.536**	0.547	**0.530**	0.562
		336	0.503	0.515	0.514	0.560	0.515	0.530	0.844	0.515	0.510	**0.493**	0.525
	Public Health	12	0.925	**0.876**	0.928	**0.838**	**0.876**	0.949	**0.913**	0.949	1.034	**0.906**	**0.896**
		24	1.386	**1.359**	1.390	**1.267**	**1.359**	**1.265**	1.622	1.386	**1.381**	1.390	1.425
		36	1.612	**1.600**	1.630	**1.389**	**1.600**	**1.593**	2.223	1.637	1.614	1.623	**1.612**
		48	1.749	1.755	**1.737**	**1.567**	1.755	**1.736**	**1.747**	**1.732**	1.761	1.759	1.771
	Security	6	103.8	104.7	**102.8**	105.7	104.7	**103.3**	145.1	**103.3**	104.0	104.2	104.6
		8	107.6	**107.2**	**105.9**	110.7	**107.2**	**106.4**	135.5	**106.5**	**106.7**	**107.1**	**107.6**
		10	111.5	112.0	**108.2**	**109.2**	112.0	**108.4**	120.1	**108.4**	**110.6**	**107.9**	**111.2**
		12	110.9	111.5	**110.8**	111.7	111.5	111.1	120.7	**110.8**	113.3	111.8	112.1
	Social Good	6	0.806	**0.794**	**0.795**	0.818	**0.794**	**0.796**	3.828	**0.794**	**0.798**	**0.794**	**0.795**
		8	0.905	**0.900**	**0.885**	**0.865**	**0.900**	0.907	2.397	**0.884**	**0.904**	**0.901**	**0.890**
		10	1.008	1.028	1.046	1.017	1.028	1.050	1.062	**1.000**	1.023	1.032	1.039
		12	1.131	**1.080**	**1.090**	**0.970**	**1.080**	**1.076**	**1.053**	**1.091**	**1.064**	**1.107**	**1.083**
	Traffic	6	0.177	**0.174**	0.180	0.177	**0.174**	0.179	0.481	**0.169**	0.186	**0.172**	0.186
		8	0.182	0.186	**0.179**	0.189	0.186	**0.181**	0.299	0.185	0.185	**0.179**	**0.181**
		10	0.193	**0.185**	**0.187**	0.198	**0.185**	**0.192**	0.214	**0.187**	**0.183**	**0.183**	0.194
		12	0.237	0.249	**0.234**	0.243	0.249	0.247	0.321	**0.236**	0.246	**0.225**	0.239

Table L.48: Comparison of multimodal fusion strategies with FiLM (+ Doc2Vec).

TS Model	Dataset	*H*	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FiLM	Agriculture	6	0.060	0.088	0.061	**0.059**	7.138	0.062	2.962	0.063	0.062	0.061	0.061
		8	0.082	0.311	**0.082**	**0.076**	5.513	0.084	1.729	**0.080**	**0.079**	**0.079**	**0.079**
		10	0.104	0.168	0.104	**0.100**	0.672	0.104	0.684	**0.104**	0.105	**0.102**	**0.103**
		12	0.137	1.725	**0.133**	**0.124**	0.317	**0.137**	0.551	**0.134**	**0.136**	**0.135**	**0.135**
	Climate	6	1.354	**1.254**	**1.268**	**1.256**	1.537	**1.272**	**1.284**	**1.250**	**1.244**	**1.234**	**1.300**
		8	1.279	**1.271**	**1.278**	**1.266**	**1.055**	1.281	**1.128**	1.295	**1.273**	**1.277**	**1.266**
		10	1.282	2.865	1.296	**1.278**	1.666	1.290	**1.095**	**1.269**	1.285	**1.270**	**1.271**
		12	1.270	2.392	1.279	1.285	1.687	1.286	**1.101**	**1.269**	**1.267**	1.278	**1.266**
	Economy	6	0.018	0.042	0.021	0.041	23.612	0.018	21.375	**0.018**	0.019	**0.017**	0.018
		8	0.019	0.109	**0.018**	0.019	11.206	0.019	11.501	**0.017**	**0.018**	**0.017**	**0.017**
		10	0.019	0.083	**0.018**	0.022	0.137	0.020	1.474	**0.018**	**0.018**	**0.017**	**0.018**
		12	0.019	0.508	0.019	0.040	0.036	0.020	1.632	**0.018**	**0.018**	**0.018**	**0.018**
	Energy	12	0.116	13.430	**0.114**	0.128	0.353	0.150	0.280	**0.103**	**0.105**	**0.104**	**0.104**
		24	0.221	0.326	0.239	**0.217**	0.673	0.246	0.810	**0.209**	0.226	0.231	**0.217**
		36	0.320	44.538	0.326	0.321	1.590	0.348	1.401	**0.300**	**0.303**	0.329	**0.313**
		48	0.445	0.623	**0.437**	**0.428**	0.680	0.459	0.648	**0.432**	**0.421**	**0.423**	**0.425**
	Environment	48	0.491	65958.3	**0.486**	0.638	0.652	0.533	0.566	**0.490**	0.516	0.493	**0.488**
		96	0.545	247802.2	**0.545**	1.312	0.695	0.635	0.775	0.549	0.568	0.546	**0.542**
		192	0.572	284870.7	0.576	0.855	0.602	0.576	0.716	**0.570**	0.601	0.573	**0.570**
		336	0.530	7.076	0.564	0.631	692.9	0.532	0.771	**0.529**	0.537	0.531	**0.528**
	Public Health	12	1.159	30.068	1.176	**0.983**	1.950	1.305	**1.131**	**1.124**	**1.145**	**1.131**	**1.129**
		24	1.491	**1.428**	1.510	**1.338**	2.024	1.567	1.745	**1.431**	**1.485**	1.505	**1.458**
		36	1.612	1.806	1.691	1.695	2.242	1.660	2.087	1.661	1.663	1.652	1.669
		48	1.705	2.023	1.772	1.866	1.987	1.760	1.873	1.716	1.768	1.718	1.738
	Security	6	127.3	**97.900**	**102.1**	**101.1**	214.1	**103.2**	186.0	**102.8**	**102.1**	**104.4**	**107.0**
		8	113.8	116.9	**107.9**	116.6	148.7	**107.0**	160.8	**112.1**	**104.1**	**106.8**	**105.1**
		10	117.0	132.9	**109.9**	133.6	**99.472**	**108.9**	**109.8**	**109.5**	**108.8**	**110.2**	**115.2**
		12	119.0	**106.4**	**109.9**	**108.8**	**104.0**	**112.0**	**111.0**	120.5	**109.5**	**112.0**	**112.8**
	Social Good	6	0.921	1.596	**0.834**	**0.828**	4.119	**0.871**	3.622	**0.829**	**0.847**	**0.831**	**0.820**
		8	1.053	12.330	**0.988**	**1.050**	2.416	**1.010**	2.589	**1.014**	**0.934**	**0.963**	**0.963**
		10	1.106	1.547	1.122	1.198	5.796	**1.092**	**1.095**	**1.014**	1.113	**1.082**	1.107
		12	1.207	8.133	**1.110**	**1.104**	3.560	**1.193**	**1.088**	1.227	**1.201**	**1.138**	**1.164**
	Traffic	6	0.228	0.276	0.238	0.249	1.073	0.236	0.440	0.240	0.234	0.231	0.242
		8	0.223	0.224	**0.220**	**0.221**	0.319	0.230	0.469	0.232	**0.213**	**0.221**	0.234
		10	0.216	0.226	0.217	**0.216**	0.413	0.219	0.407	0.238	**0.214**	0.217	**0.215**
		12	0.253	5.092	0.259	0.267	0.687	0.264	0.386	0.283	**0.244**	0.274	**0.250**

Table L.49: Comparison of multimodal fusion strategies with TiDE (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TiDE	Agriculture	6	0.072	**0.070**	0.086	**0.070**	3.204	**0.069**	3.675	**0.060**	**0.063**	**0.061**	**0.060**
		8	0.087	**0.084**	0.090	0.093	1.532	0.091	1.582	**0.083**	**0.081**	**0.082**	**0.081**
		10	0.112	0.266	**0.112**	0.114	0.168	0.121	0.461	**0.103**	**0.104**	**0.103**	**0.103**
		12	0.151	0.496	**0.146**	**0.131**	1.262	**0.150**	1.014	**0.135**	**0.134**	**0.133**	**0.134**
	Climate	6	1.443	1.533	1.553	1.528	1.573	**1.433**	**1.409**	**1.259**	**1.235**	**1.238**	**1.261**
		8	1.506	**1.448**	**1.384**	**1.461**	**1.111**	1.546	**1.138**	**1.262**	**1.278**	**1.250**	**1.366**
		10	1.397	1.558	1.402	1.423	1.417	1.546	**1.177**	**1.279**	**1.270**	**1.258**	**1.254**
		12	1.468	1.518	**1.422**	**1.390**	**1.251**	1.472	**1.132**	**1.255**	**1.274**	**1.262**	**1.269**
	Economy	6	0.033	0.046	0.039	0.048	20.458	0.050	21.635	**0.019**	**0.017**	**0.016**	**0.018**
		8	0.039	0.046	**0.038**	**0.039**	11.799	**0.031**	11.915	**0.018**	**0.018**	**0.017**	**0.017**
		10	0.029	0.050	0.032	0.038	0.148	0.040	1.679	**0.018**	**0.017**	**0.018**	**0.018**
		12	0.033	0.042	**0.031**	0.034	1.603	0.038	1.593	**0.018**	**0.018**	**0.018**	**0.017**
	Energy	12	0.135	4.723	0.138	**0.134**	0.842	0.135	0.210	**0.106**	**0.102**	**0.105**	**0.106**
		24	0.242	0.435	**0.238**	**0.236**	0.829	0.249	0.818	**0.218**	**0.219**	**0.211**	**0.204**
		36	0.326	53.277	0.332	**0.318**	21.779	0.335	1.655	**0.292**	**0.302**	**0.289**	**0.295**
		48	0.444	0.530	**0.437**	**0.416**	0.760	**0.441**	0.793	**0.406**	**0.408**	**0.414**	**0.403**
	Environment	48	0.484	1.118	**0.483**	1.019	0.804	**0.483**	0.781	**0.483**	**0.483**	0.484	**0.482**
		96	0.543	1.341	**0.543**	1.262	0.661	**0.539**	0.668	**0.541**	**0.537**	**0.542**	**0.543**
		192	0.576	151.7	0.577	0.805	11910.0	0.577	0.757	0.577	0.576	0.578	0.576
		336	0.533	6258.2	0.533	0.539	2568.8	**0.532**	0.660	0.533	0.533	0.535	**0.533**
	Public Health	12	1.323	2.924	**1.314**	**1.156**	2.002	**1.279**	**1.307**	**1.107**	**1.078**	**1.083**	**1.089**
		24	1.537	2.307	**1.508**	**1.481**	1.799	1.606	1.827	**1.450**	**1.478**	**1.439**	**1.426**
		36	1.676	10.500	**1.669**	**1.600**	12.984	1.702	2.238	**1.637**	**1.638**	**1.609**	**1.623**
		48	1.772	2.218	1.776	**1.747**	1.847	**1.768**	1.956	**1.715**	1.772	**1.722**	**1.727**
	Security	6	146.5	**123.0**	**134.9**	**123.4**	197.7	**122.0**	188.9	**104.4**	**106.6**	**107.2**	**108.1**
		8	129.5	133.4	132.5	133.7	152.8	**129.0**	154.9	**107.9**	**108.5**	**112.4**	**108.5**
		10	132.2	138.2	135.1	**132.1**	**99.922**	135.3	**117.1**	**112.6**	**110.1**	**113.5**	**112.7**
		12	145.2	**142.5**	**139.1**	**134.4**	**103.0**	**142.3**	**120.1**	**112.5**	**112.8**	**112.8**	**111.8**
	Social Good	6	0.968	**0.914**	1.043	**0.916**	4.189	**0.915**	4.017	**0.836**	**0.884**	**0.862**	**0.825**
		8	1.140	**1.078**	**1.059**	**1.025**	2.249	**1.057**	2.311	**0.952**	**0.943**	**0.952**	**0.950**
		10	1.127	2.480	1.184	1.187	3.021	1.264	**0.986**	**1.057**	**1.062**	**1.064**	**1.078**
		12	1.351	6.833	**1.185**	**1.266**	1.430	**1.216**	**1.060**	**1.192**	**1.160**	**1.156**	**1.142**
	Traffic	6	0.298	0.303	**0.286**	0.308	0.730	0.316	0.763	**0.236**	**0.235**	**0.237**	**0.233**
		8	0.303	**0.300**	**0.277**	**0.298**	0.351	**0.284**	0.391	**0.232**	**0.229**	**0.233**	**0.225**
		10	0.248	0.861	**0.245**	0.297	1.311	0.296	0.475	**0.223**	**0.231**	**0.225**	**0.228**
		12	0.319	1.090	**0.308**	0.324	0.496	0.334	**0.316**	**0.288**	**0.288**	**0.284**	**0.290**

Table L.50: Comparison of multimodal fusion strategies with FEDformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
FEDformer	Agriculture	6	0.055	0.058	0.060	**0.054**	0.063	0.060	3.212	0.058	0.057	0.062	0.061
		8	0.072	0.076	**0.069**	**0.070**	0.080	0.073	2.878	**0.069**	0.075	0.073	**0.068**
		10	0.086	0.088	0.094	0.094	0.101	0.087	0.787	0.095	0.092	0.088	0.088
		12	0.112	0.128	0.126	0.118	0.128	0.119	0.642	0.121	0.125	0.114	0.117
	Climate	6	1.084	1.093	1.129	**1.058**	**1.055**	1.084	1.191	**1.069**	1.103	**1.083**	**1.081**
		8	1.097	**1.060**	**1.048**	**1.065**	**1.034**	**1.064**	**0.965**	**1.062**	**1.056**	**1.063**	**1.059**
		10	1.113	**1.108**	**1.097**	**1.102**	**1.049**	**1.081**	**0.926**	**1.099**	**1.077**	**1.070**	**1.069**
		12	1.109	**1.076**	**1.104**	**1.095**	**1.092**	**1.090**	**0.913**	**1.107**	1.111	**1.091**	**1.071**
	Economy	6	0.038	**0.036**	**0.027**	0.040	**0.037**	0.039	9.961	**0.030**	0.046	**0.034**	**0.038**
		8	0.050	**0.047**	**0.045**	0.053	**0.028**	**0.041**	6.877	**0.027**	0.051	0.050	**0.043**
		10	0.039	0.042	**0.034**	0.047	0.043	**0.035**	1.150	**0.035**	**0.031**	**0.036**	0.042
		12	0.051	**0.033**	**0.048**	0.052	**0.041**	**0.035**	1.164	**0.032**	**0.037**	**0.036**	**0.043**
	Energy	12	0.097	0.105	**0.092**	**0.095**	0.114	**0.093**	0.189	**0.093**	**0.096**	**0.092**	**0.093**
		24	0.177	0.242	0.190	**0.176**	0.193	0.180	0.868	0.198	0.187	0.181	0.186
		36	0.257	0.270	0.259	**0.247**	0.285	0.261	1.438	**0.256**	**0.253**	0.274	0.264
		48	0.365	0.376	0.369	0.378	0.500	0.382	0.861	**0.362**	0.380	**0.363**	0.384
	Environment	48	0.461	0.478	0.466	0.518	0.493	**0.448**	0.662	0.503	0.608	0.510	0.470
		96	0.480	0.563	0.514	0.708	0.497	**0.470**	**0.463**	0.543	0.505	0.523	0.493
		192	0.484	0.508	0.526	0.585	0.569	0.518	0.691	0.511	0.495	0.514	0.505
		336	0.470	0.485	**0.464**	0.535	**0.468**	0.482	0.697	**0.465**	0.481	0.486	0.485
	Public Health	12	1.070	1.110	1.090	**1.062**	1.129	1.099	**1.025**	1.083	1.088	1.078	1.108
		24	1.311	1.412	1.398	1.415	1.406	1.383	1.480	1.346	1.353	**1.305**	1.402
		36	1.557	**1.550**	**1.544**	**1.536**	**1.489**	**1.536**	1.961	**1.502**	**1.500**	**1.495**	**1.466**
		48	1.558	1.600	1.575	**1.541**	1.592	**1.497**	1.604	1.604	**1.513**	**1.524**	**1.519**
	Security	6	105.9	109.3	106.7	113.2	106.1	**105.0**	161.1	106.6	**105.4**	108.7	106.9
		8	107.9	**107.1**	**107.3**	109.3	110.2	**105.4**	141.2	**107.2**	110.5	109.8	110.0
		10	113.7	**112.1**	**111.7**	114.6	**111.5**	115.2	117.5	**111.7**	**112.2**	**109.3**	114.4
		12	117.4	118.5	**114.5**	117.6	**114.1**	122.6	118.5	**114.5**	**113.6**	**111.0**	**114.1**
	Social Good	6	0.905	**0.844**	**0.841**	**0.806**	**0.891**	**0.860**	2.253	**0.817**	**0.815**	**0.867**	**0.859**
		8	0.890	**0.850**	**0.850**	**0.863**	**0.856**	**0.837**	2.710	**0.850**	**0.812**	0.895	**0.865**
		10	0.948	**0.924**	**0.902**	**0.900**	1.091	**0.894**	1.080	**0.902**	**0.884**	0.960	**0.900**
		12	1.043	**1.006**	**0.982**	**1.003**	1.092	**0.960**	1.066	**0.980**	**0.962**	**0.985**	**0.964**
	Traffic	6	0.152	**0.152**	**0.152**	**0.151**	**0.145**	**0.147**	0.653	**0.152**	0.152	**0.150**	0.152
		8	0.155	0.160	0.157	**0.151**	**0.152**	0.156	0.347	0.156	**0.153**	0.158	**0.155**
		10	0.166	**0.164**	**0.162**	**0.165**	**0.147**	**0.163**	0.206	**0.163**	0.168	**0.164**	**0.162**
		12	0.221	0.243	0.229	0.222	**0.212**	0.225	0.231	0.227	**0.217**	**0.211**	**0.219**

Table L.51: Comparison of multimodal fusion strategies with Autoformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Autoformer	Agriculture	6	0.071	**0.070**	**0.066**	**0.065**	**0.068**	**0.061**	3.357	**0.063**	**0.065**	**0.065**	**0.065**
		8	0.088	0.089	**0.084**	**0.083**	**0.084**	**0.083**	1.849	**0.079**	0.090	**0.074**	0.092
		10	0.095	0.109	0.107	0.104	0.112	0.098	1.030	0.110	0.103	0.098	0.108
		12	0.136	**0.130**	**0.128**	**0.133**	0.144	**0.133**	0.637	**0.127**	**0.128**	**0.126**	**0.120**
	Climate	6	1.241	**1.204**	**1.235**	**1.224**	**1.173**	**1.119**	1.297	1.260	**1.220**	**1.165**	**1.221**
		8	1.201	1.215	1.204	**1.156**	1.247	**1.157**	**1.008**	**1.201**	**1.170**	1.223	**1.147**
		10	1.211	1.238	**1.196**	**1.188**	**1.154**	1.215	**1.082**	**1.195**	**1.151**	**1.146**	1.277
		12	1.183	**1.165**	1.189	1.185	1.217	**1.171**	**0.970**	1.193	**1.158**	**1.125**	1.188
	Economy	6	0.058	0.059	**0.051**	**0.051**	0.072	0.061	13.506	**0.053**	0.058	0.068	**0.042**
		8	0.063	0.067	**0.062**	0.069	0.063	**0.055**	7.793	**0.047**	**0.052**	**0.055**	0.067
		10	0.061	0.069	**0.055**	**0.045**	0.074	**0.039**	1.772	**0.054**	0.062	0.070	**0.047**
		12	0.055	**0.049**	**0.051**	0.080	**0.049**	**0.032**	1.602	**0.043**	**0.047**	**0.053**	0.059
	Energy	12	0.128	0.179	0.147	0.167	0.215	0.132	0.361	0.140	0.170	0.186	0.165
		24	0.300	0.331	0.337	0.301	0.328	0.307	0.888	0.316	0.324	**0.299**	**0.288**
		36	0.368	0.373	0.399	0.410	0.381	**0.368**	1.497	0.380	**0.366**	**0.367**	0.395
		48	0.494	**0.476**	**0.484**	0.496	**0.485**	**0.478**	0.759	**0.463**	**0.481**	**0.473**	**0.488**
	Environment	48	0.523	0.596	0.559	0.827	0.618	0.572	0.558	**0.523**	0.615	0.554	0.540
		96	0.541	0.718	0.756	0.620	0.599	0.563	1.372	0.746	0.595	0.649	0.577
		192	0.568	0.583	0.624	0.896	0.613	0.658	0.915	0.694	0.950	0.889	0.634
		336	0.514	0.555	0.537	0.673	0.543	0.605	0.723	0.561	0.609	0.566	0.568
	Public Health	12	1.506	1.579	1.748	1.558	1.708	**1.389**	1.596	1.538	1.529	1.513	1.603
		24	1.882	2.028	2.024	1.890	1.895	1.950	**1.610**	**1.827**	**1.765**	1.899	**1.870**
		36	1.867	1.907	1.983	1.876	2.201	1.910	**1.833**	1.877	**1.863**	**1.826**	**1.852**
		48	1.953	**1.892**	2.059	**1.850**	**1.906**	**1.852**	**1.664**	**1.925**	**1.820**	**1.867**	**1.921**
	Security	6	105.8	108.2	108.3	**105.5**	**104.4**	109.0	154.2	108.0	108.0	109.3	109.8
		8	110.5	**108.7**	110.9	111.2	111.0	111.6	134.2	**108.3**	**106.8**	**107.4**	114.7
		10	115.2	**112.8**	115.5	**115.0**	**112.5**	**112.7**	**114.4**	115.5	**111.5**	116.4	**114.6**
		12	117.2	**116.9**	**115.4**	**115.3**	**114.0**	118.3	118.6	**115.4**	**111.6**	**116.8**	**113.1**
	Social Good	6	0.896	**0.812**	**0.854**	**0.847**	**0.819**	0.910	4.220	**0.837**	**0.857**	**0.860**	**0.835**
		8	0.972	0.983	**0.957**	1.022	1.010	**0.937**	2.715	0.992	1.033	**0.950**	0.988
		10	0.983	1.009	1.075	1.042	1.105	0.989	1.034	1.006	1.041	0.999	1.037
		12	1.092	1.122	**1.067**	1.125	1.194	1.136	1.135	1.104	1.190	**1.089**	**1.059**
	Traffic	6	0.173	0.192	**0.170**	**0.158**	**0.167**	**0.164**	0.520	**0.167**	**0.170**	0.174	0.196
		8	0.186	0.188	0.198	0.200	0.245	**0.180**	0.429	0.192	0.195	0.194	0.187
		10	0.192	**0.191**	**0.185**	0.210	0.215	**0.171**	0.197	0.195	**0.189**	0.208	**0.185**
		12	0.241	0.260	**0.234**	**0.238**	**0.233**	**0.227**	0.287	**0.233**	0.250	**0.235**	**0.224**

Table L.52: Comparison of multimodal fusion strategies with Crossformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	**Additive**			**Concat**			**Constrained**			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Crossformer	Agriculture	6	0.152	**0.117**	0.195	**0.151**	**0.130**	0.226	0.192	0.155	**0.118**	**0.139**	0.173
		8	0.198	0.248	0.281	**0.149**	0.743	0.295	0.239	0.283	0.261	0.254	**0.167**
		10	0.265	**0.215**	**0.247**	0.346	**0.261**	0.395	0.378	0.268	0.299	**0.192**	**0.251**
		12	0.380	**0.357**	**0.363**	0.401	**0.307**	0.509	0.538	0.396	**0.282**	**0.326**	0.459
	Climate	6	1.063	**1.053**	**1.027**	**1.049**	**1.024**	**1.053**	1.081	1.093	1.067	**1.024**	**1.050**
		8	1.079	1.109	1.081	1.115	1.136	**1.072**	1.094	**1.060**	1.088	1.081	1.079
		10	1.079	1.097	**1.075**	1.105	1.084	1.097	1.080	1.105	1.085	1.101	1.101
		12	1.099	**1.096**	1.111	1.116	1.129	**1.090**	**1.080**	**1.072**	**1.094**	**1.090**	1.106
	Economy	6	0.477	**0.077**	**0.409**	**0.229**	**0.353**	0.697	0.519	**0.218**	**0.247**	**0.138**	**0.180**
		8	0.366	**0.296**	**0.162**	**0.179**	5.881	0.666	**0.326**	**0.180**	**0.167**	**0.255**	0.515
		10	0.374	0.797	0.688	0.588	**0.347**	0.764	1.015	**0.146**	**0.364**	0.441	**0.251**
		12	0.722	**0.581**	**0.568**	1.073	**0.559**	**0.648**	1.065	**0.376**	**0.295**	**0.561**	**0.168**
	Energy	12	0.130	0.131	0.151	0.171	0.177	0.151	0.162	0.151	0.132	0.148	**0.114**
		24	0.256	**0.238**	**0.238**	0.265	0.451	0.288	0.288	0.283	0.280	0.265	**0.249**
		36	0.344	**0.336**	0.359	**0.340**	0.346	0.351	0.351	**0.335**	**0.344**	**0.332**	0.355
		48	0.440	0.449	**0.433**	**0.417**	**0.427**	0.466	0.470	0.440	0.453	0.459	**0.428**
	Environment	48	0.492	0.580	0.511	0.573	0.549	0.504	0.571	0.499	0.581	0.531	0.529
		96	0.542	**0.530**	0.639	0.751	0.603	0.591	0.573	0.584	0.637	0.606	**0.533**
		192	0.521	0.590	0.649	0.686	0.658	0.619	0.608	0.588	0.616	0.591	0.584
		336	0.528	0.540	0.593	0.662	0.530	0.558	0.619	0.587	0.587	0.577	0.543
	Public Health	12	1.172	1.180	**1.106**	**1.132**	1.247	**1.136**	**1.126**	**1.136**	**1.132**	**1.044**	**1.023**
		24	1.356	1.377	**1.350**	1.359	1.686	1.444	1.463	**1.354**	**1.337**	**1.315**	**1.349**
		36	1.391	1.392	**1.389**	**1.286**	**1.362**	1.463	1.433	1.405	**1.388**	**1.292**	**1.366**
		48	1.480	**1.438**	**1.452**	1.523	1.504	**1.432**	1.540	**1.471**	1.483	**1.472**	**1.427**
	Security	6	120.5	120.7	121.4	**117.5**	**120.3**	120.6	121.7	**120.3**	**120.1**	**119.7**	**119.4**
		8	121.8	124.1	124.9	124.6	133.0	126.9	126.9	123.3	121.8	122.8	122.0
		10	124.1	125.8	125.6	125.6	124.2	125.4	125.2	126.0	124.5	125.9	**122.4**
		12	127.2	**121.3**	128.6	128.3	128.5	**125.1**	127.8	129.2	**124.9**	128.3	**126.0**
	Social Good	6	0.719	0.729	0.738	0.745	0.742	0.730	0.724	0.742	0.737	0.754	0.733
		8	0.817	0.819	0.817	**0.800**	1.472	**0.795**	0.821	0.832	0.821	**0.812**	**0.813**
		10	0.879	0.902	**0.851**	**0.850**	**0.875**	**0.863**	**0.872**	0.880	**0.867**	**0.869**	0.883
		12	0.928	0.940	**0.926**	0.931	0.943	**0.911**	**0.915**	0.948	**0.900**	**0.912**	0.929
	Traffic	6	0.231	**0.217**	**0.207**	**0.212**	**0.215**	**0.216**	**0.220**	**0.222**	**0.229**	**0.204**	**0.209**
		8	0.210	0.233	0.228	0.219	0.324	0.220	**0.201**	**0.210**	0.213	0.222	0.229
		10	0.220	**0.219**	0.223	0.225	0.224	**0.215**	**0.208**	**0.212**	**0.215**	0.222	**0.217**
		12	0.243	0.250	0.253	0.250	0.269	0.245	**0.243**	0.247	**0.243**	0.248	0.256

Table L.53: Comparison of multimodal fusion strategies with Reformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Reformer	Agriculture	6	0.189	**0.183**	0.277	**0.181**	0.205	**0.140**	0.322	0.265	**0.181**	0.199	**0.183**
		8	0.217	0.275	**0.215**	**0.173**	0.377	0.235	0.417	0.265	0.295	**0.197**	0.383
		10	0.489	**0.419**	**0.471**	**0.273**	**0.408**	**0.332**	0.732	**0.371**	**0.294**	0.502	**0.341**
		12	0.414	0.585	**0.333**	**0.366**	0.565	0.618	0.601	**0.349**	**0.390**	**0.259**	**0.406**
	Climate	6	0.983	1.013	1.014	1.045	1.007	1.065	**0.933**	1.004	1.093	**0.974**	1.054
		8	1.083	**1.046**	1.105	**1.044**	**1.073**	**1.051**	**0.946**	1.097	**1.065**	**1.078**	**1.042**
		10	1.096	**1.047**	**1.080**	1.112	1.098	**1.069**	**0.907**	**1.075**	1.102	1.113	**1.073**
		12	1.077	**1.046**	1.107	**1.068**	1.121	1.146	**1.052**	1.093	**1.041**	1.100	**1.063**
	Economy	6	0.268	0.332	0.337	0.377	0.643	0.316	0.649	**0.175**	0.302	**0.199**	0.344
		8	0.422	**0.213**	**0.096**	0.536	**0.379**	0.709	1.053	**0.340**	**0.221**	**0.326**	**0.260**
		10	0.447	0.703	0.834	0.531	1.110	0.817	2.016	0.615	**0.441**	0.633	0.747
		12	0.367	1.166	**0.300**	**0.280**	1.543	1.564	0.943	0.435	0.922	0.458	0.381
	Energy	12	0.267	**0.201**	**0.156**	**0.209**	**0.205**	**0.200**	**0.145**	**0.167**	**0.223**	**0.197**	**0.219**
		24	0.436	**0.410**	0.440	**0.408**	**0.317**	**0.383**	**0.333**	**0.401**	**0.401**	**0.372**	**0.400**
		36	0.503	**0.462**	**0.480**	**0.462**	**0.370**	**0.483**	**0.470**	**0.389**	**0.481**	**0.436**	**0.425**
		48	0.600	**0.557**	**0.527**	**0.513**	0.640	**0.536**	**0.583**	**0.510**	**0.488**	**0.523**	**0.518**
	Environment	48	0.411	0.533	0.466	0.454	**0.403**	0.462	0.561	0.463	0.445	0.453	0.453
		96	0.472	0.575	0.497	0.475	0.558	**0.438**	0.686	0.565	0.492	**0.438**	**0.450**
		192	0.437	0.567	0.468	0.485	0.544	0.457	0.709	0.453	0.485	0.456	0.457
		336	0.446	0.468	**0.434**	0.510	0.576	0.458	0.575	0.470	0.446	0.466	0.507
	Public Health	12	1.176	**0.931**	1.251	**1.098**	**1.015**	**1.094**	**1.148**	**1.107**	**1.175**	1.188	**1.086**
		24	1.272	1.341	**1.238**	1.324	1.327	1.286	1.363	1.317	**1.215**	**1.206**	1.285
		36	1.325	1.435	1.365	1.410	**1.266**	**1.252**	1.394	**1.249**	**1.282**	**1.280**	1.334
		48	1.415	**1.298**	1.550	1.429	1.442	1.449	1.531	1.600	1.431	1.440	**1.375**
	Security	6	124.9	**124.5**	125.5	**123.9**	**118.9**	**119.2**	**121.6**	125.0	**123.8**	**123.5**	**122.7**
		8	124.9	**123.0**	**123.3**	125.6	**123.2**	**123.5**	**124.5**	**123.3**	**123.3**	**124.2**	**124.8**
		10	126.5	127.1	**125.6**	**124.8**	129.0	**124.7**	127.1	**125.5**	**123.6**	**124.8**	127.3
		12	125.1	**123.4**	126.5	125.9	126.0	125.5	127.1	126.5	**124.8**	127.7	125.6
	Social Good	6	0.804	**0.782**	0.808	**0.800**	**0.796**	0.860	**0.774**	0.847	**0.800**	0.821	0.807
		8	0.912	**0.886**	**0.880**	**0.872**	**0.897**	**0.899**	0.918	**0.899**	**0.899**	**0.902**	**0.858**
		10	0.954	**0.950**	0.970	0.976	0.970	**0.948**	0.958	0.971	0.964	**0.933**	0.958
		12	0.993	1.007	**0.939**	**0.963**	1.007	**0.980**	**0.991**	**0.927**	0.998	**0.984**	1.007
	Traffic	6	0.232	0.244	0.260	0.253	0.275	0.297	**0.205**	0.246	**0.224**	**0.216**	0.258
		8	0.240	0.261	0.249	0.279	0.245	0.270	0.241	0.249	0.265	0.258	0.270
		10	0.265	**0.257**	**0.239**	**0.233**	**0.223**	0.312	**0.223**	**0.225**	**0.241**	0.276	**0.246**
		12	0.260	**0.252**	**0.247**	**0.244**	0.262	0.292	**0.237**	**0.257**	**0.232**	**0.242**	**0.240**

Table L.54: Comparison of multimodal fusion strategies with Transformer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive First	Additive Middle	Additive Last	Concat First	Concat Middle	Concat Last	Constrained Orthogonal	Constrained FiLM	Constrained Gating	Constrained **CFA**
Transformer	Agriculture	6	0.138	0.160	**0.138**	**0.095**	**0.097**	0.143	0.285	**0.126**	0.162	0.151	0.143
		8	0.155	0.223	0.179	0.218	**0.152**	0.281	0.446	0.183	0.201	0.253	0.181
		10	0.202	0.317	0.236	**0.195**	**0.115**	**0.181**	0.677	0.245	**0.192**	**0.184**	**0.197**
		12	0.195	0.273	0.274	0.224	**0.146**	0.373	0.534	0.268	0.207	0.205	0.324
	Climate	6	1.023	**0.990**	1.023	**1.019**	**0.971**	**1.009**	1.091	1.058	1.080	1.032	1.087
		8	1.048	1.060	1.106	**1.023**	1.057	1.050	1.068	1.104	**1.040**	1.061	**1.041**
		10	1.094	**1.061**	**1.067**	1.099	1.097	**0.985**	**1.040**	**1.067**	**1.048**	1.106	**1.070**
		12	1.021	**1.007**	1.051	1.067	1.088	1.082	1.023	1.039	1.037	1.060	1.105
	Economy	6	0.252	**0.244**	**0.235**	0.415	**0.108**	0.284	0.526	**0.248**	0.447	**0.160**	0.309
		8	0.259	0.538	**0.208**	0.331	**0.062**	0.460	0.735	0.266	0.428	**0.148**	**0.244**
		10	0.288	0.711	**0.217**	**0.189**	**0.110**	**0.104**	1.452	**0.251**	**0.191**	**0.098**	**0.110**
		12	0.265	0.342	0.556	**0.186**	**0.088**	0.567	0.937	0.476	**0.052**	0.513	0.392
	Energy	12	0.085	0.132	0.102	0.143	0.117	0.109	0.124	0.095	0.101	0.098	0.106
		24	0.204	0.222	**0.200**	0.303	0.269	0.232	0.224	0.218	0.204	**0.185**	0.241
		36	0.357	0.422	0.366	**0.308**	**0.314**	**0.278**	**0.270**	**0.335**	**0.346**	**0.312**	**0.298**
		48	0.479	0.490	**0.405**	0.485	**0.399**	**0.402**	**0.422**	**0.369**	**0.435**	**0.441**	0.481
	Environment	48	0.407	0.524	0.430	0.448	0.465	0.442	0.501	0.428	0.466	0.410	0.410
		96	0.487	**0.466**	**0.454**	**0.465**	**0.423**	**0.448**	0.523	**0.470**	**0.465**	**0.433**	0.491
		192	0.445	0.528	0.452	0.519	0.460	0.468	0.651	0.463	**0.442**	0.452	**0.442**
		336	0.449	0.478	0.464	0.477	0.538	0.477	0.555	0.474	**0.408**	0.458	**0.434**
	Public Health	12	0.968	1.069	1.119	1.161	1.087	1.040	1.062	1.287	1.068	**0.961**	**0.962**
		24	1.285	1.288	**1.221**	1.352	**1.153**	1.293	1.449	**1.208**	1.322	1.296	**1.207**
		36	1.318	1.321	**1.294**	1.345	**1.282**	1.413	**1.198**	**1.265**	**1.295**	**1.288**	**1.277**
		48	1.427	1.432	**1.300**	**1.280**	**1.391**	1.432	1.521	**1.408**	**1.389**	**1.416**	1.576
	Security	6	126.6	127.3	**126.5**	**126.0**	**122.3**	**124.0**	**124.4**	**125.9**	**124.6**	128.0	**124.5**
		8	126.1	127.5	128.3	**125.9**	**123.9**	127.6	128.5	128.4	126.9	126.7	130.4
		10	129.3	**129.3**	130.7	**128.8**	**124.1**	**128.6**	129.9	131.2	130.1	129.8	130.7
		12	128.4	**126.5**	131.3	129.9	**126.7**	130.4	131.1	130.9	129.2	129.0	**118.5**
	Social Good	6	0.698	0.737	0.769	0.781	0.795	0.743	0.724	0.770	0.765	0.741	0.764
		8	0.786	**0.779**	0.856	0.855	0.843	0.813	**0.769**	0.829	0.868	0.815	0.841
		10	0.888	**0.831**	0.904	**0.855**	**0.864**	0.925	**0.853**	0.929	**0.835**	0.899	0.913
		12	0.868	0.896	0.874	**0.852**	0.894	0.914	**0.867**	0.983	0.942	**0.862**	0.940
	Traffic	6	0.161	0.162	0.163	0.167	0.173	0.171	**0.158**	0.163	0.185	**0.152**	0.166
		8	0.165	**0.164**	0.176	0.169	0.196	**0.159**	**0.160**	0.176	**0.162**	0.176	0.167
		10	0.181	**0.174**	0.192	**0.172**	0.199	0.194	**0.168**	0.192	0.190	**0.180**	0.208
		12	0.213	0.227	0.218	**0.209**	0.237	0.220	**0.209**	0.217	0.215	0.217	0.214

Table L.55: Comparison of multimodal fusion strategies with TSMixer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
TSMixer	Agriculture	6	0.085	0.098	0.091	0.100	0.204	**0.084**	0.143	0.099	0.137	0.102	**0.077**
		8	0.124	0.157	0.158	0.311	0.205	0.300	0.167	0.171	**0.118**	0.128	0.174
		10	0.259	**0.199**	0.374	**0.245**	0.503	0.489	**0.213**	0.364	**0.224**	0.291	**0.205**
		12	0.606	0.809	**0.573**	0.616	0.907	0.644	**0.567**	**0.514**	1.412	0.685	**0.249**
	Climate	6	1.058	1.066	1.077	1.074	1.087	1.077	1.079	1.071	1.069	1.062	**1.048**
		8	1.092	**1.088**	**1.083**	**1.068**	1.102	1.095	1.100	1.104	1.095	**1.085**	1.098
		10	1.106	**1.104**	1.110	**1.091**	**1.105**	1.117	1.112	1.113	1.109	**1.098**	1.111
		12	1.104	1.114	1.117	1.110	1.118	**1.097**	**1.096**	1.115	1.130	1.113	**1.091**
	Economy	6	0.045	0.061	0.056	0.097	0.133	0.049	0.128	0.195	0.067	0.047	**0.036**
		8	0.036	0.109	0.126	0.071	0.346	0.213	0.208	0.244	0.090	0.054	0.093
		10	0.358	0.416	**0.174**	**0.239**	**0.165**	0.971	**0.203**	0.572	**0.297**	**0.223**	**0.158**
		12	0.792	**0.736**	1.217	0.876	1.525	**0.485**	**0.440**	**0.226**	1.956	0.835	**0.111**
	Energy	12	0.157	0.172	**0.150**	0.170	0.167	**0.137**	0.178	**0.127**	**0.144**	**0.143**	**0.149**
		24	0.264	0.272	0.289	0.330	0.276	0.271	0.276	**0.251**	0.276	0.304	0.278
		36	0.361	**0.360**	0.377	0.403	0.363	**0.348**	0.366	**0.338**	0.370	**0.355**	**0.333**
		48	0.454	0.456	0.474	0.465	**0.446**	**0.437**	0.459	**0.438**	0.484	0.469	0.459
	Environment	48	0.539	0.587	0.716	0.769	0.576	**0.516**	0.718	**0.521**	0.543	0.663	**0.518**
		96	0.606	0.647	0.738	1.042	0.648	0.625	0.732	**0.592**	0.664	0.637	**0.565**
		192	0.660	0.718	0.680	0.697	0.674	**0.633**	1.066	**0.592**	0.693	0.674	**0.588**
		336	0.586	0.660	0.663	0.670	**0.567**	0.595	0.892	**0.569**	0.631	0.643	**0.580**
	Public Health	12	1.074	1.116	1.208	1.222	**1.062**	1.127	1.101	1.163	1.121	1.106	**1.050**
		24	1.425	1.504	**1.389**	1.497	1.432	1.503	1.563	**1.404**	1.513	**1.395**	**1.366**
		36	1.488	**1.447**	**1.434**	**1.392**	1.493	1.536	1.509	1.523	**1.481**	**1.465**	1.565
		48	1.605	1.644	1.626	**1.602**	1.759	1.705	1.683	**1.541**	1.669	**1.575**	**1.526**
	Security	6	128.2	128.2	129.8	**127.2**	**124.9**	**125.7**	128.8	**123.1**	**124.1**	**125.9**	**127.9**
		8	127.8	**123.5**	127.8	128.6	**122.3**	**122.7**	130.2	**126.7**	**126.2**	**127.7**	**125.9**
		10	129.9	**129.7**	130.2	131.9	**123.7**	**124.6**	**124.9**	131.9	130.1	130.1	**127.9**
		12	130.2	133.3	132.1	133.5	132.2	**127.8**	**128.9**	133.7	130.5	**129.7**	**129.7**
	Social Good	6	0.744	0.748	0.782	**0.738**	0.745	**0.730**	**0.730**	0.824	**0.744**	0.772	**0.733**
		8	0.883	0.914	1.065	0.934	0.889	**0.857**	0.891	0.934	**0.817**	**0.831**	**0.823**
		10	0.890	**0.851**	0.912	**0.841**	0.897	0.932	0.893	0.900	**0.837**	0.892	**0.886**
		12	0.881	0.888	0.926	0.913	1.267	0.905	1.230	0.976	0.986	0.887	0.888
	Traffic	6	0.214	**0.201**	0.228	**0.204**	**0.206**	0.228	0.226	0.230	0.226	**0.207**	**0.187**
		8	0.212	0.220	0.223	0.213	0.226	0.222	0.235	0.275	0.276	**0.201**	**0.188**
		10	0.222	0.229	0.243	0.225	**0.222**	0.292	**0.218**	0.266	0.304	0.231	**0.207**
		12	0.289	**0.289**	0.297	0.304	0.451	**0.274**	**0.268**	0.347	0.504	**0.259**	**0.262**

Table L.56: Comparison of multimodal fusion strategies with Informer (+ Doc2Vec).

TS Model	Dataset	H	Unimodal	Additive			Concat			Constrained			
				First	Middle	Last	First	Middle	Last	Orthogonal	FiLM	Gating	**CFA**
Informer	Agriculture	6	0.228	0.468	0.342	0.249	0.240	0.306	0.270	0.244	**0.212**	**0.200**	**0.218**
		8	0.307	0.398	**0.204**	**0.276**	**0.233**	**0.199**	0.390	**0.254**	**0.264**	**0.184**	**0.232**
		10	0.369	**0.267**	0.392	0.450	0.572	**0.256**	0.411	0.382	**0.363**	0.371	**0.341**
		12	0.570	0.609	0.584	0.625	**0.463**	**0.553**	**0.485**	**0.274**	**0.358**	**0.352**	**0.517**
	Climate	6	1.091	**1.045**	1.093	**1.063**	**1.029**	**1.062**	**1.068**	**1.066**	**1.051**	**1.026**	**1.016**
		8	1.127	**1.030**	**1.062**	**1.094**	**1.003**	**1.055**	**1.065**	**1.058**	**1.082**	**1.041**	**1.032**
		10	1.052	1.061	**1.050**	1.084	**0.883**	1.076	1.068	1.076	1.058	1.083	1.091
		12	1.058	1.084	1.071	1.074	**0.907**	**1.024**	1.069	1.065	1.064	1.069	1.103
	Economy	6	0.552	0.667	0.726	**0.404**	**0.543**	0.603	0.943	**0.192**	**0.510**	**0.526**	**0.381**
		8	0.704	0.852	**0.700**	0.904	**0.271**	0.812	**0.450**	**0.618**	**0.464**	**0.387**	0.720
		10	0.864	**0.741**	**0.662**	**0.727**	1.073	0.928	**0.813**	**0.757**	0.940	**0.597**	**0.276**
		12	1.015	**0.894**	**0.254**	1.273	**0.515**	1.101	**0.767**	**0.979**	1.081	**1.011**	1.057
	Energy	12	0.190	**0.177**	0.208	0.216	0.214	**0.183**	**0.174**	0.203	0.225	0.200	0.205
		24	0.276	0.297	0.408	0.294	**0.263**	0.359	**0.255**	0.341	0.323	0.374	0.286
		36	0.371	0.401	0.452	0.374	**0.364**	0.418	0.381	0.431	**0.320**	0.411	0.481
		48	0.490	**0.480**	0.510	0.520	**0.481**	0.508	0.516	**0.483**	**0.457**	**0.463**	0.501
	Environment	48	0.412	0.593	0.424	0.509	0.502	0.436	0.506	0.455	0.459	0.474	0.449
		96	0.411	0.501	0.505	0.527	0.478	0.456	0.527	0.429	0.461	0.455	0.441
		192	0.445	0.458	0.482	0.588	0.576	0.480	0.486	0.468	0.460	0.452	0.448
		336	0.436	0.512	0.478	0.489	0.500	0.455	0.548	0.493	0.458	0.452	0.461
	Public Health	12	1.061	1.124	1.109	1.116	1.103	**0.994**	**1.004**	1.097	1.105	1.125	1.091
		24	1.293	1.334	1.409	1.338	1.359	1.416	1.348	1.405	**1.288**	1.326	**1.287**
		36	1.436	**1.416**	**1.415**	1.534	**1.228**	**1.403**	1.548	1.461	1.443	1.451	1.509
		48	1.556	1.657	1.634	1.671	**1.332**	1.669	1.574	1.665	1.772	1.618	1.646
	Security	6	124.2	127.0	126.6	128.0	125.7	128.0	124.4	128.6	127.1	127.8	127.2
		8	122.3	127.7	128.0	129.0	128.8	128.4	127.3	130.1	126.7	127.5	128.8
		10	129.5	130.2	**125.6**	**127.0**	131.3	**129.2**	**128.8**	**129.4**	**129.0**	**128.4**	129.9
		12	130.8	131.3	130.9	**129.5**	**127.4**	**126.5**	**130.4**	131.1	**127.3**	132.3	**129.9**
	Social Good	6	0.725	0.754	0.790	0.727	0.752	0.757	0.766	**0.711**	0.747	0.770	0.756
		8	0.801	**0.769**	**0.788**	0.801	0.809	**0.800**	0.808	0.824	0.803	0.834	0.816
		10	0.849	**0.838**	**0.801**	0.855	**0.783**	0.861	**0.798**	0.850	**0.837**	0.884	0.898
		12	0.911	**0.862**	0.940	**0.860**	**0.902**	**0.870**	**0.870**	0.931	**0.884**	**0.883**	**0.885**
	Traffic	6	0.180	**0.178**	0.192	**0.148**	**0.157**	**0.154**	**0.159**	**0.164**	**0.177**	**0.155**	**0.156**
		8	0.174	**0.169**	**0.167**	0.185	**0.158**	**0.170**	**0.168**	0.193	0.177	**0.163**	0.182
		10	0.208	**0.181**	**0.165**	**0.193**	**0.200**	**0.177**	**0.178**	**0.187**	**0.177**	**0.173**	**0.193**
		12	0.213	0.221	0.227	**0.210**	**0.206**	**0.212**	**0.211**	0.220	0.215	0.221	0.229