



Decentralized Attention Fails Centralized Signals

—*Rethinking Transformers for Medical Time Series*

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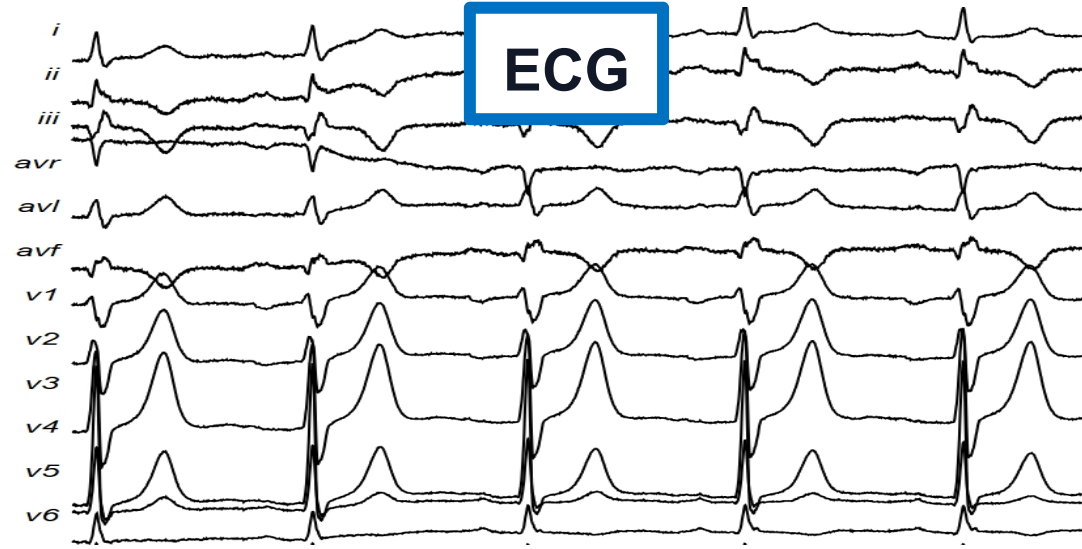
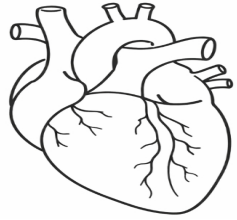


Paper



Code

1. Background



Cardiac Analysis:
*Atrial Fibrillation,
Myocardial Infarction,
etc.*

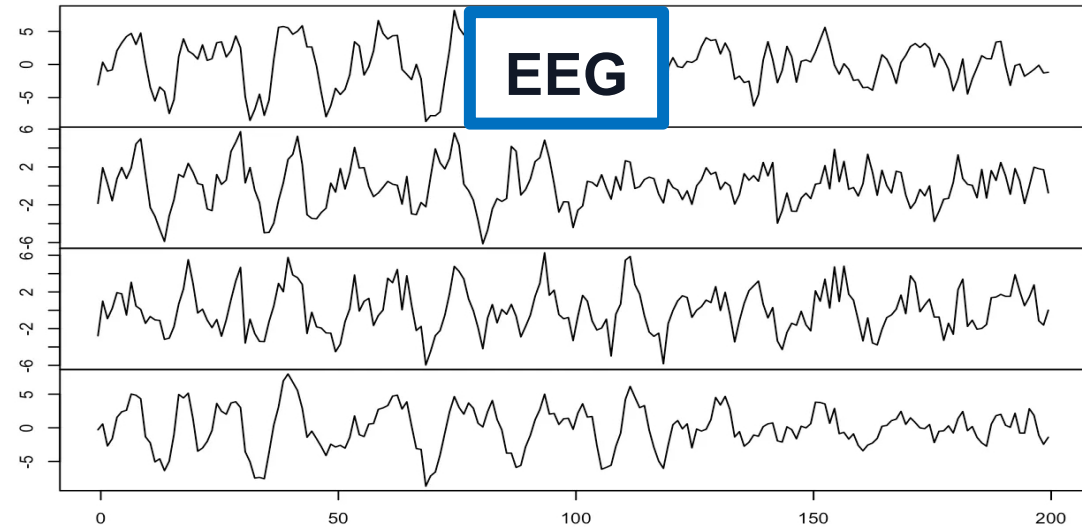
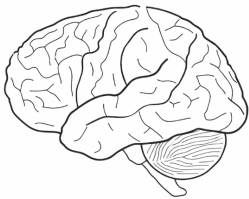
2. Challenge

3. Solution

4. Results

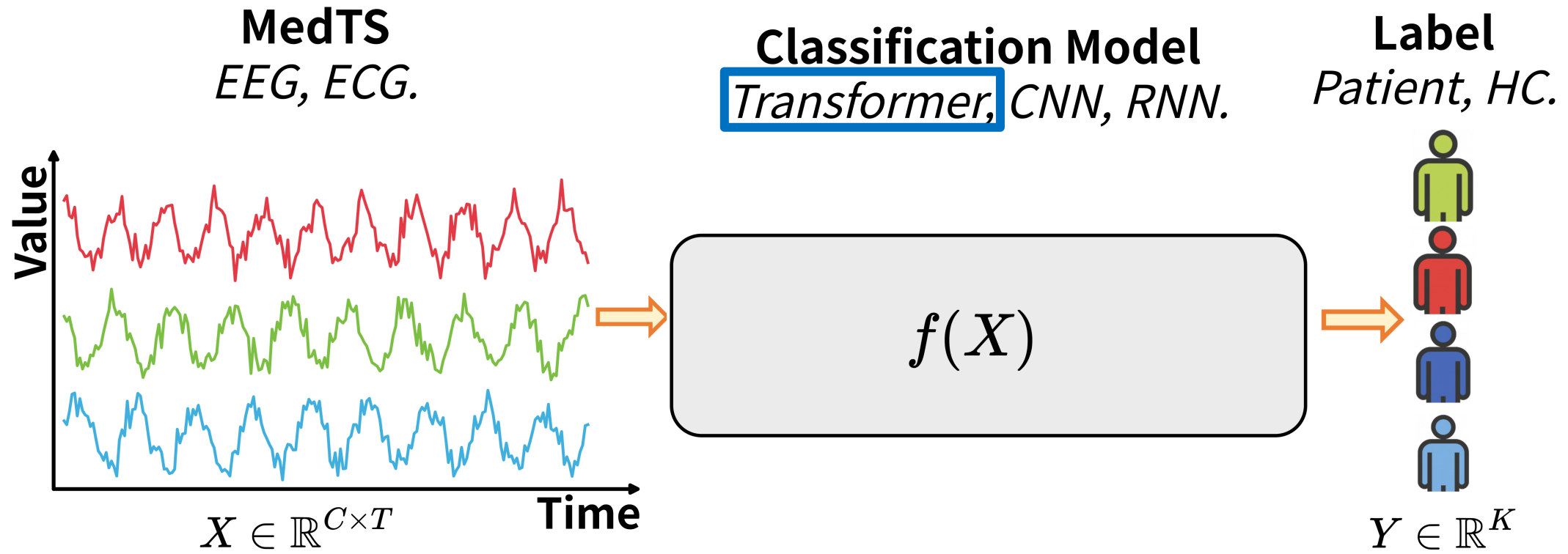
5. Inspirations

Medical Time Series (MedTS)

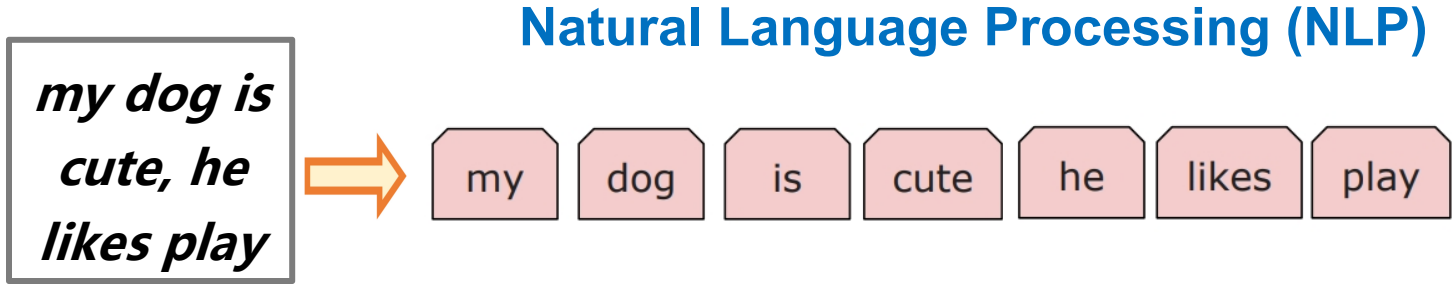


Brain Analysis:
*Epilepsy,
Insomnia,
etc.*

- 1. Background
- 2. Challenge
- 3. Solution
- 4. Results
- 5. Inspirations



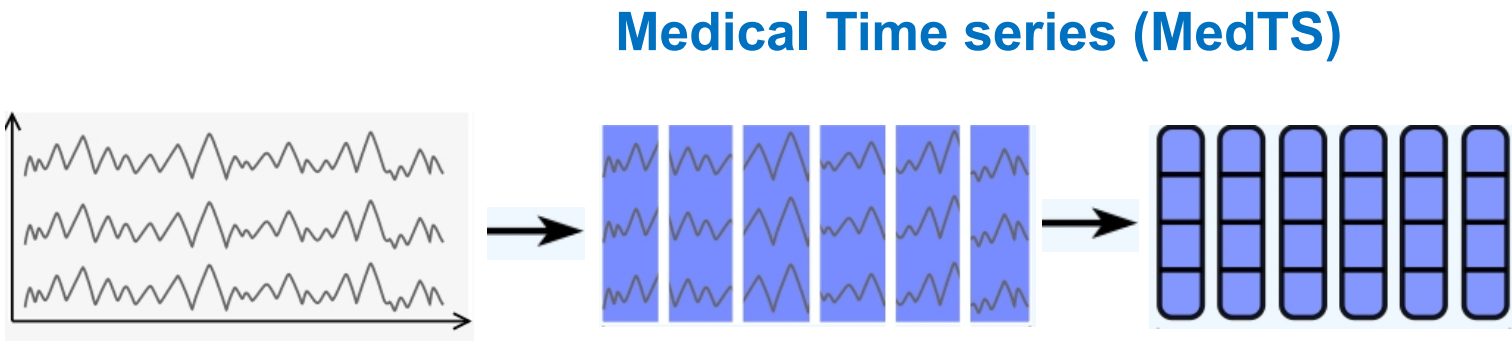
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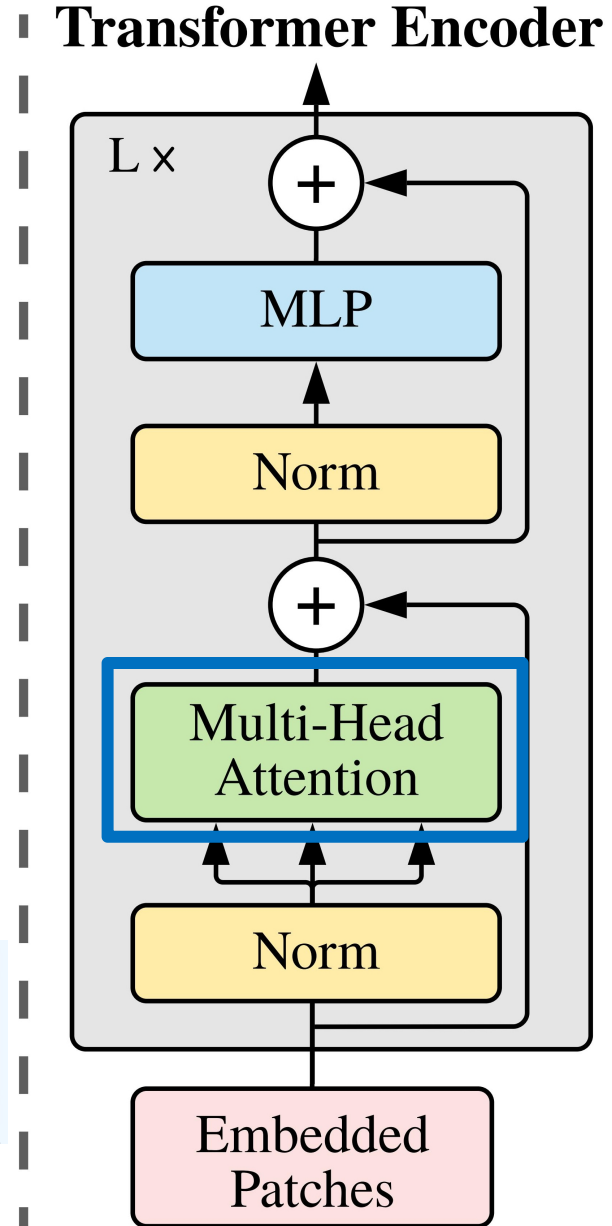
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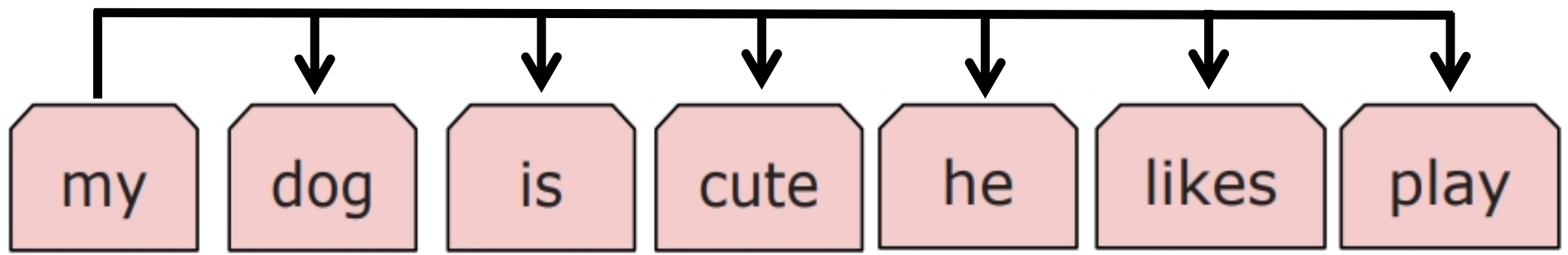
3. Solution



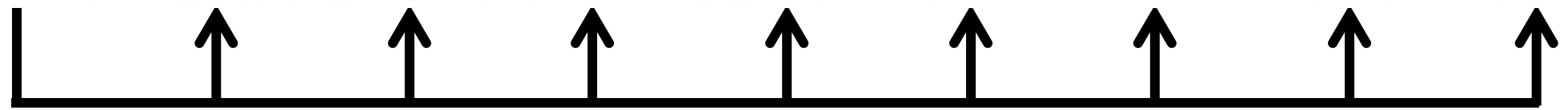
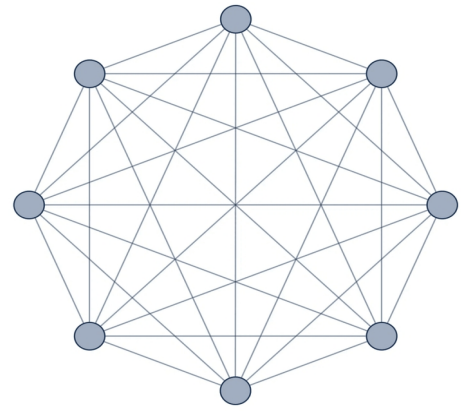
5. Inspirations



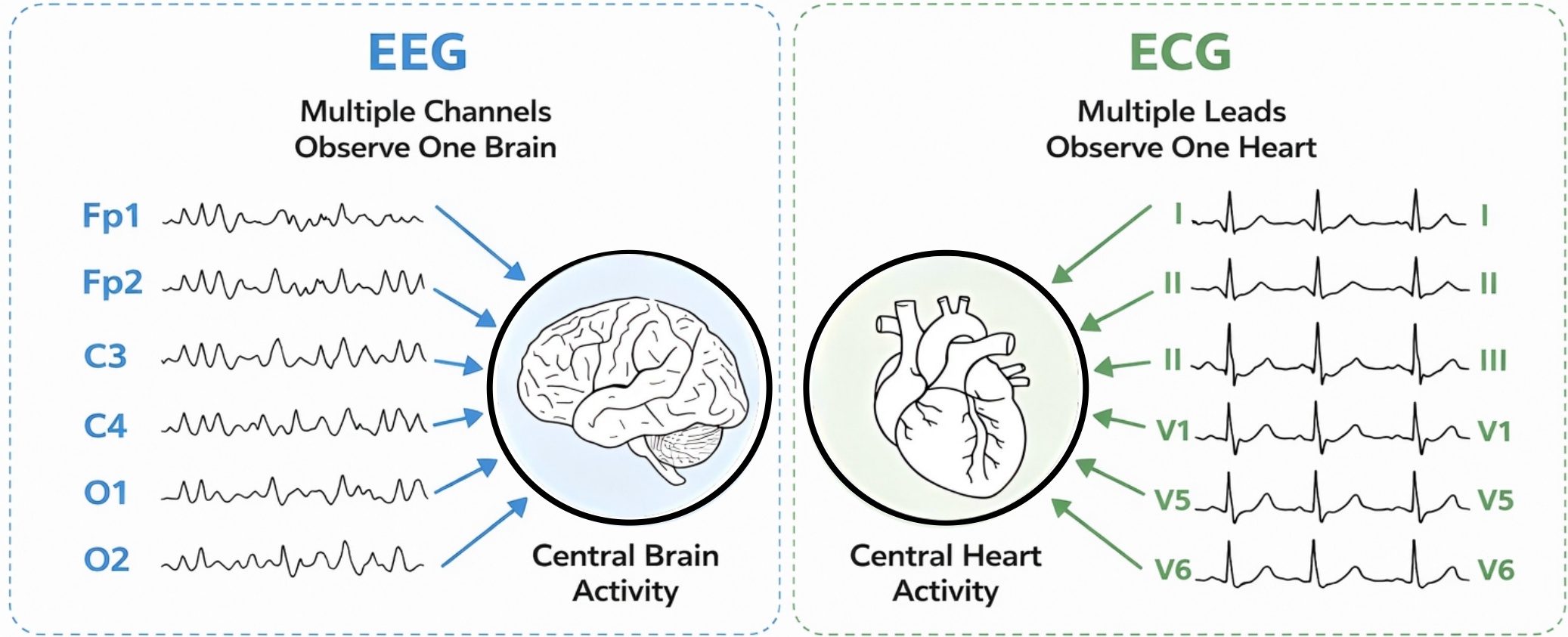
- 1. Background
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Decentralized Structure



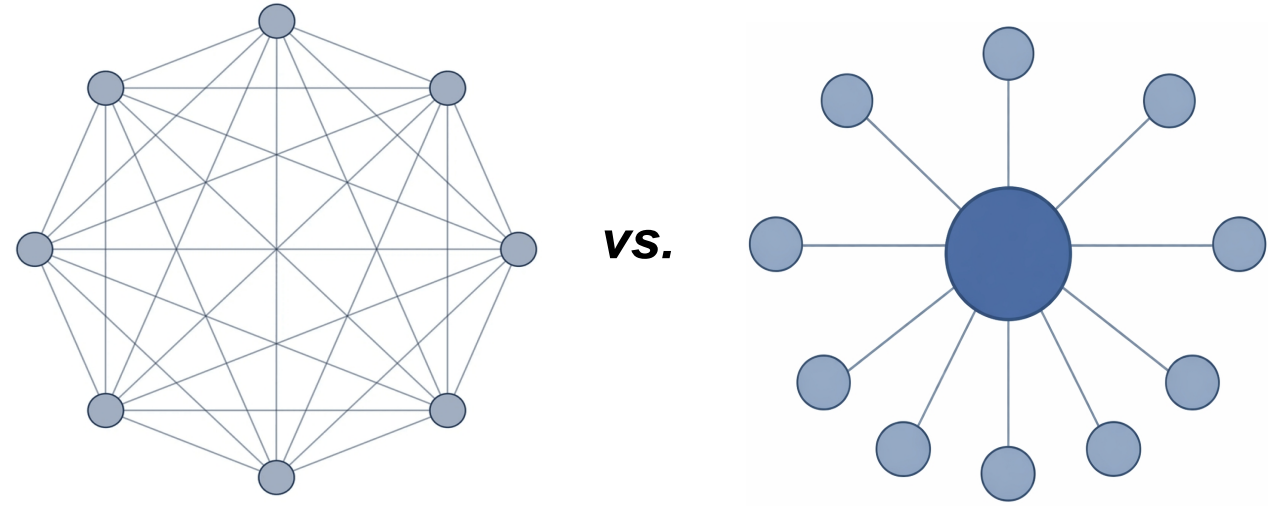
- 1. Background
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*Different Sensors,
Same Physiological Source*

Centralized Signals

- 1. Background
- 2. Challenge
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- 5. Inspirations



Mismatch:
Decentralized Attention vs. Centralized Signals

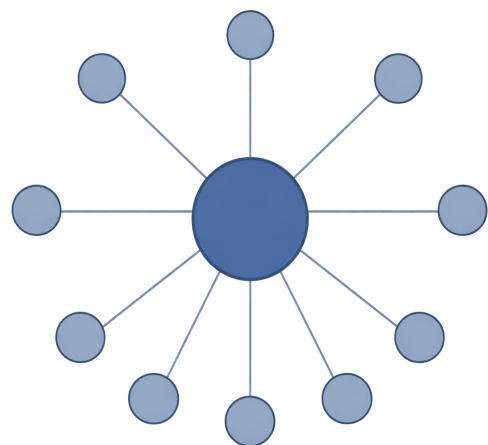
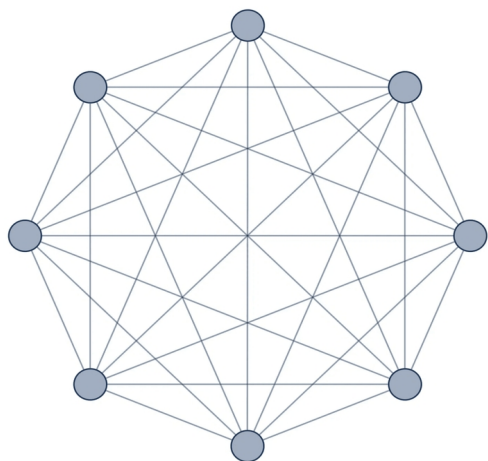
1. Background

2. Challenge

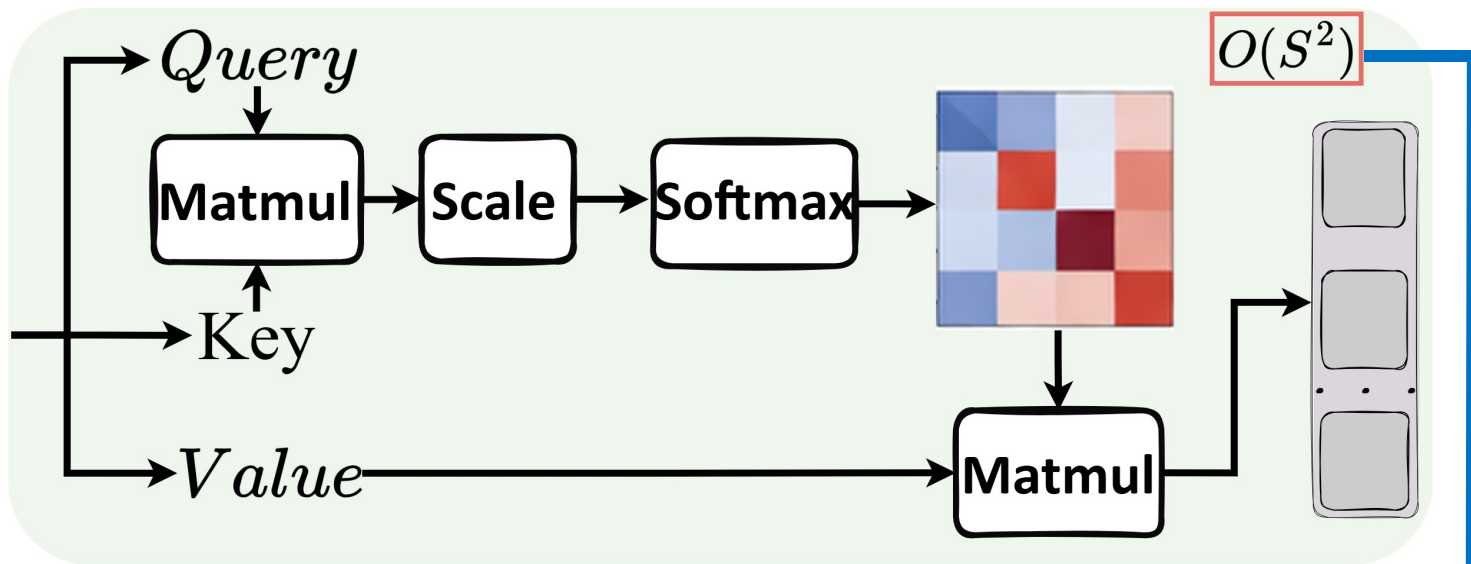
3. Solution

4. Results

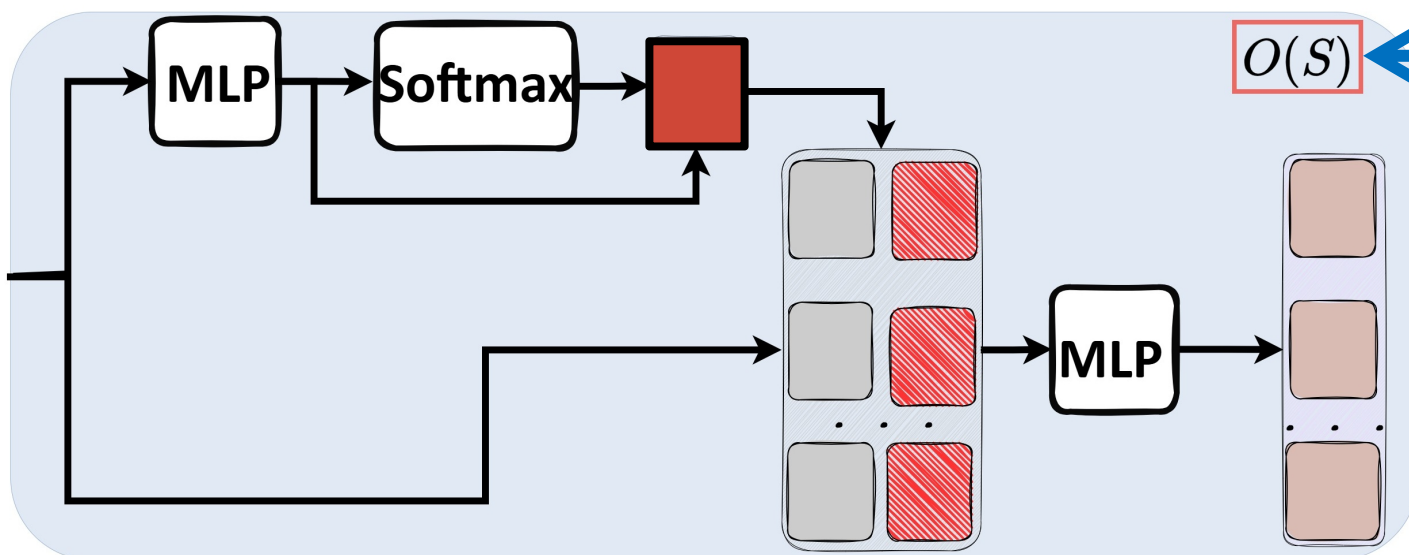
5. Inspirations



Attention



Core Token Aggregation-Redistribution (CoTAR)



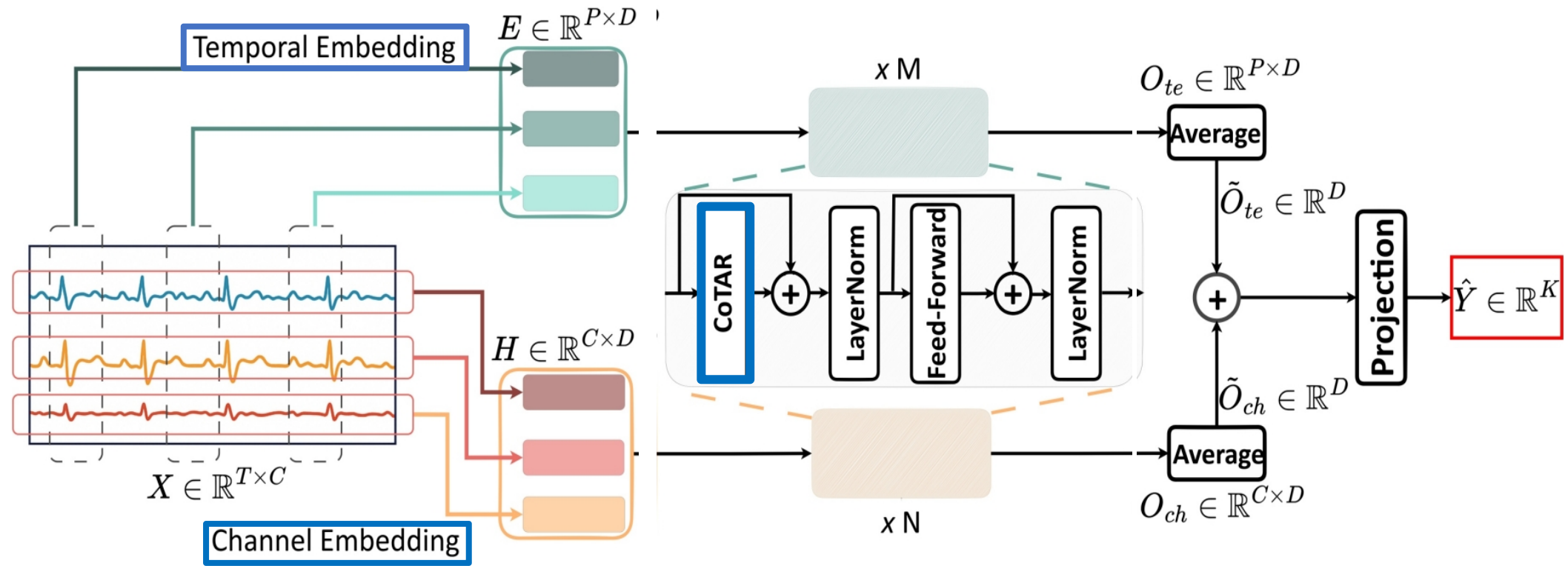
1. Background

2. Challenge

3. Solution

4. Results

5. Inspirations



1. Background

2. Challenge

3. Solution

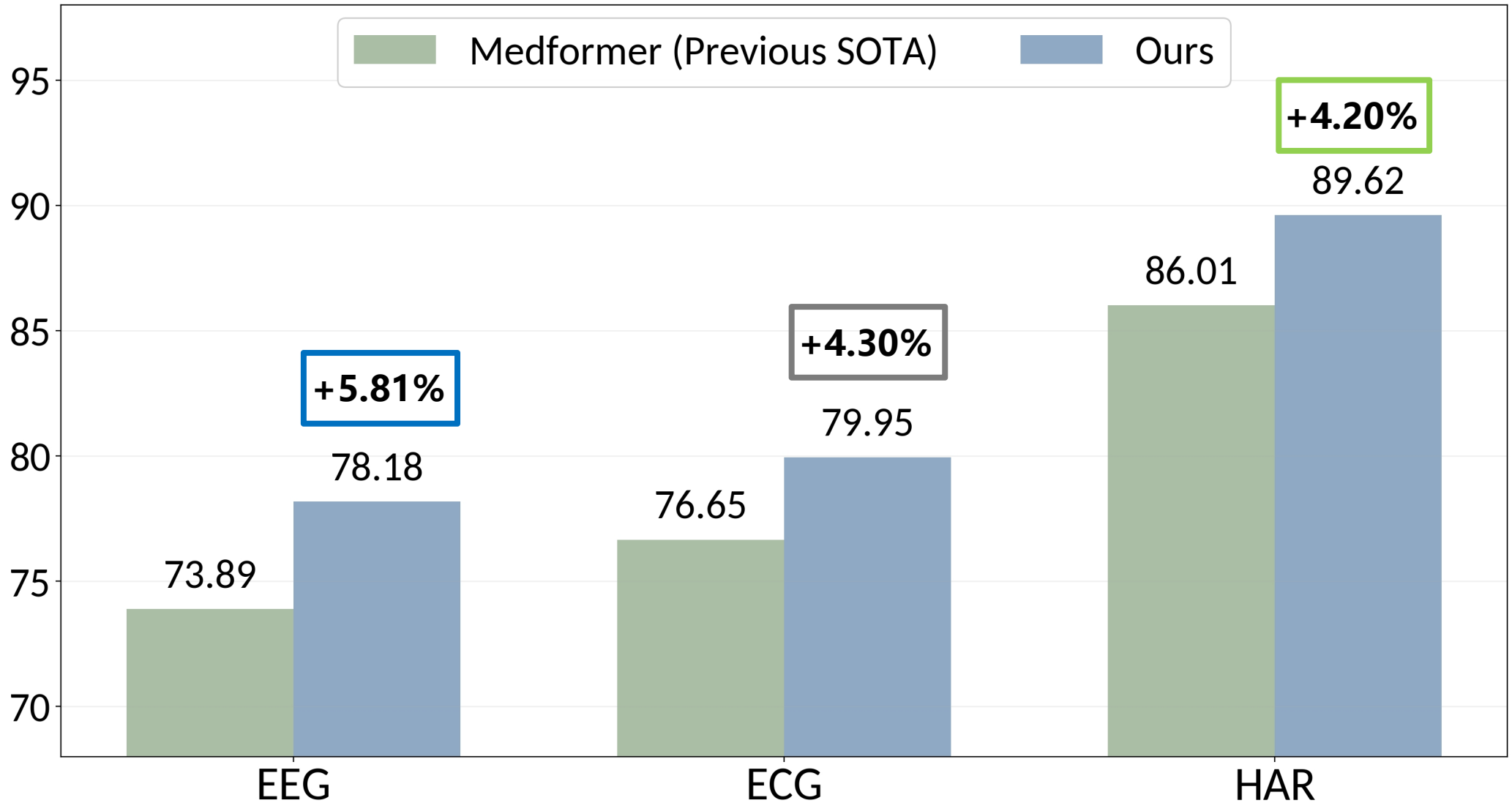
4. Results

5. Inspirations

Table 1: **The information of utilized datasets**, including the number of subjects, samples, sample channels, and timestamps (TS).

	Dataset	#-Subject	#-Sample	#-Class	#-Channel	#-TS
EEG	ADFTD	88	69,752	3	19	256
	APAVA	23	5,967	2	16	256
	TDBrain	72	6,240	2	33	256
ECG	PTB	198	64,356	2	15	300
	PTB-XL	17,596	191,400	5	12	250
Human Activity Recognition	FLAPP	8	13123	10	6	100
	UCI-HAR	30	10,299	6	9	128

Ours vs. Medformer (Previous SOTA)



1. Background

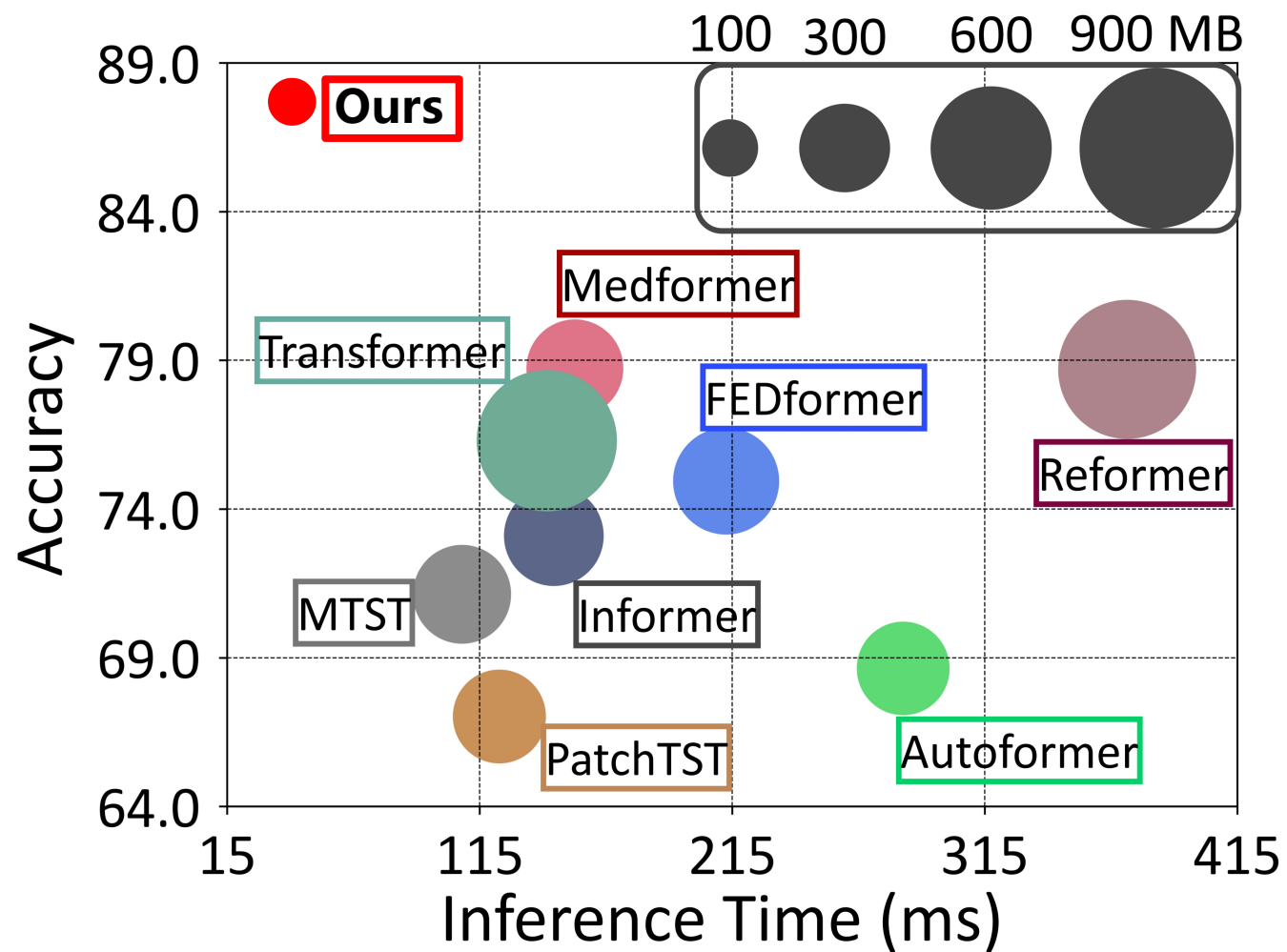
2. Challenge

3. Solution

4. Results

5. Inspirations

Efficiency Analysis



1. Background

+12.13% Improvement

2. Challenge

33% Memory Usage

3. Solution

20% Inference Time

4. Results

5. Inspirations

Noise Robustness Test

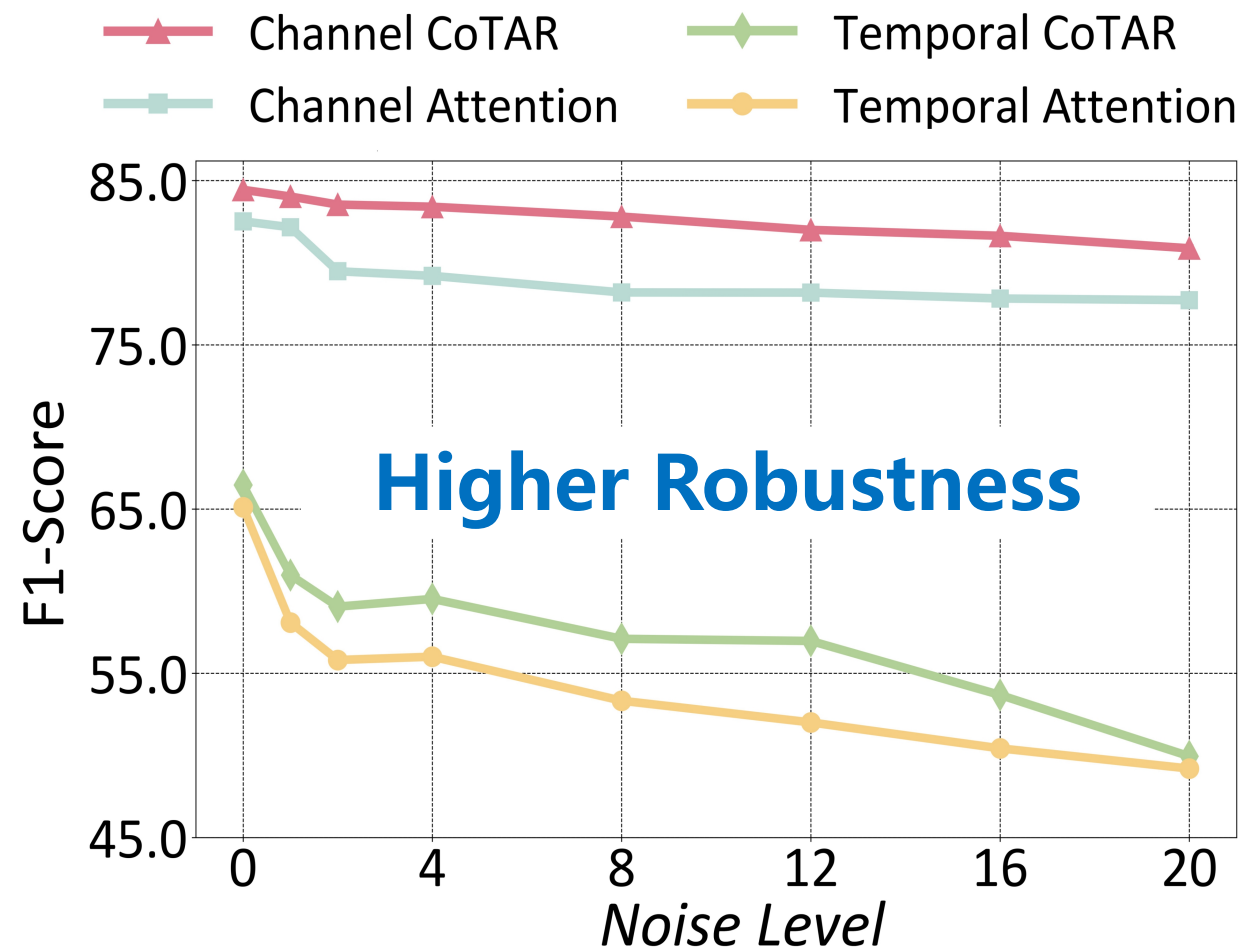
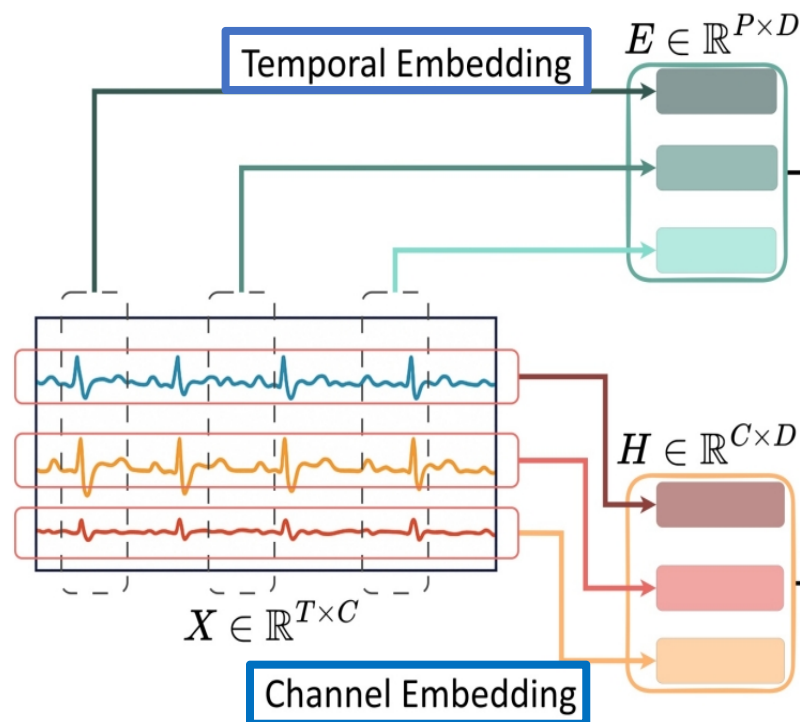
1. Background

2. Challenge

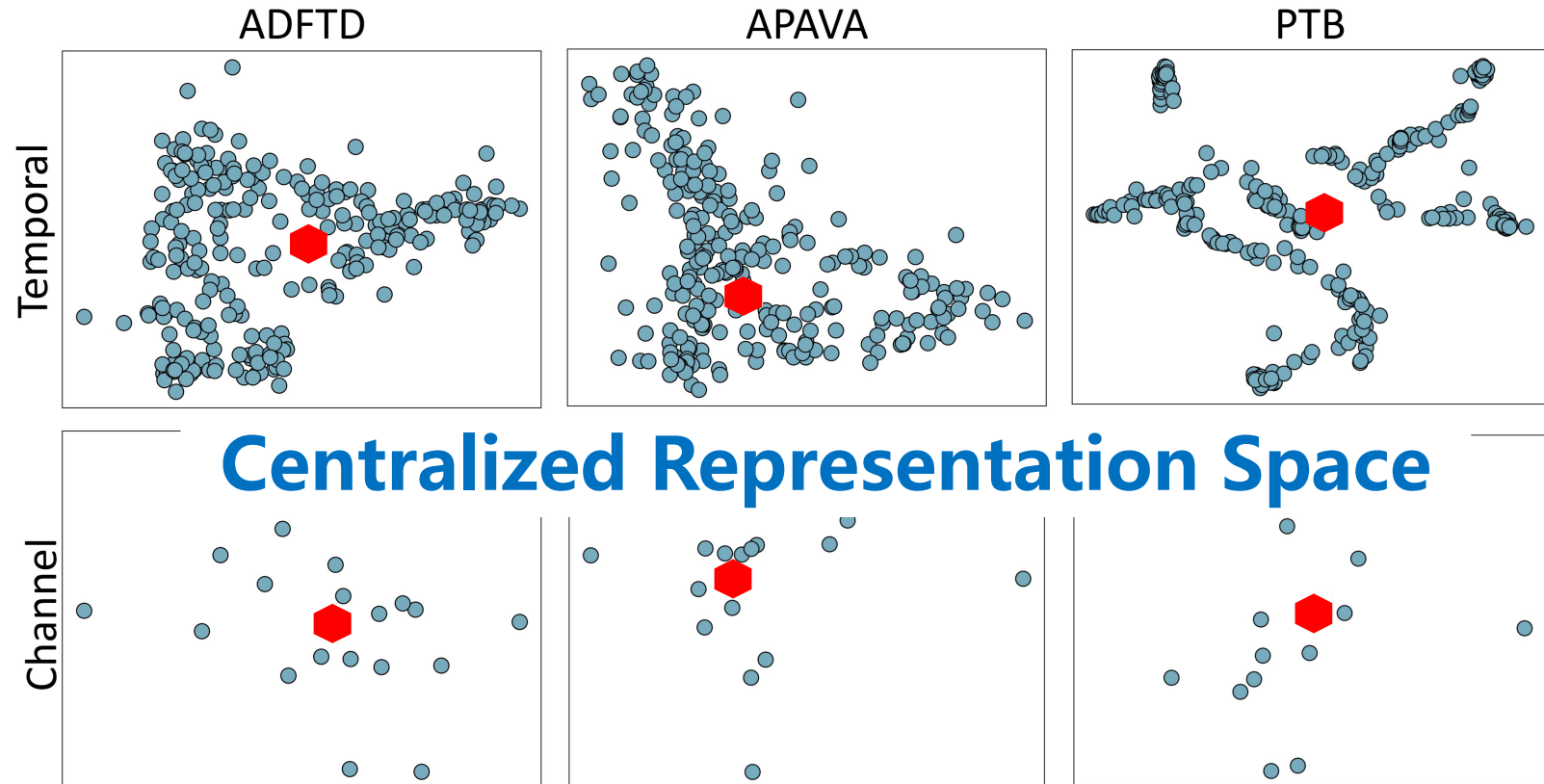
3. Solution

4. Results

5. Inspirations



Feature Visualization



Global Physiological State

1. Background

2. Challenge

3. Solution

4. Results

5. Inspirations

1. Background

1. Inductive bias over brute-force complexity

2. Challenge

2. Structure-aligned MedTS foundation model

3. Solution

3. Modalities governed by a centralized physiological state, fNIRS, fMRI, HAR, etc.

4. Results

5. Inspirations