

Comparing Embedding Space Across Different Modalities

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By: CoffeeMeetsGPT!

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Overview & Motivation

Main Idea

Comparing representation of entities across different modalities

- Images
- Text (Labels of those images)
- EEG (of human subjects being shown the images)

Motivation

- Do these modalities have bias towards certain entities?
- How does brain internal representations differ from a computer?

How Did We Generate Embedding Spaces?



Image

Google Vision Transformer

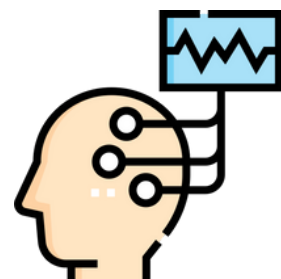
Image Embeddings

Gold Fish

Label

BERT Language Model

Text Embeddings



EEG Recording

Pre-trained EEGNet

EEG Embeddings

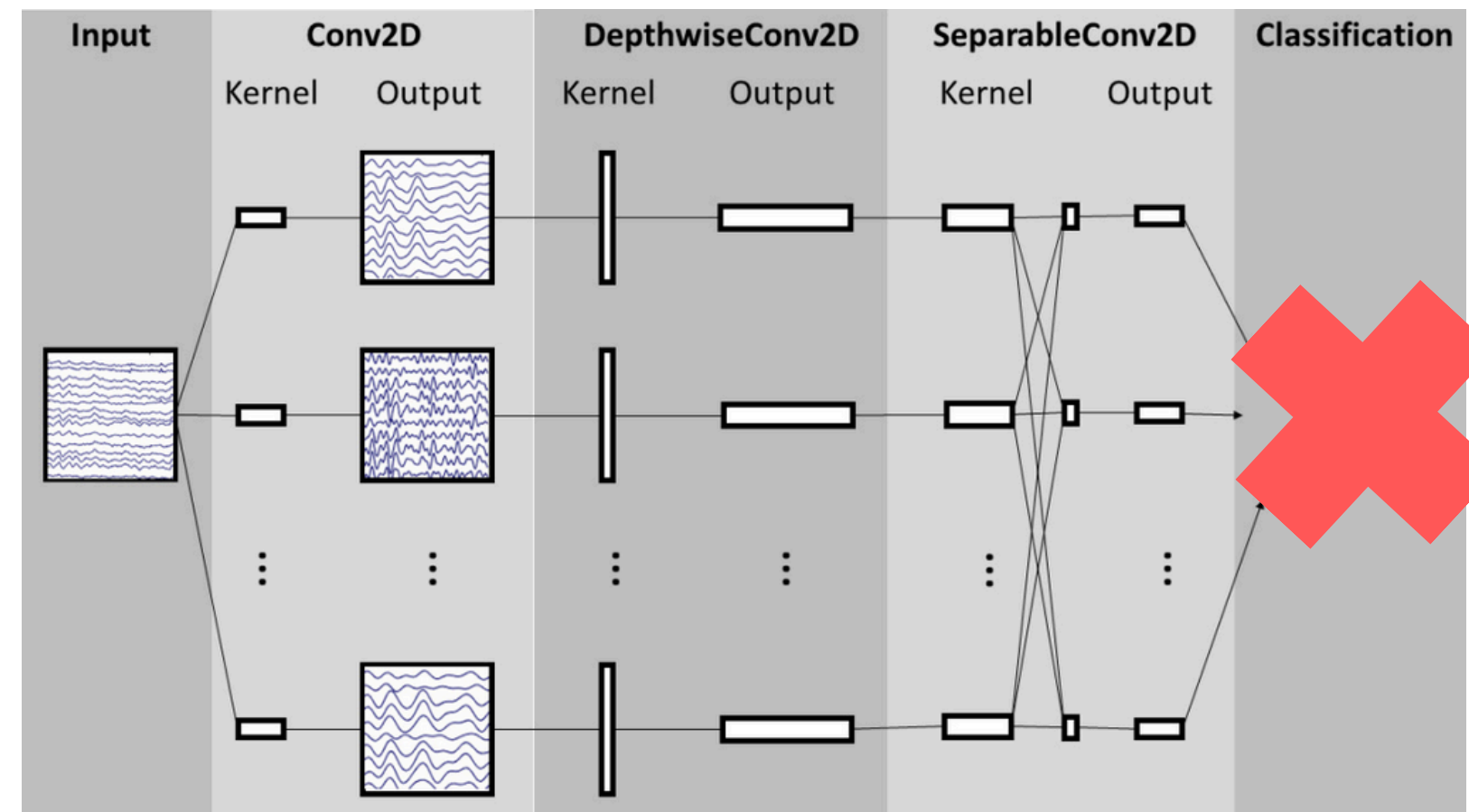
Challenge: EEG Representations!

Variations of EEG Recordings



Appropriate pre-trained EEG foundation models are hard to find!

Our Solution to The Problem



How Did We Compare The Embedding Spaces?

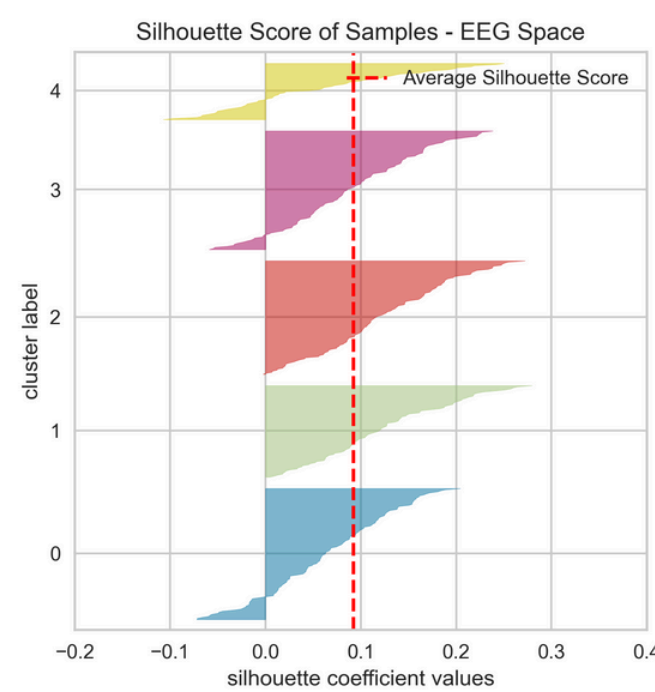
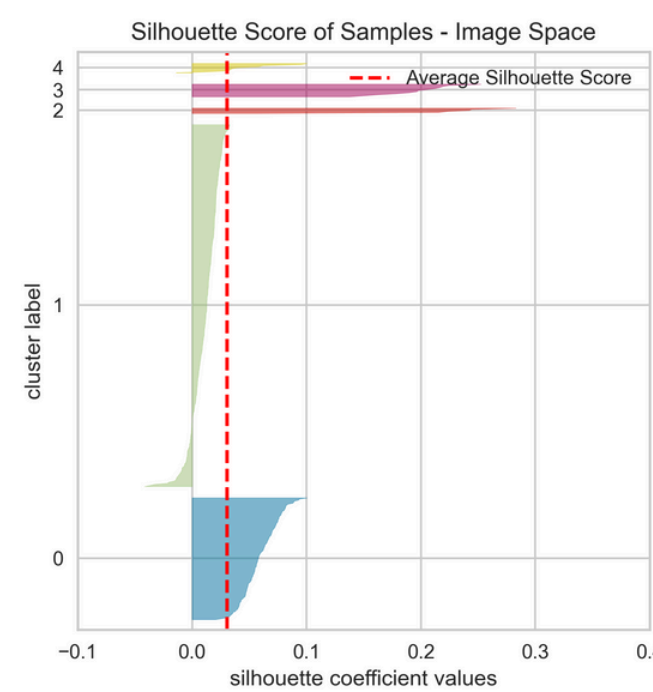
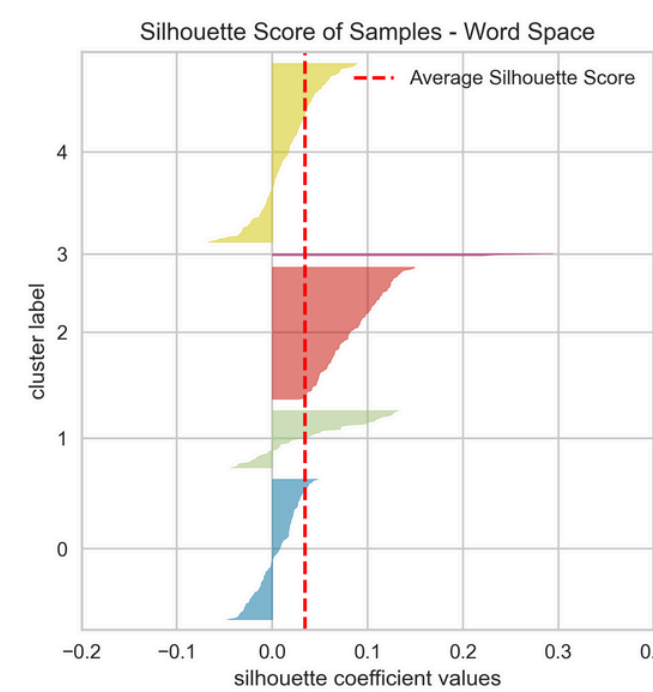
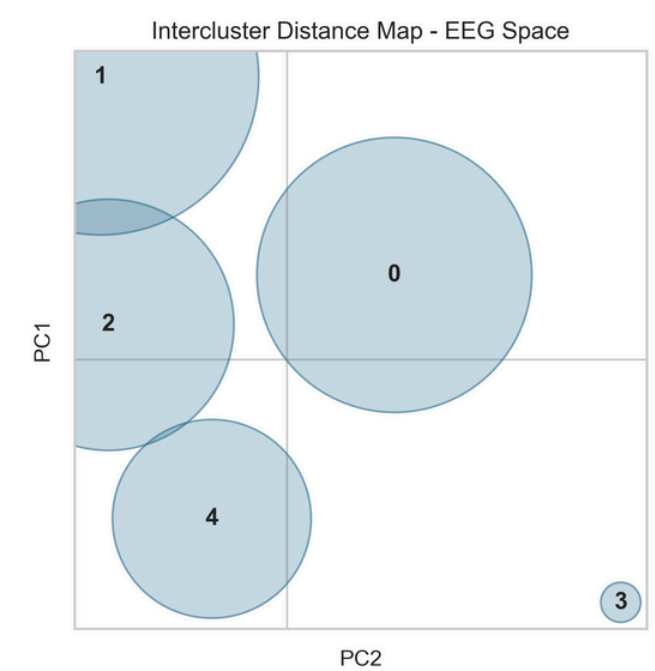
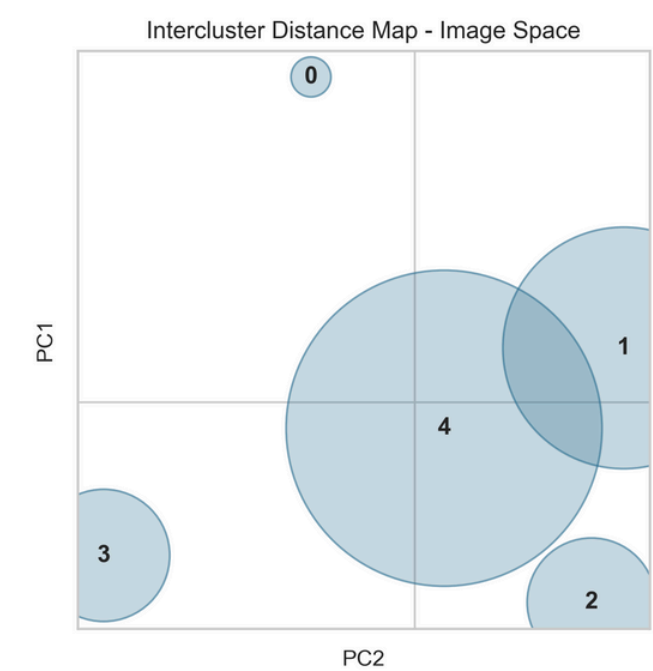
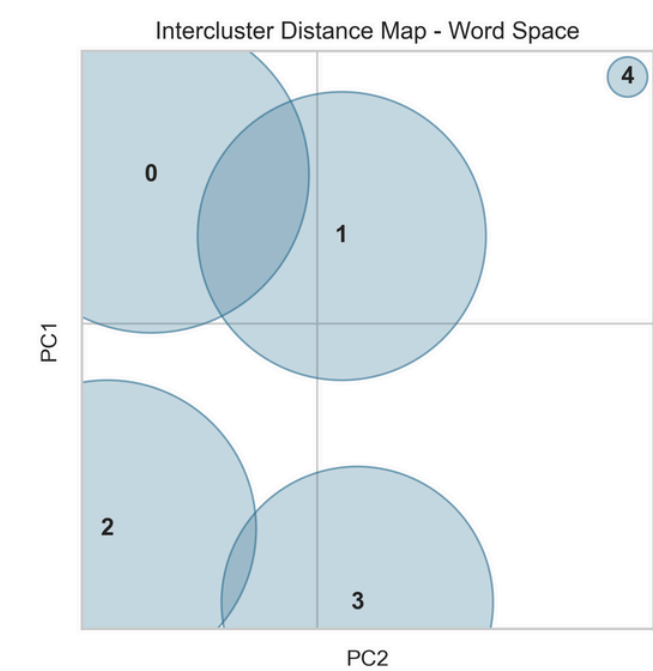
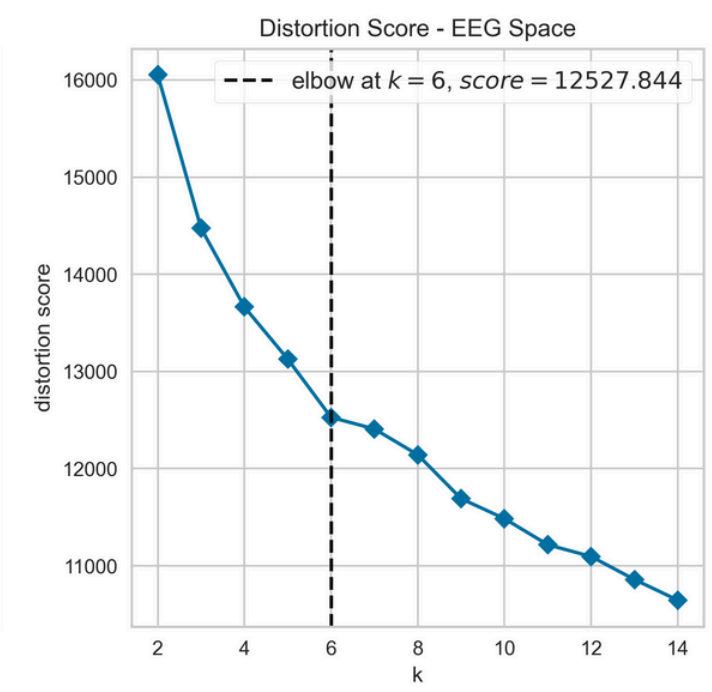
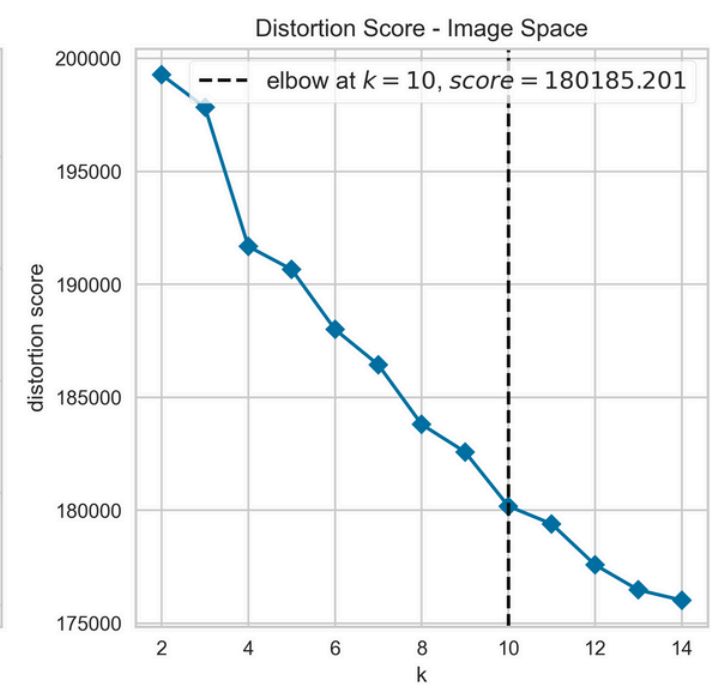
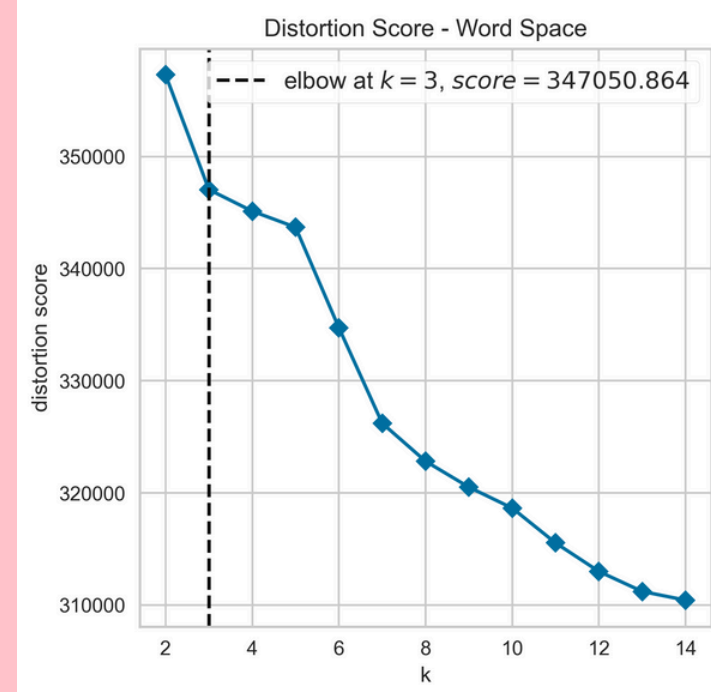
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- **Clustering** to see the hierarchical representation of entities
- **Comparing Distance of Entities Across Modalities** to assess the similarity of representations
- **Cross Composition** to see if there is a linear mapping between embedding spaces

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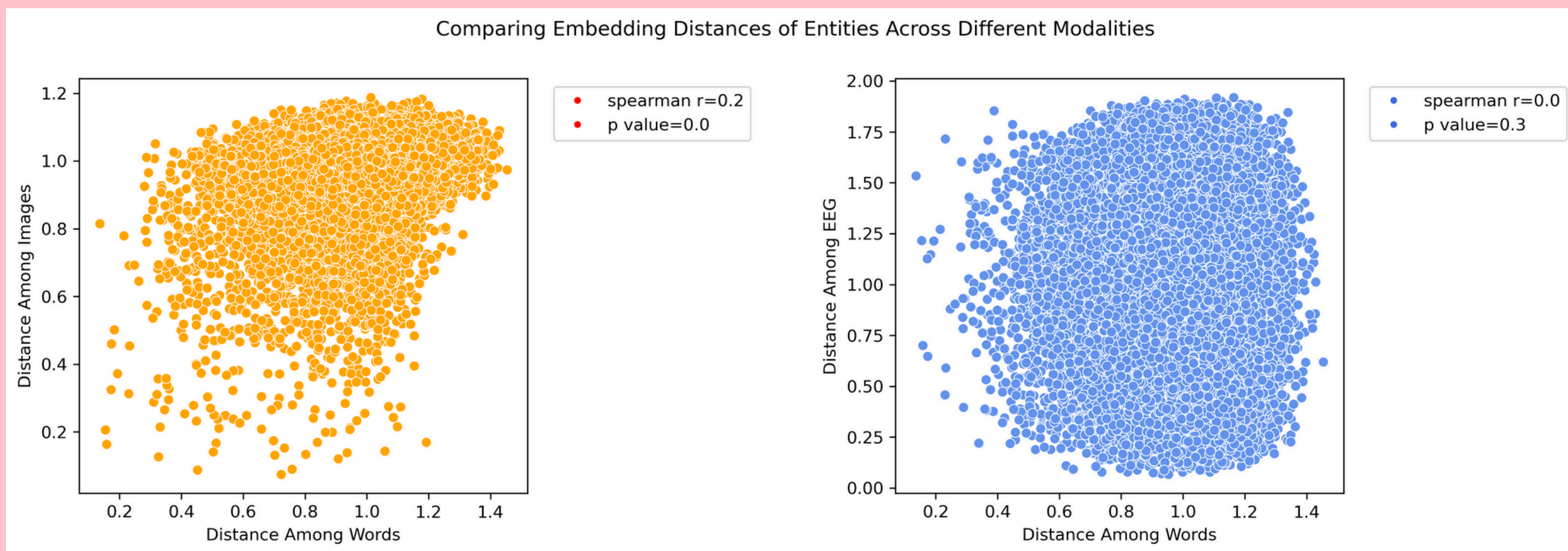
Results: Clustering

Kmeans Clustering for Embedding Spaces



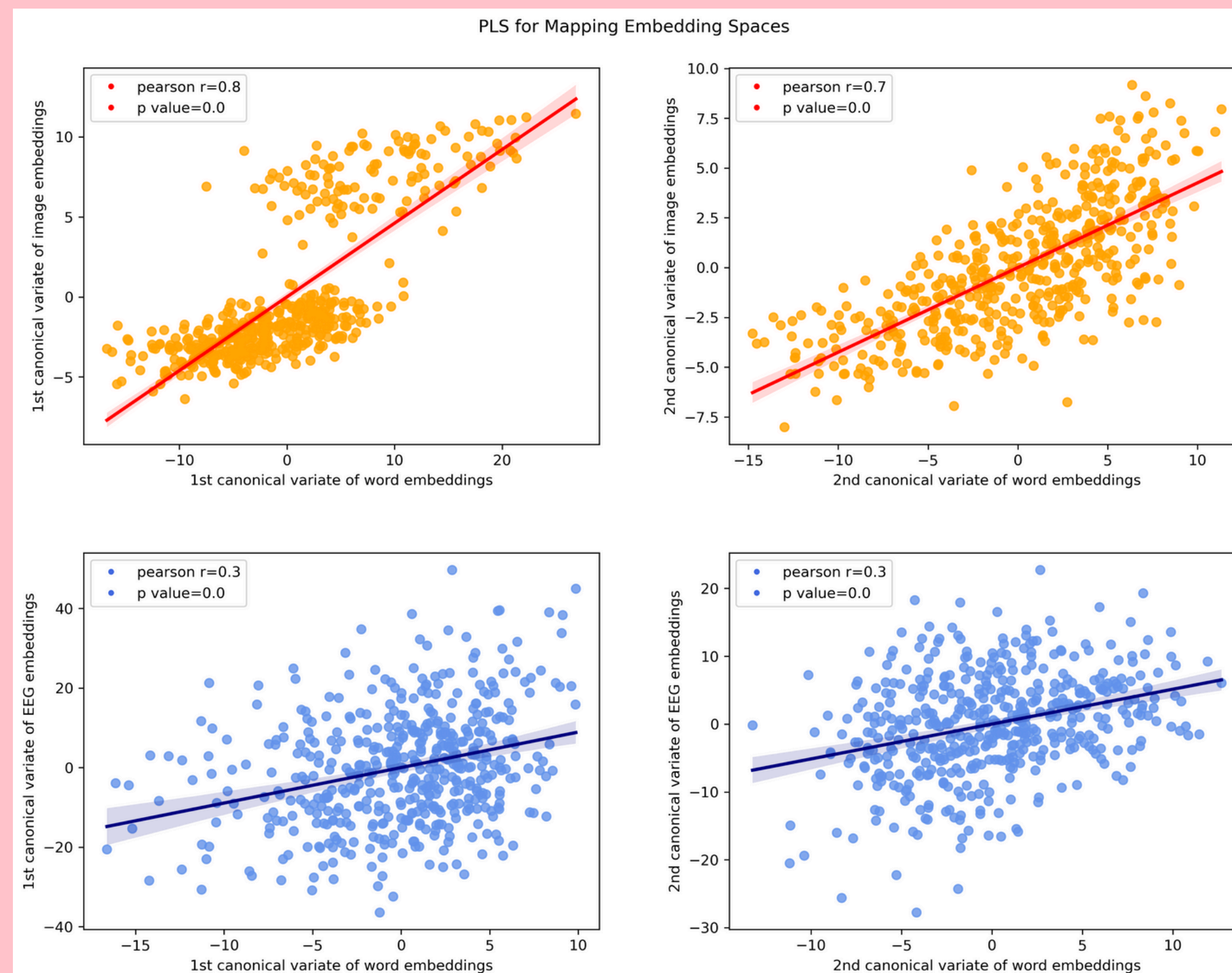
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Results: Comparing Distance of Entities



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Results: Finding Linear Mapping Between Embedding Spaces



What Comes Next?

Potential Applications

Provide explainable advancements
in Brain-Computer Interfaces

Address biases in each of the
brain/Vision Transformer uses



Future Directions

Compare embedding spaces of
modalities using more
sophisticated analyses

Find a solid pre-trained EEG
foundation model to extract EEG
embeddings

From: Coffee Meets GPT

Thank You!

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