

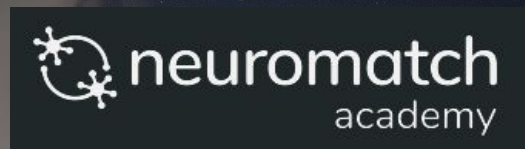
Classifying fMRI data for **context dependent** and **independent** language tasks

(Can signature brain activity of **story comprehension** and **arithmetic calculation** be used to classify the fMRI data into these two categories?)

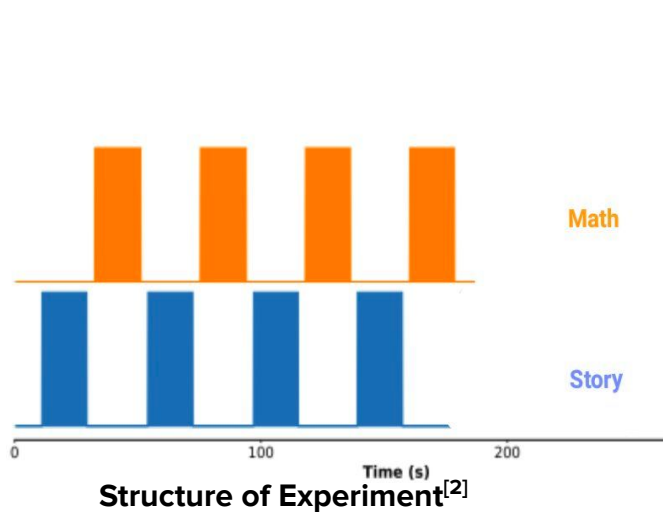
Akshi¹, Kanishk Kalra², Yash Choudhary³

Thanks to our Neuromatch Academy mentor, Anne E. Urai⁶, for her valuable guidance and our pod TAs Alish Dipani⁴ and Anindita Bhattacharjee⁵ for their support and guidance

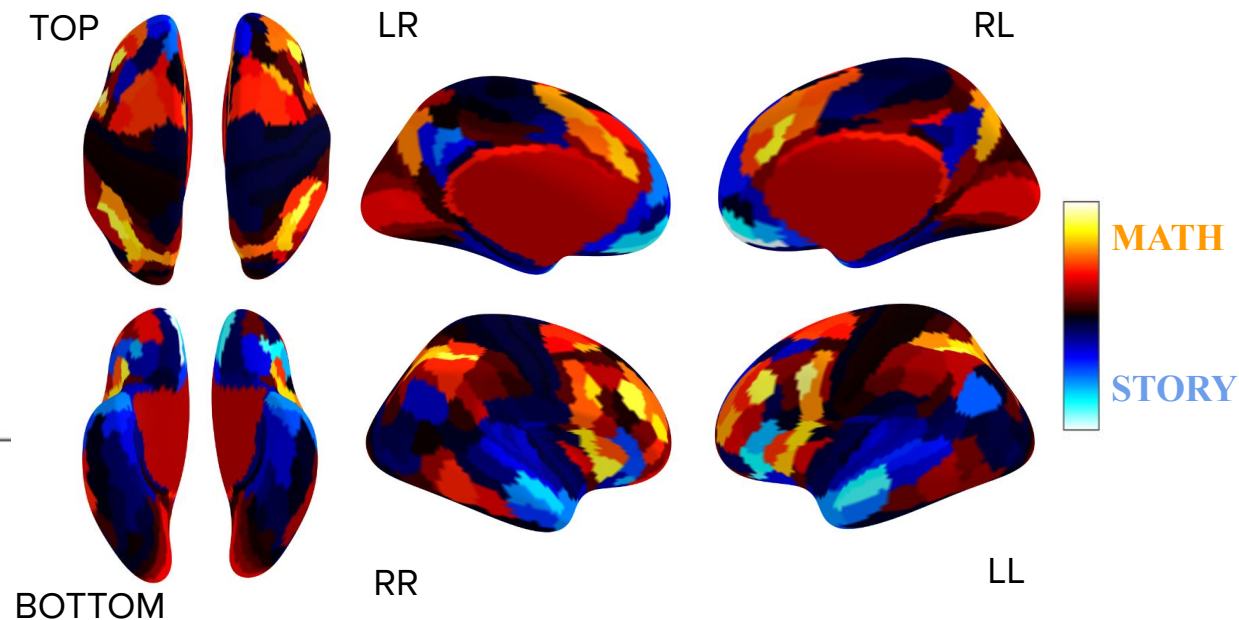
[1] International Institute of Information Technology, Bangalore, India [2] Amity University, Noida, India [3] Indian Institute of Technology, Kanpur, India [4] Birla Institute of Technology and Sciences (BITS) Pilani, Goa, India [5] Indian Institute of Technology, Banaras Hindu University, India [6] Cold Spring Harbor Laboratory, United States



HCP Language Processing dataset^[1]: fMRI data for Context Dependent task (Story) and Context Independent task (Math)



- Number of subjects: **339**
- Parcellation of brain: **360 parcels**^[3,4]



Inflated surfaces of left and right hemispheres

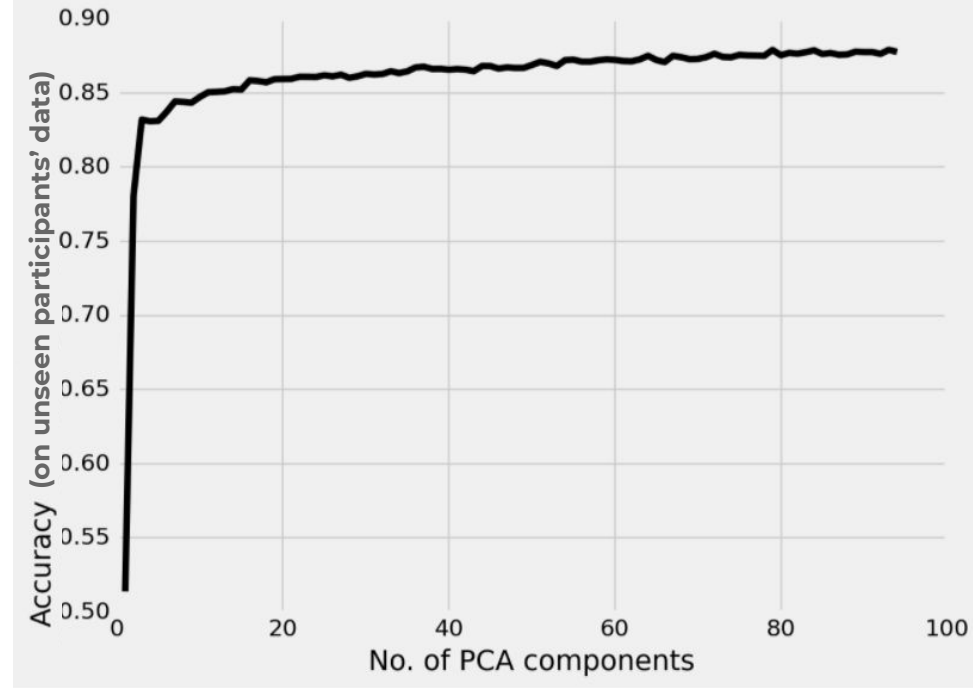
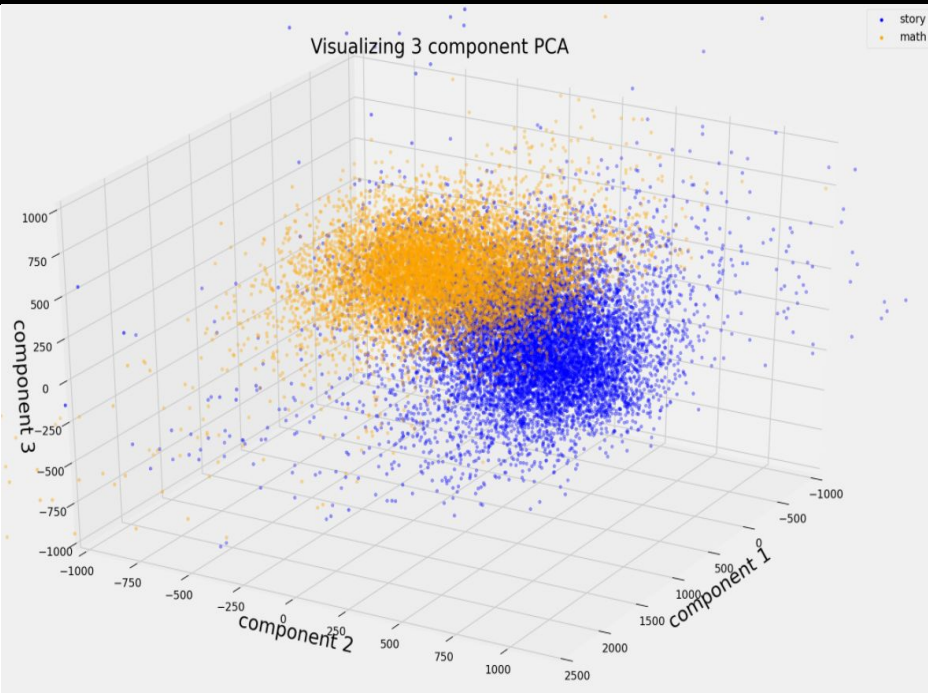
[1] David C. Van Essen (2013) The WU-Minn Human Connectome Project: An overview *NeuroImage*

[2] Binder et al. (2011) Mapping anterior temporal lobe language areas with fMRI: A multicenter normative study. *NeuroImage*

[3] Ji et al. (2019) Mapping the human brain's cortical-subcortical functional network organization. *Neuroimage*

[4] Glasser et al (2016) A multi-modal parcellation of human cerebral cortex. *Nature*

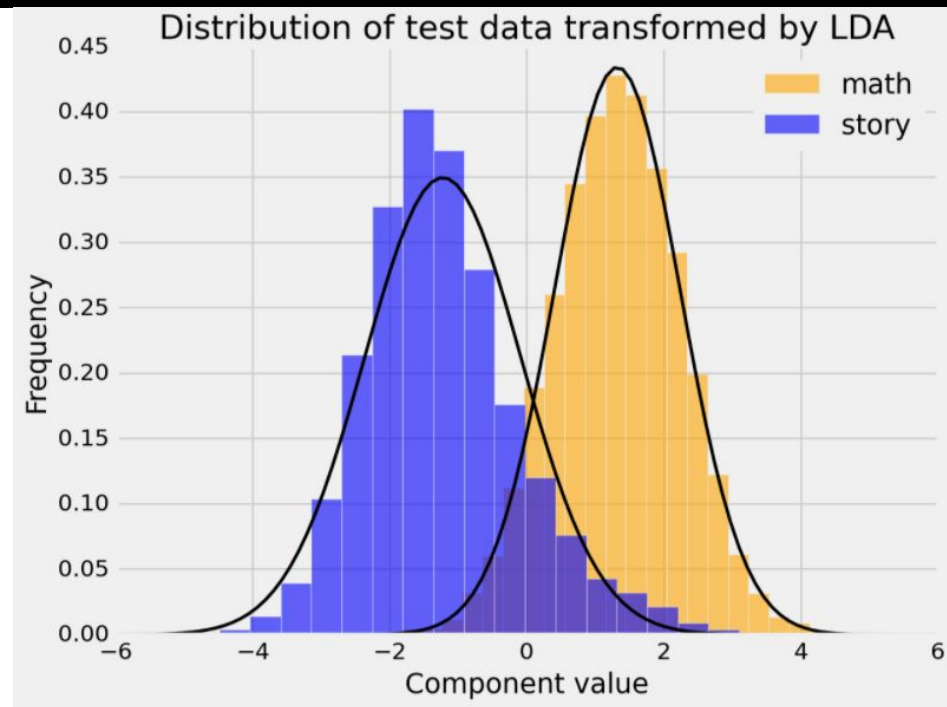
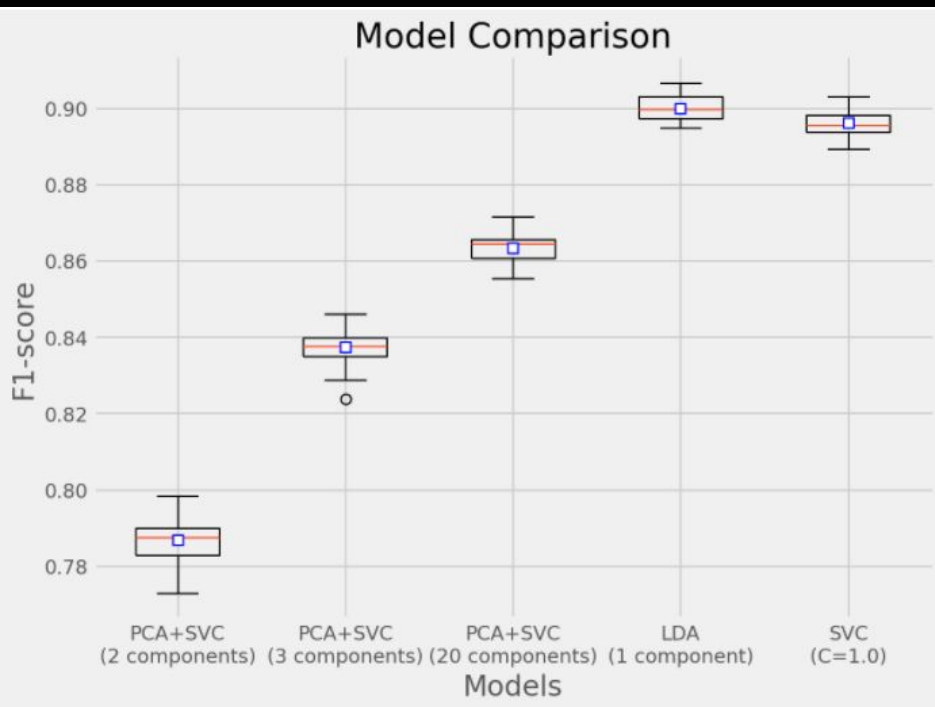
PCA (Unsupervised) + Linear Support Vector Classifier (SVC)



Accuracy with **2** components: **0.78**
Accuracy with **3** components: **0.83**

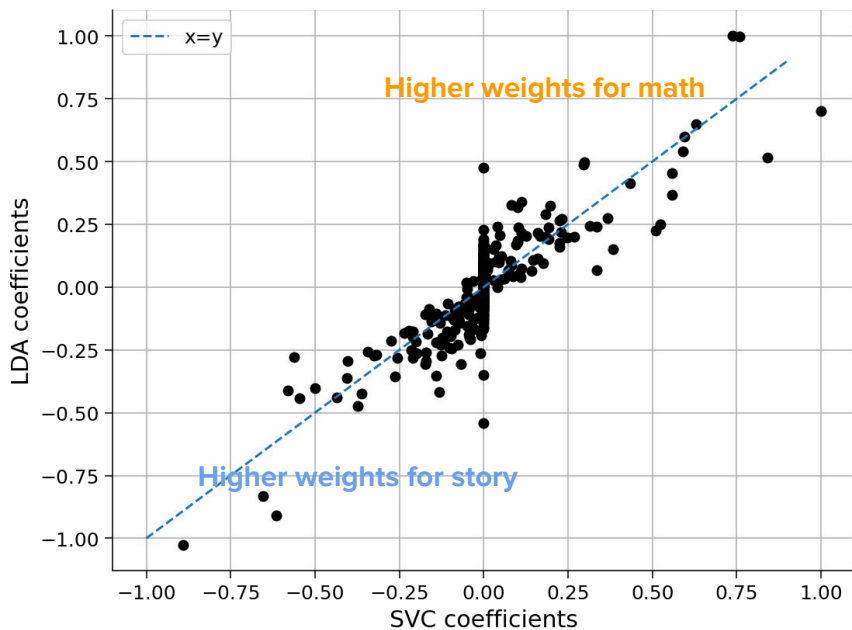
- Linear SVC on top of Principal Component Analysis (PCA) plateaued around **0.85** for **20** components
- Wang et al. (2019)^[5] achieved a classification accuracy of **0.87** using a linear SVM on this dataset.

LDA (Supervised) - The Blessing of Dimensionality

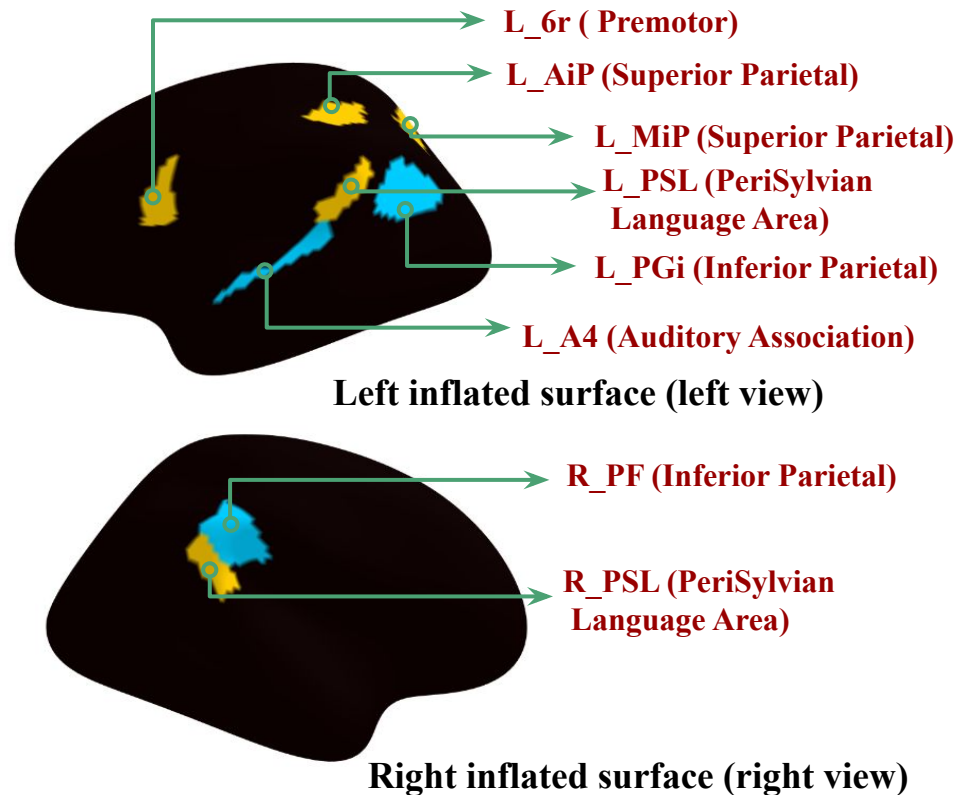


- Linear Discriminant Analysis (LDA) achieved a mean **0.9 F1-score** on **stratified 10-fold cross-validation**
- Validating the blessing of dimensionality = Class preservation + linear separation of data points with high probability.

Analysis of distribution of weights in SVC and LDA



Normalised weights of LDA vs Normalised weights of SVC

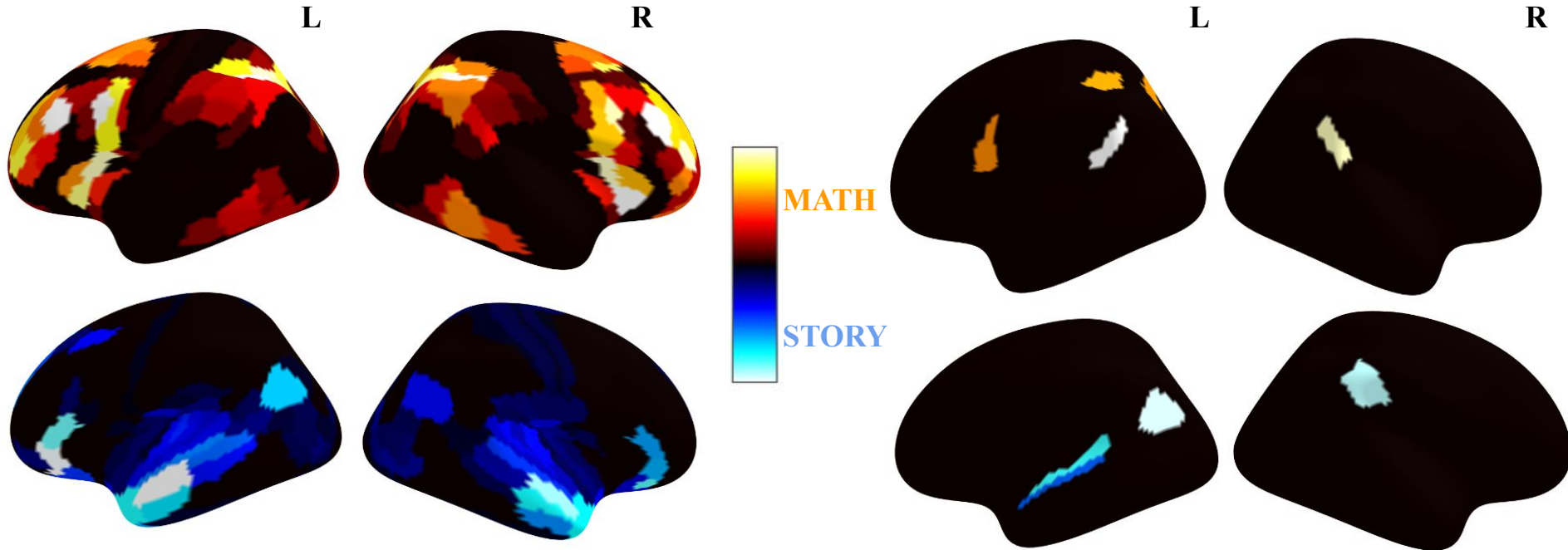


Conclusion and What's next?

- Classified fMRI data into **story** and **math** with **90% accuracy**
- Brain regions contributing to the classification may **not always** be related to the associated task

What we knew

Our results



THANK YOU

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Poster slides and prerecorded video available [here](#).

QUESTIONS?

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