

Decoding ECoG hand and tongue movement



Pod Felfa / feat.ECoG

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Decoding hand and tongue movement



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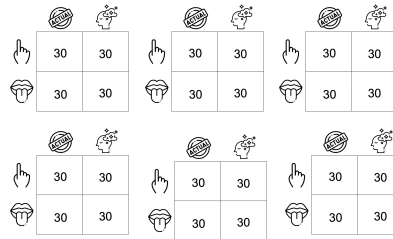
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Across 7 Subjects



Our Question

Which temporal, spatial and spectral features would lead to the best classification accuracy of actual hand vs. tongue movement?

Our Hypotheses

- **Temporal features:** a time window around half a second giving adequate information
- **Spatial features:** electrodes placed in the sensorimotor and motor cortex being most critical
- **Spectral features:** possibility of replicating previous studies which showed that high gamma band (50–90 Hz) carried the most information

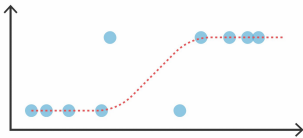
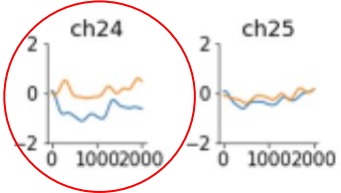
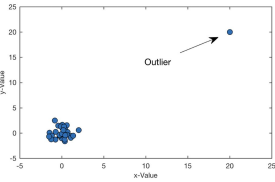
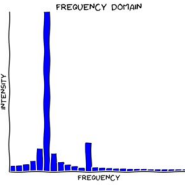
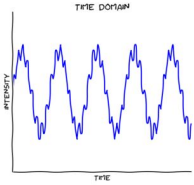
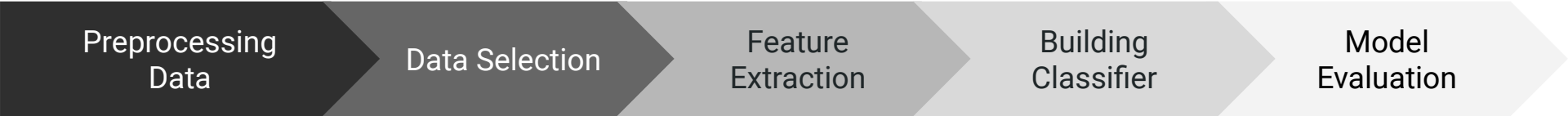
Dataset from Miller, 2019
<https://exhibits.stanford.edu/data/catalog/zk881ps0522>



PIPELINE



Pipeline



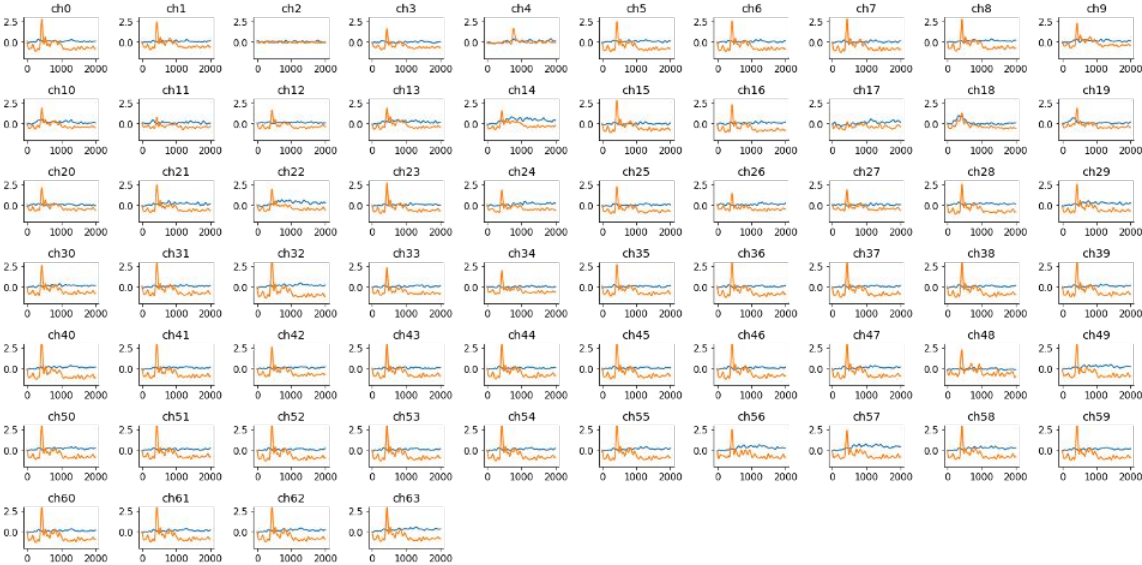
		True Class	
		Positive	Negative
Predicted Class	Positive	TP	FP
	Negative	FN	TN

$$accuracy = \frac{n(\text{all correct predictions})}{n(\text{all predictions})}$$

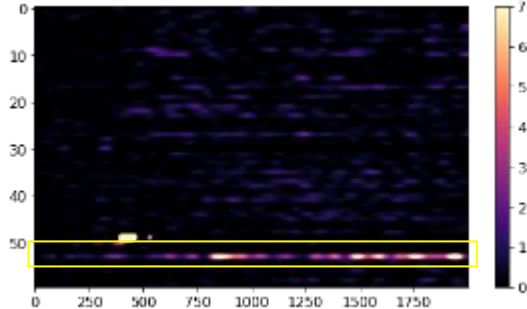


Removal of bad trials for one subject

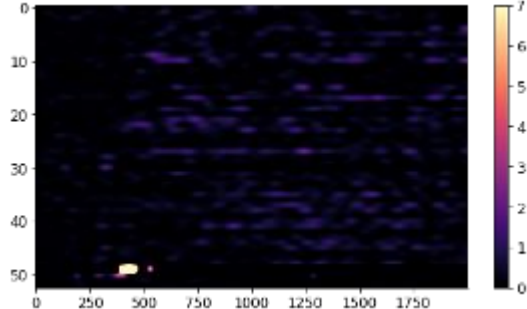
Gamma Frequency
50 - 170 Hz



Channel 32



All trials

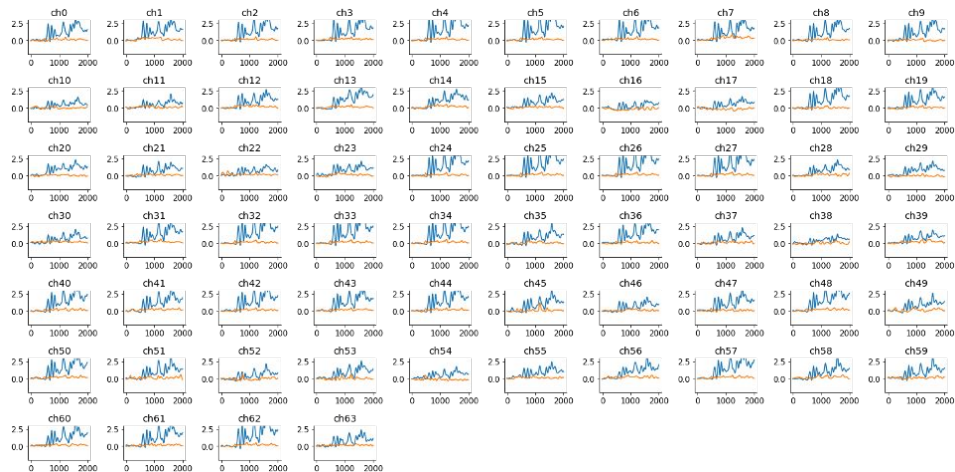


6 trials manually removed

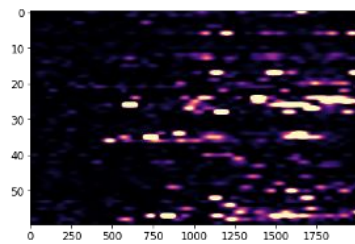


Subject exclusion

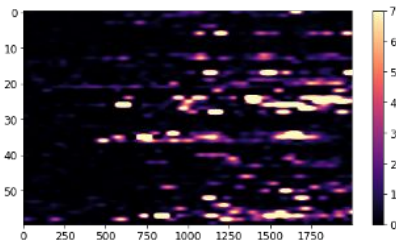
Gamma Frequency
50 - 170 Hz



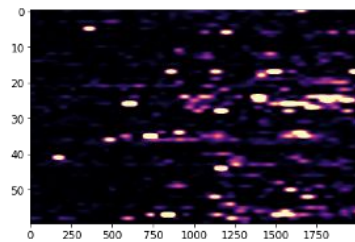
Channel 2



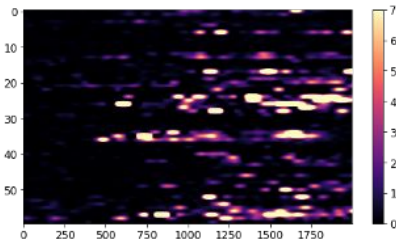
Channel 26



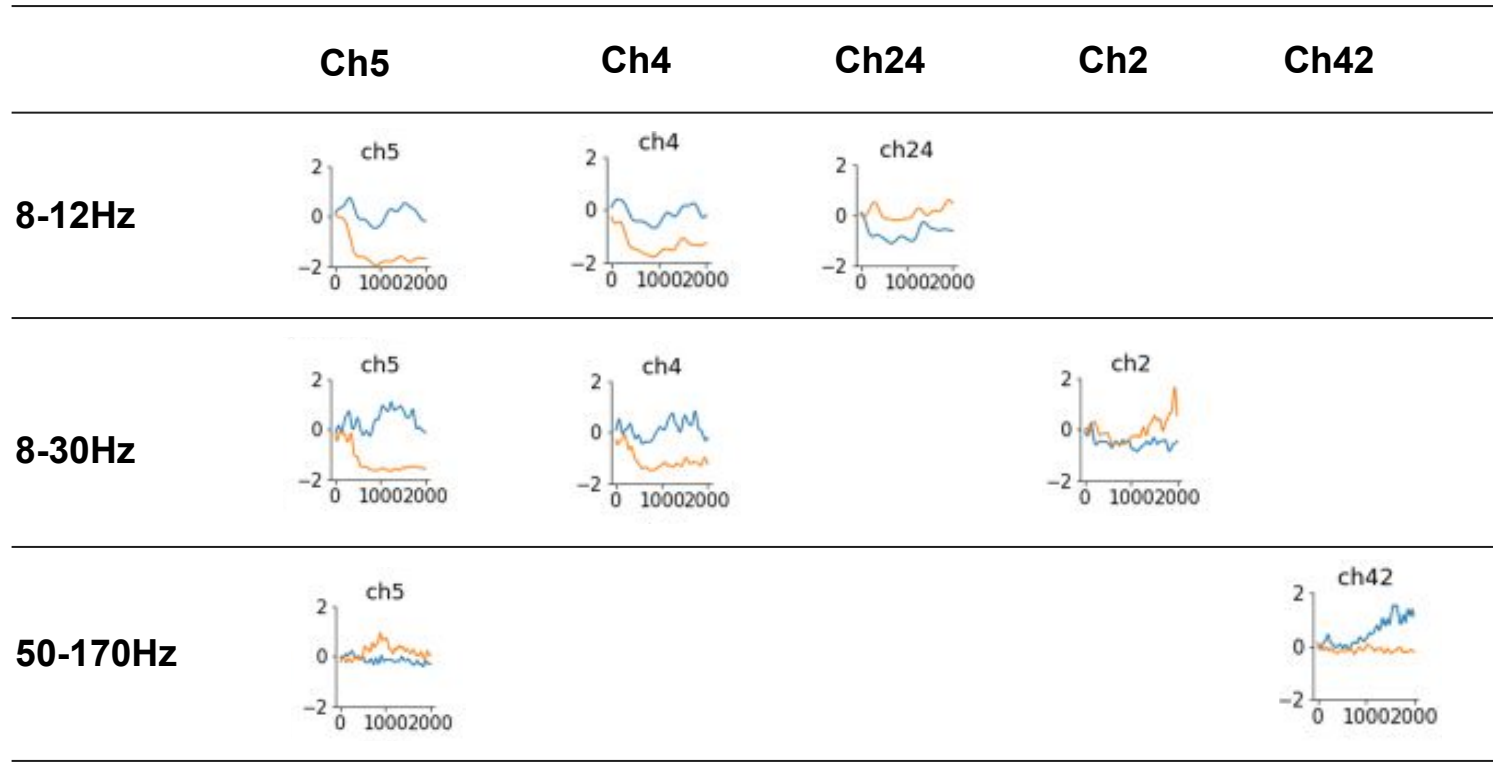
Channel 45



Channel 32



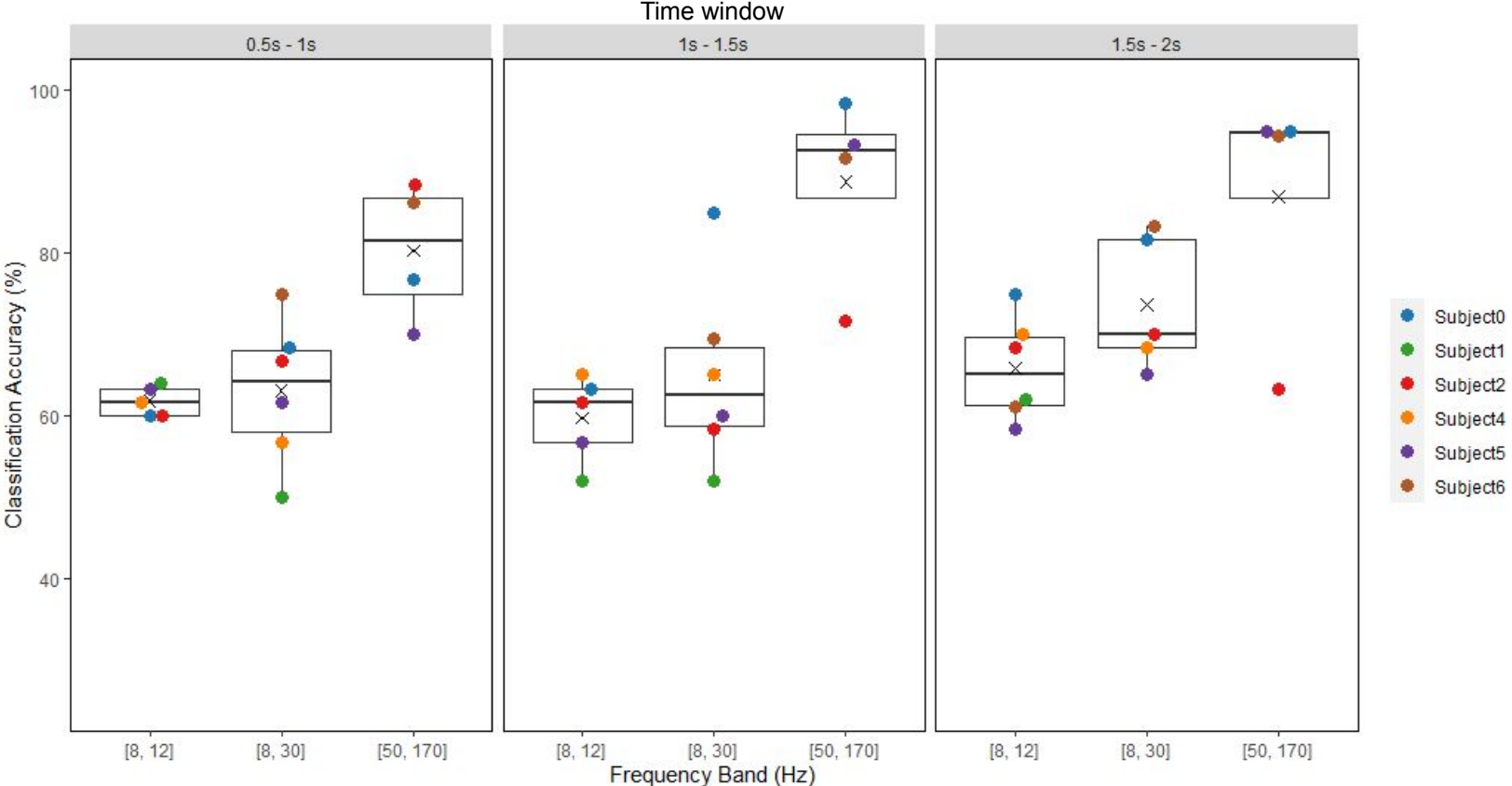
Channel Selection (subject 0)



RESULTS

Classification accuracy per subject

X - mean across subjects

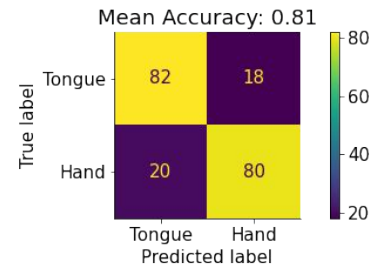
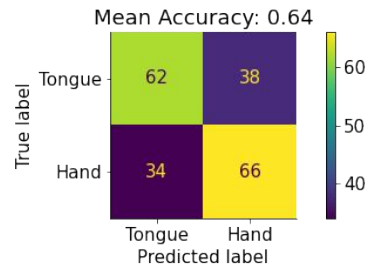
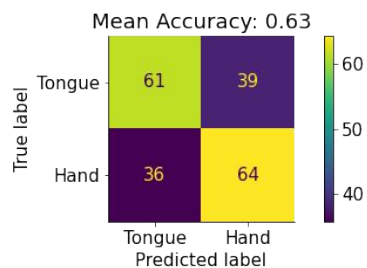


Alpha Frequency 8 - 12 Hz

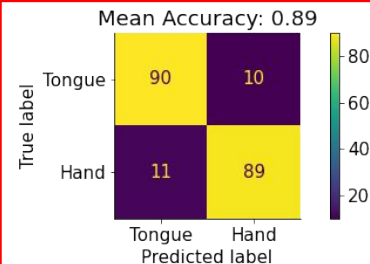
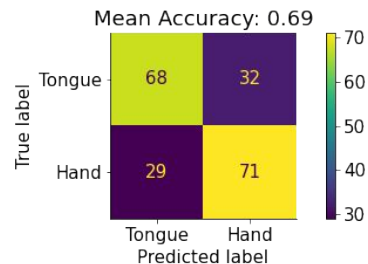
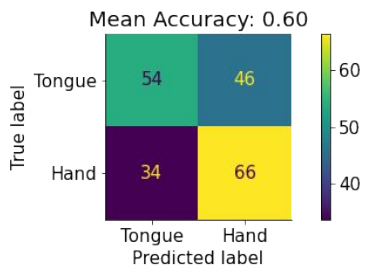
Alpha & Beta Frequency 8 - 30 Hz

Gamma Frequency 50 - 170 Hz

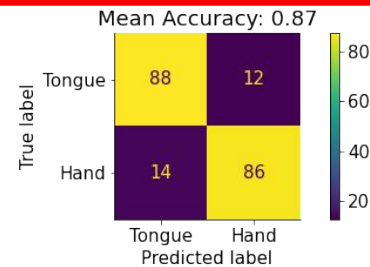
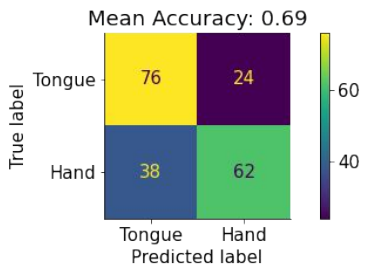
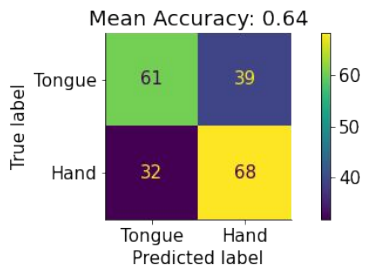
Time window
0.5 - 1 s



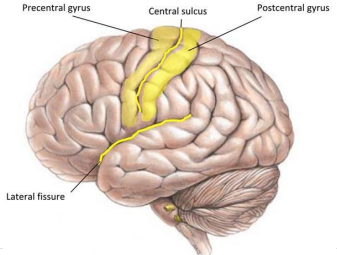
Time window
1 - 1.5 s



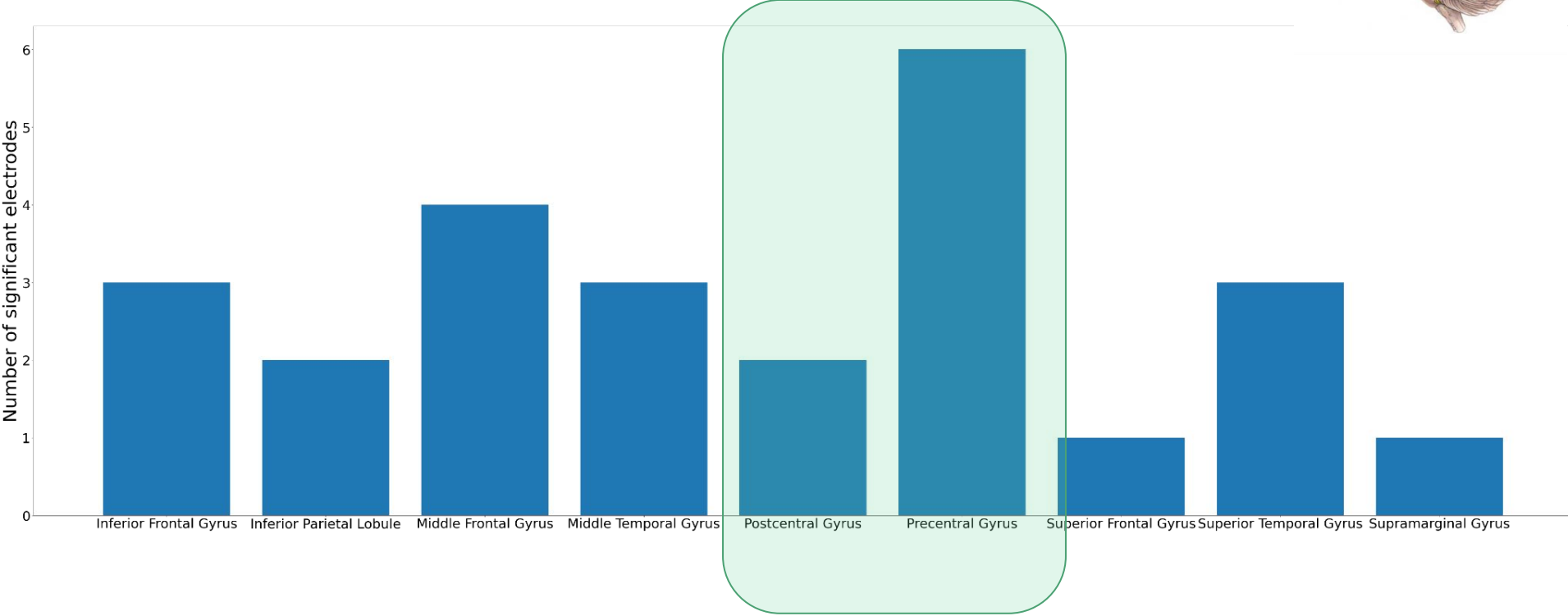
Time window
1.5 - 2 s



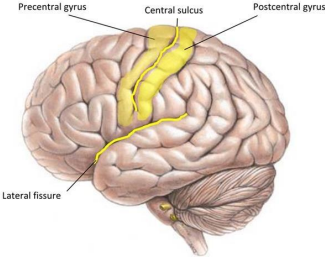
Location of significant electrodes



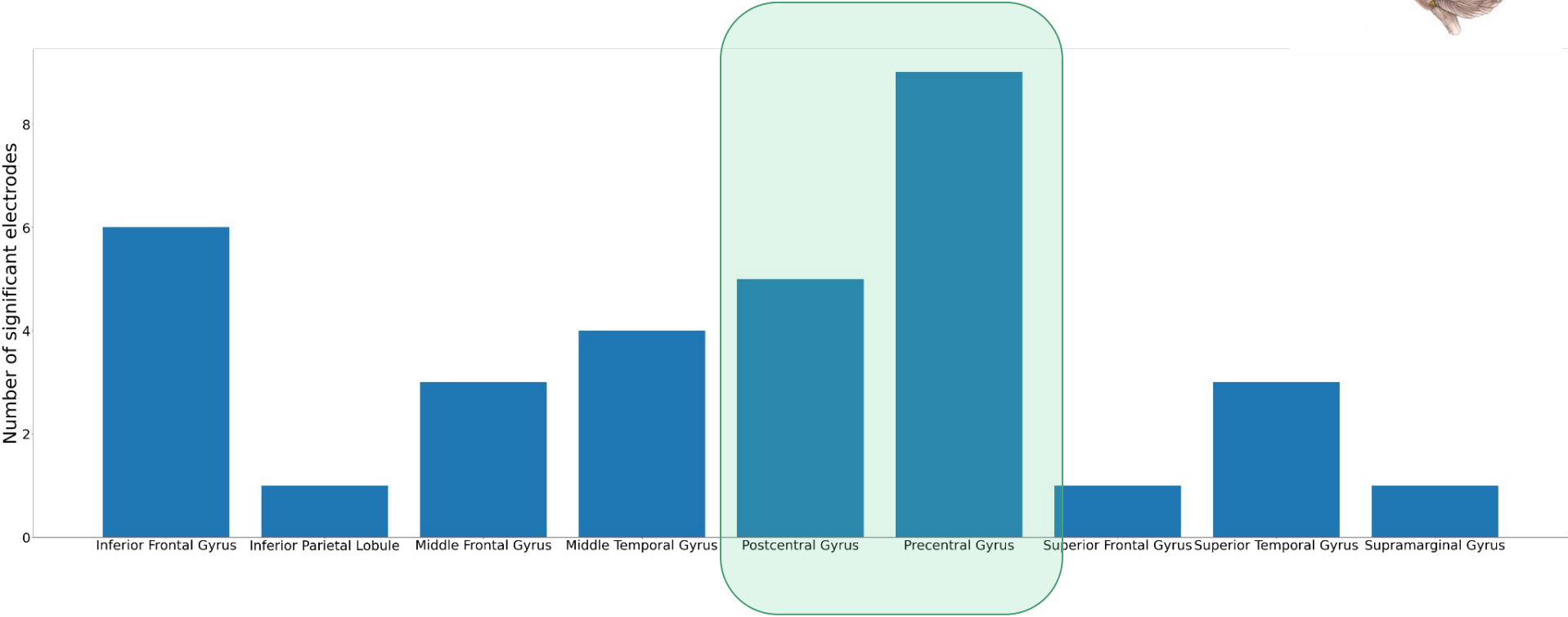
Alpha Frequency 8-12 Hz



Location of significant electrodes

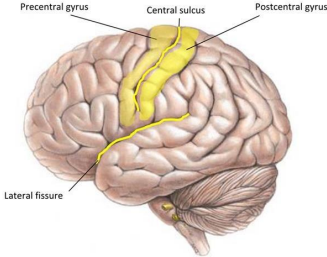


Alpha & Beta Frequency 8-30 Hz



Location of significant electrodes

Gamma Frequency 50-170 Hz

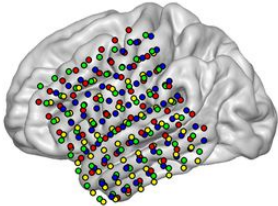


DISCUSSION

Discussion

Study objective:

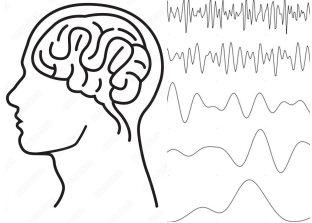
Maximize classification accuracy by adjusting:



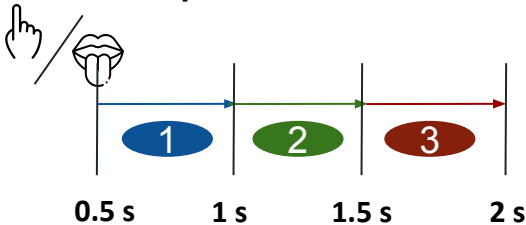
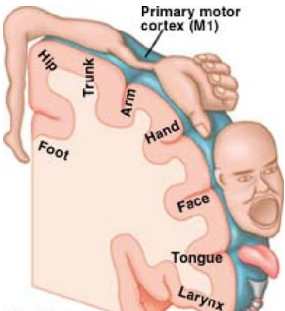
Spatial features



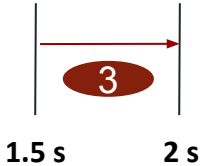
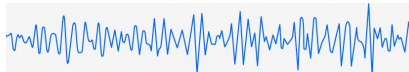
Temporal features



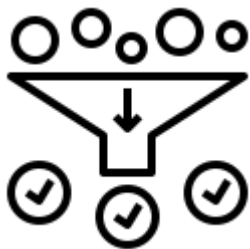
Spectral features



Gamma Frequency
(50 - 170 Hz)



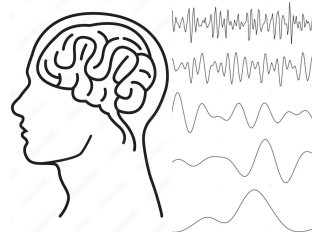
Future scope



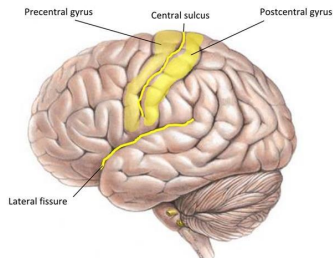
Improve preprocessing



Explore more time windows



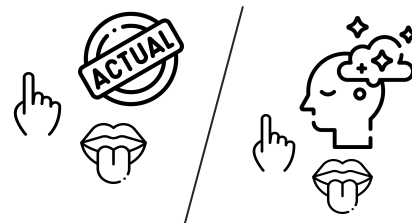
Use more high gamma frequency intervals



Explore motor (and sensory) electrodes



Classify imagined movements



Investigate signals between actual and imagined



THANK YOU!



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