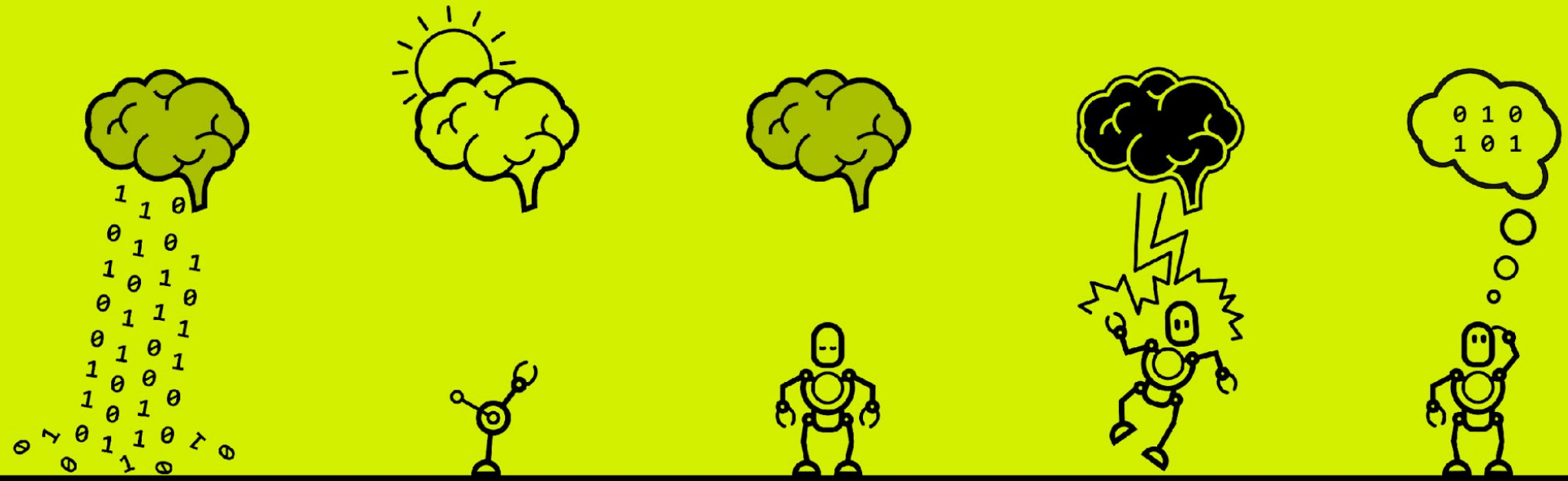

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THE BRAIN-COMPUTER INTERFACE DESIGNERS HACKATHON

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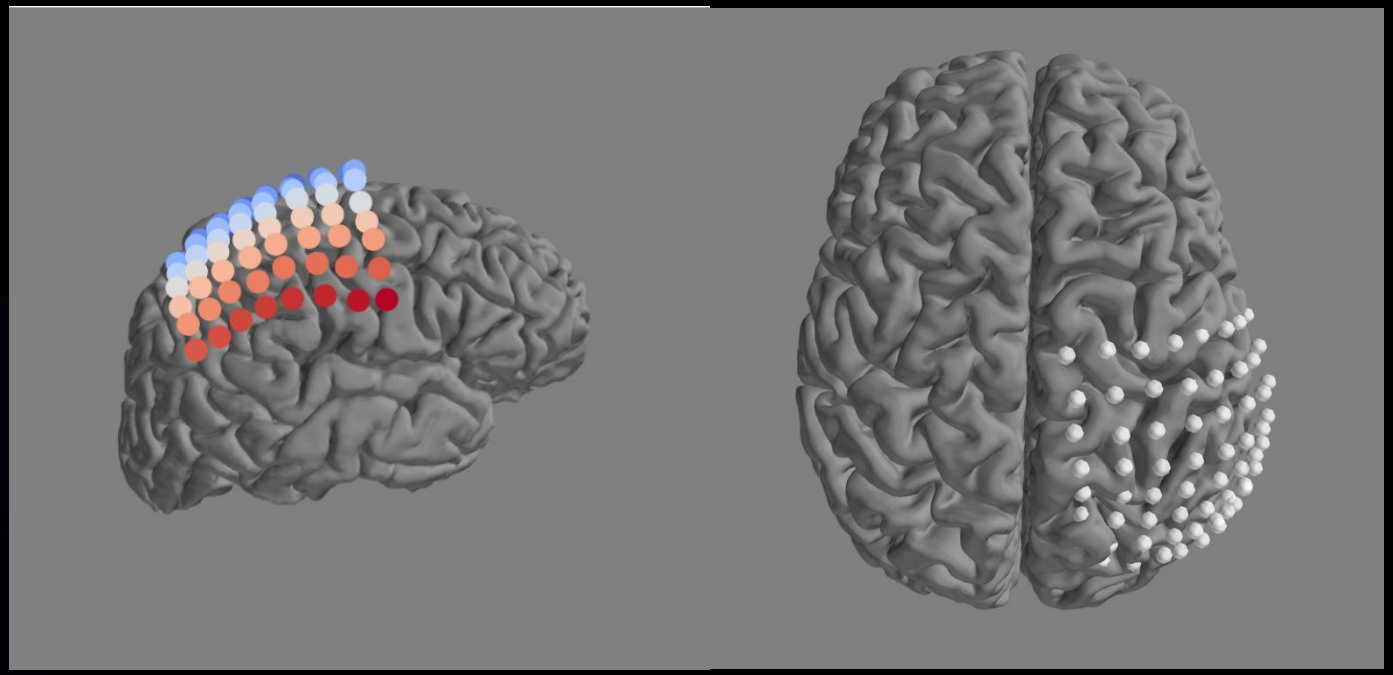
ECoG Hand Pose Data Analysis

Eidan Tzdaka
Konstantin Volzhenin
Antoine Prosper

INTRODUCTION

ECoG data set of a Rock/Paper/Scissors training session.



IDEAS AND WORKING PROCESS

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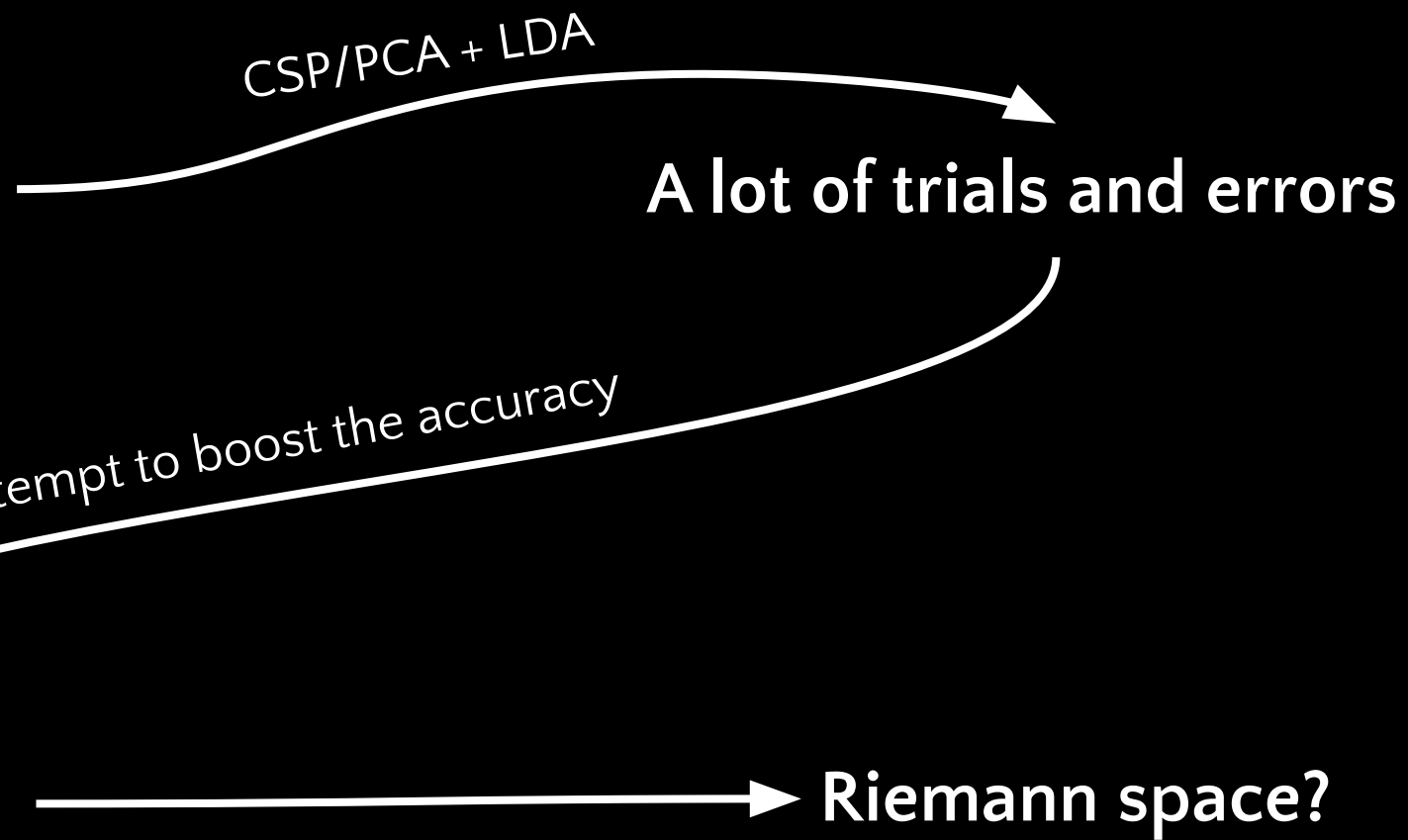
Hint:

Time-Variant Linear Discriminant Analysis Improves Hand Gesture and Finger Movement Decoding for Invasive Brain-Computer Interfaces



IMPLEMENTATION REALIZATION...

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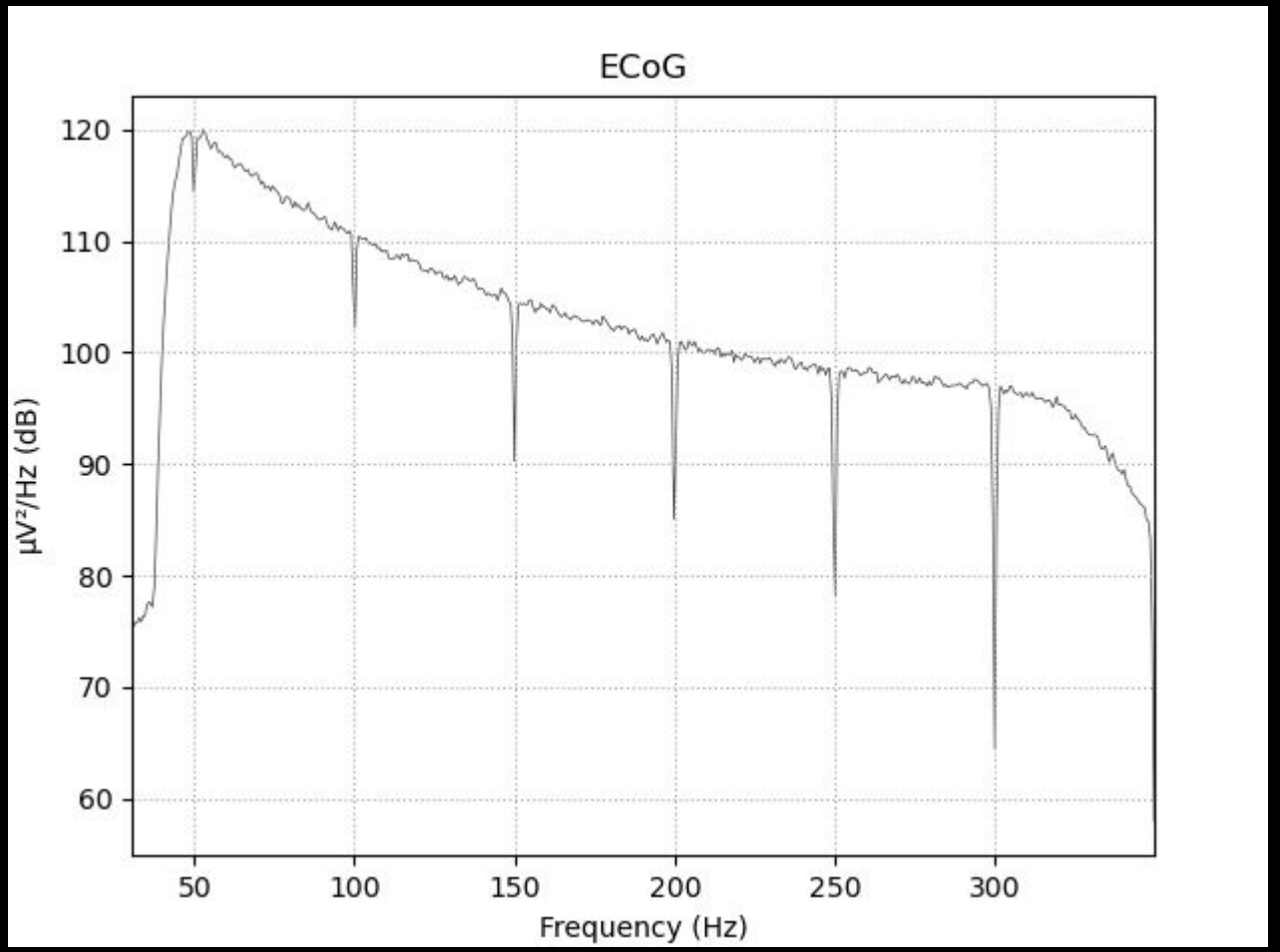
Preprocessing:

1) Re-referenced the data by the common average
2) Band-pass filter for high-gamma frequency band (50-300Hz)
3) Notch filter for power line frequency removal



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Feature Reduction

1) **PCA** – Find highest variance axes in the data to project dimensions with minimal loss of information
2) **CSP** – Signal decomposition using the Common Spatial Patterns with 4 CSP components
3) **Covariance matrix** – covariance matrix estimation for each given trial

Classification Algorithms

1) **LDA** – You all know it, Don't you?
2) **MDM** – Minimum Distance to Mean : Classification by nearest centroid in Riemann space using Riemann distance
3) **Tangent Space logistic regression** – project the Riemann space onto tangent (linear) space and use Euclidean distance

RESULTS

Method	CSP+LDA	PCA+LDA	Covariance matrices + MDM in Riemann space	Covariance matrices + Riemann Tangent Space logistic regression	Multi class LDA
Accuracy	87%	84%	82%	84%	67%

REFLECTION...

What else could we have looked at?

TVLDA: Dynamic updating of the classifiers

Pay close attention to overfitting: performance dropped when trying to build 1-vs-1 classifiers -> overfitting is an issue with our implementation

Look at frequency bands other than Gamma to confirm the classifications.

GROUP PICTURE

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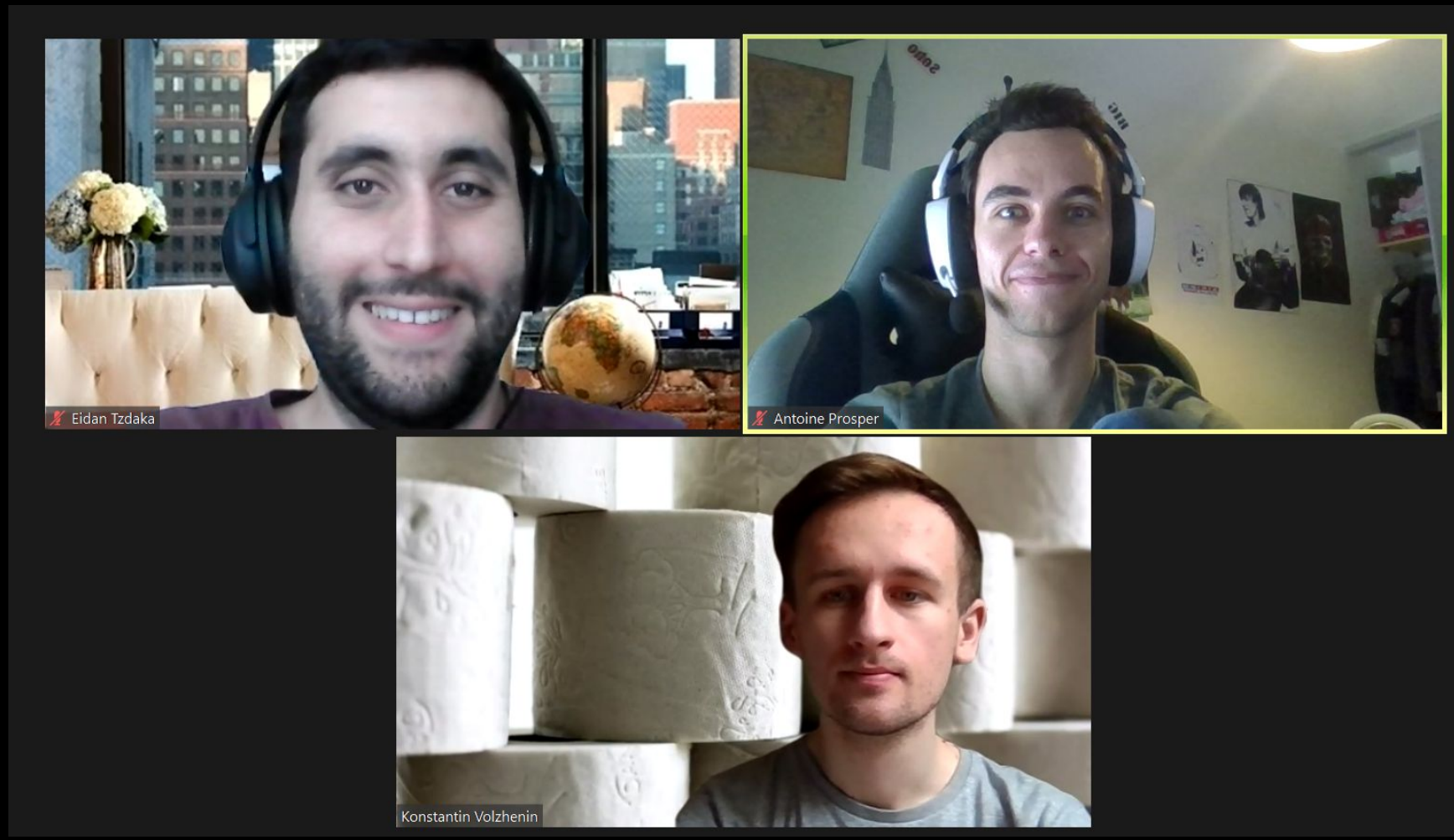

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