

Comparison of strategies to elicit motor imagery-related brain patterns in multimodal BCI settings

Tristan Venot¹² Arthur Desbois¹² Marie Constance Corsi¹² Laurent Hugueville¹ Ludovic Saint-Bauzel³ Fabrizio De Vico Fallani¹²
 1. Sorbonne Université, Inserm U-1127, CNRS UMR-7225, Paris Brain Institute, Paris, France, 2. Inria Paris, Aramis project-team, Paris, France, 3. ISIR, Sorbonne Université, Paris, France

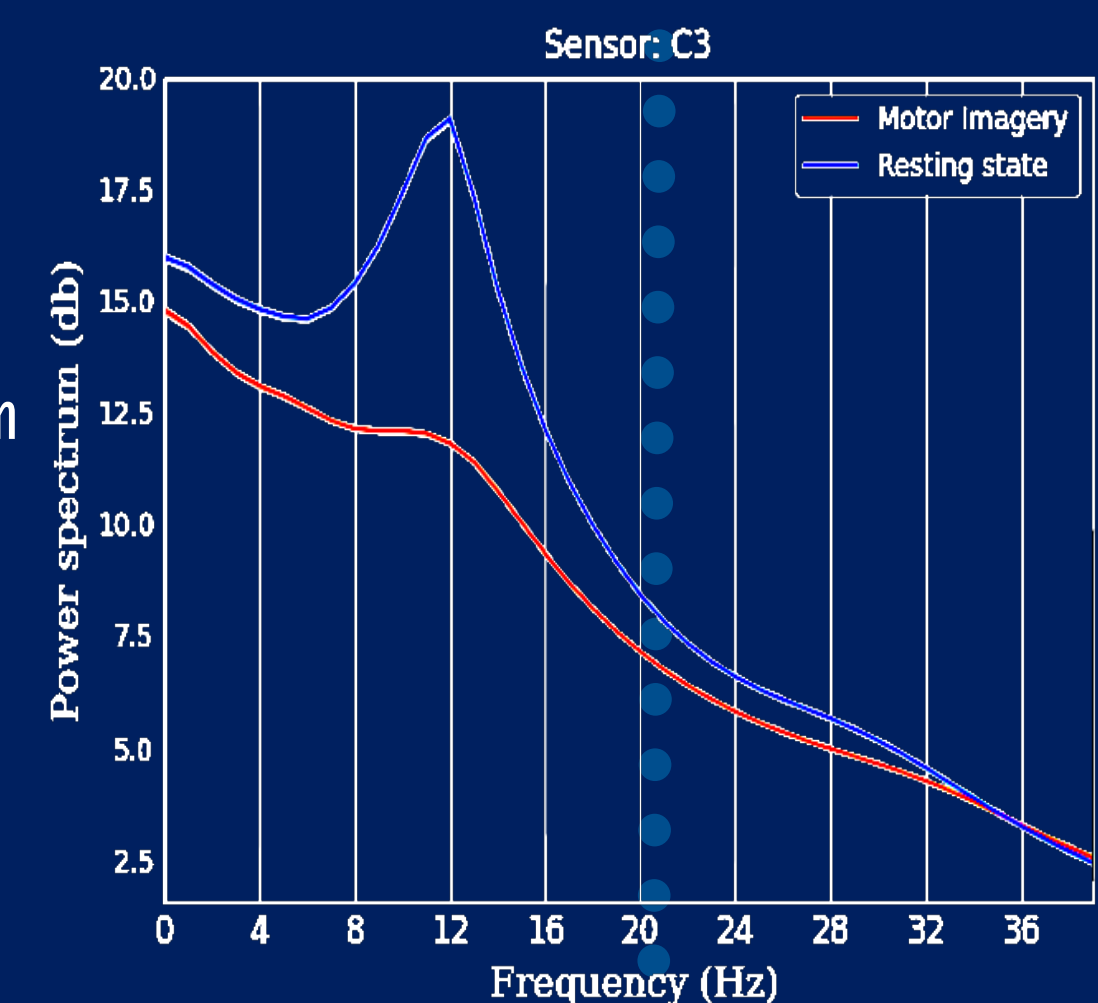
Introduction



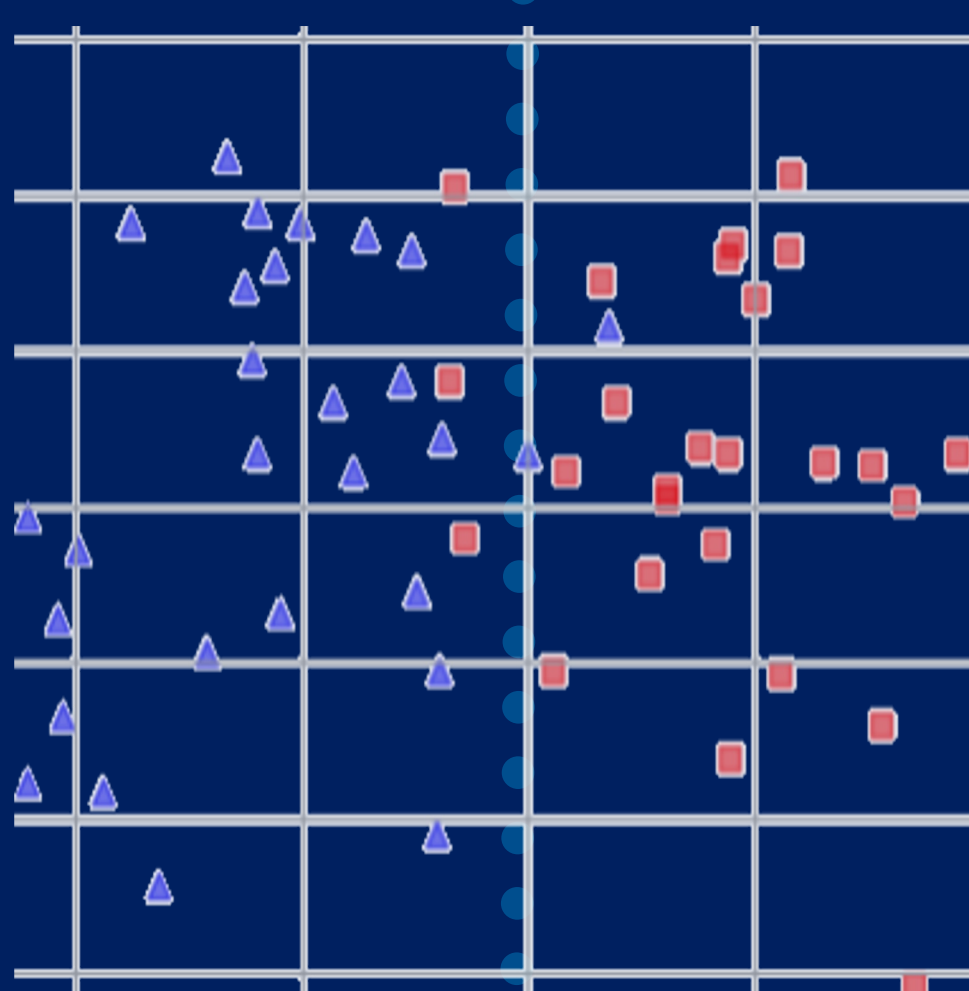
Task: Motor Imagery of the Right Hand

Acquisition: EEG to capture brain patterns corresponding to the task

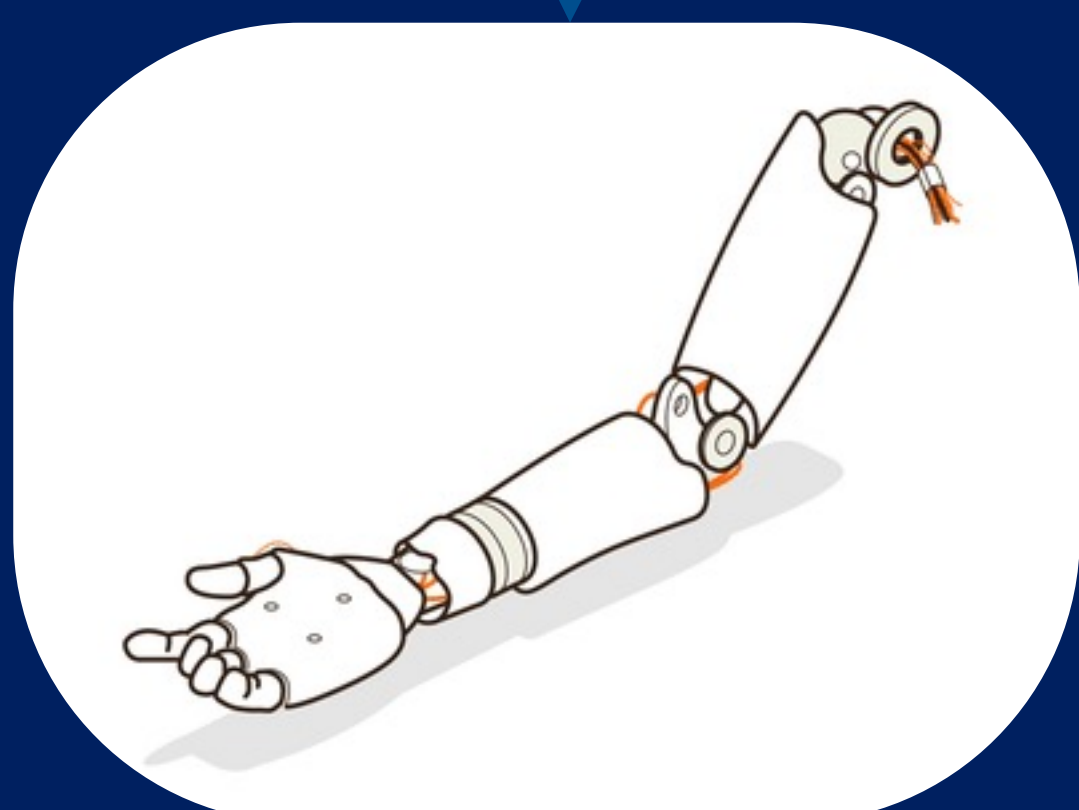
Feature selection: Power Spectrum at specific frequency for specific electrodes



Classification: Discrimination between classes, feedback based on probability to belong to a class

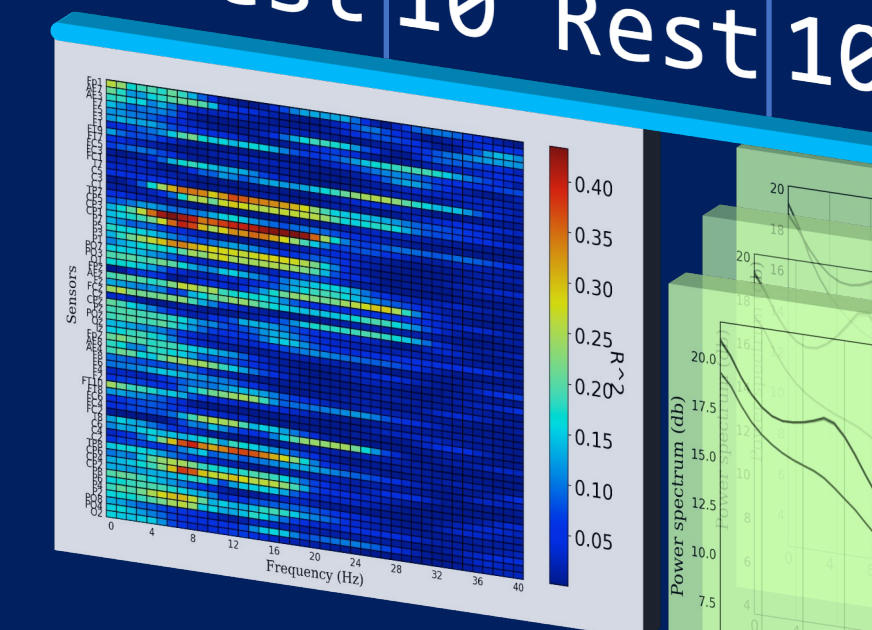


Active feedback: Control of devices, the nature of the feedback influences the performances



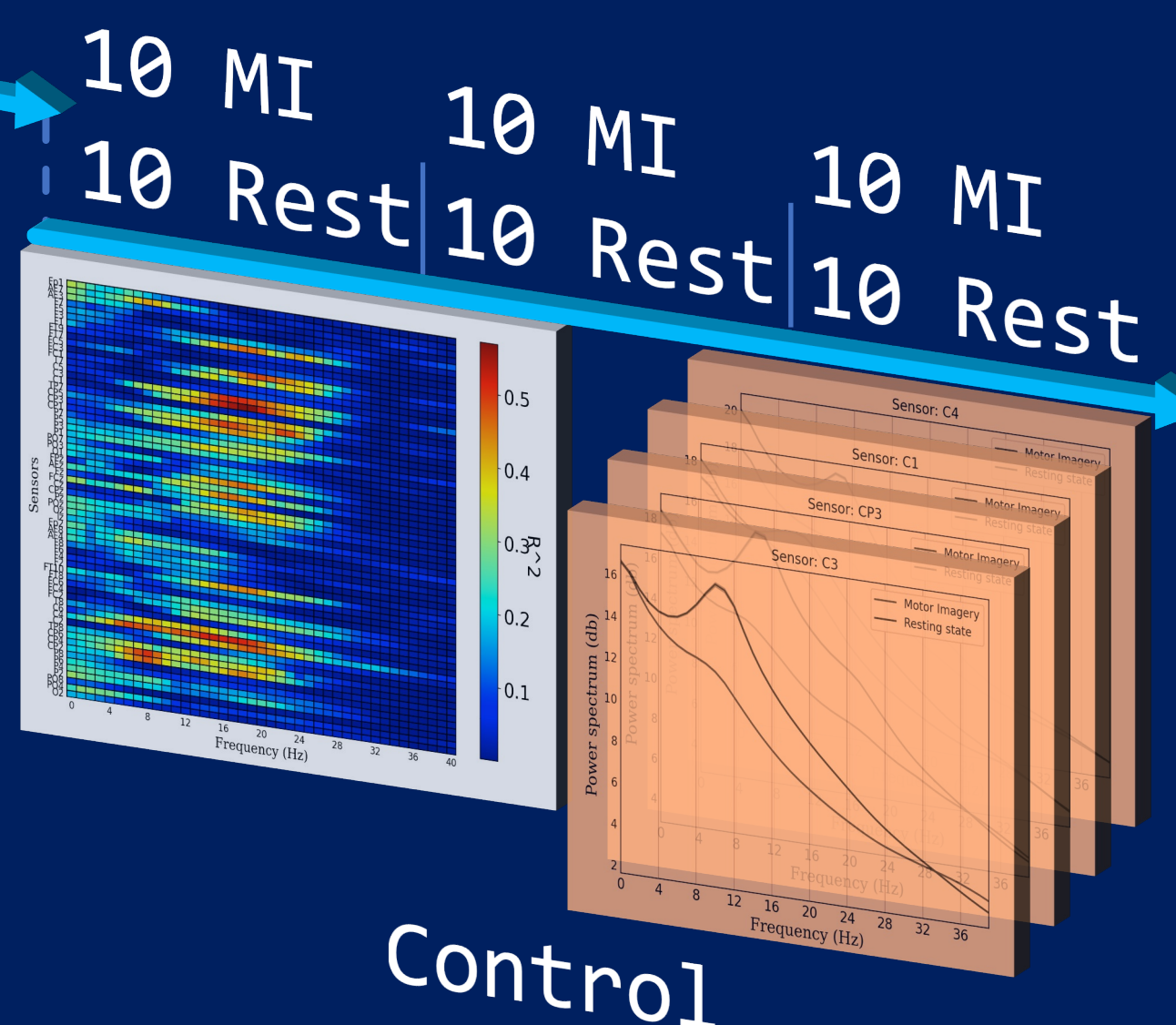
Methods

10 MI 10 Rest 10 MI 10 Rest 10 MI 10 Rest
 LDA Classifier



Calibration

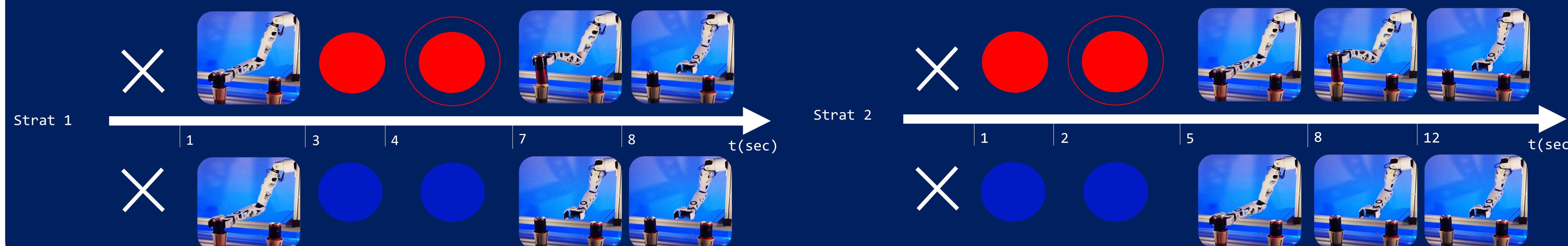
Feature Selection



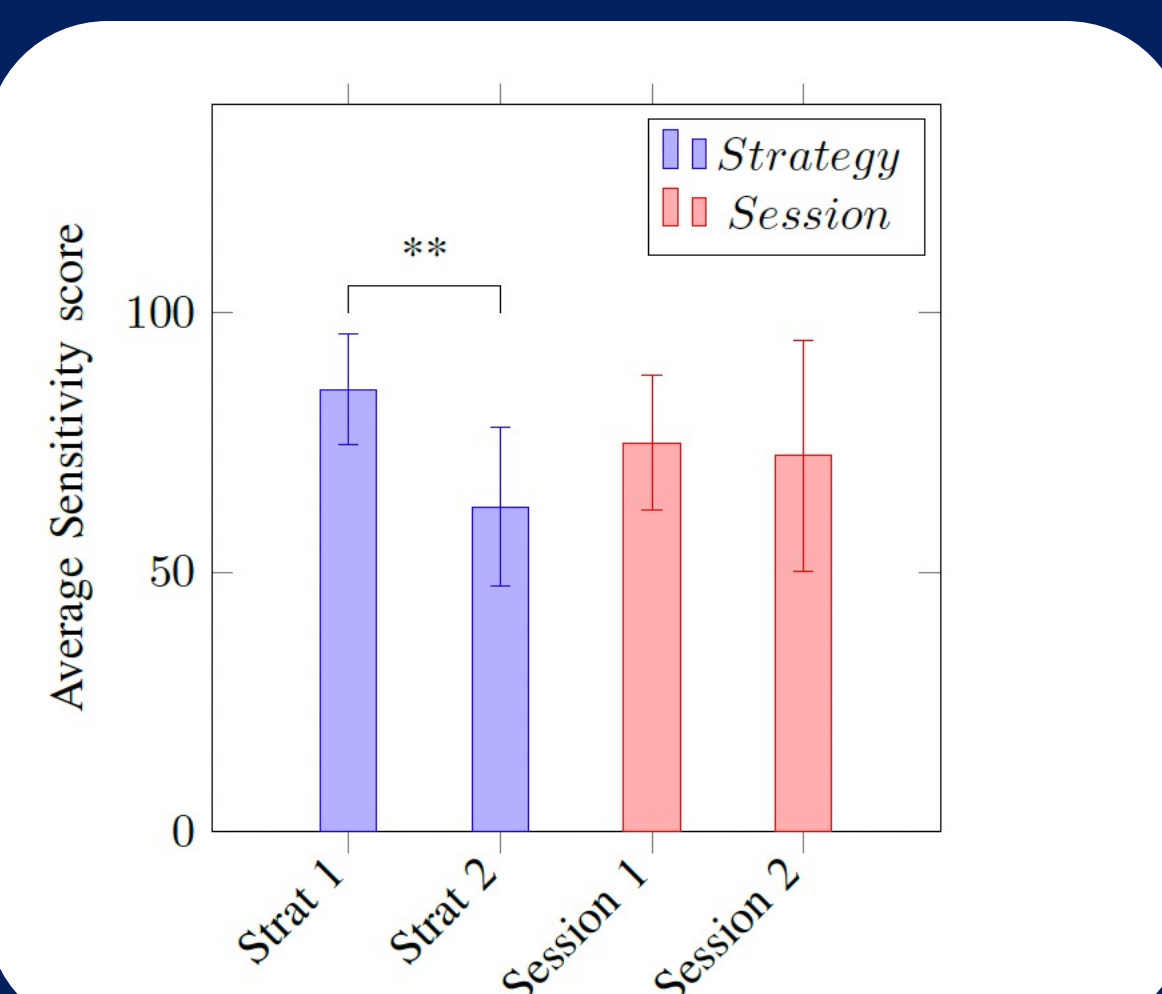
Control

- Seven healthy subjects (27.2 +/- 2.1 years old, 1 Male)
- 2 sessions
- 1-2 weeks between sessions
- 64 BrainAmp Active electrodes - TP9/TP10 REF/GND

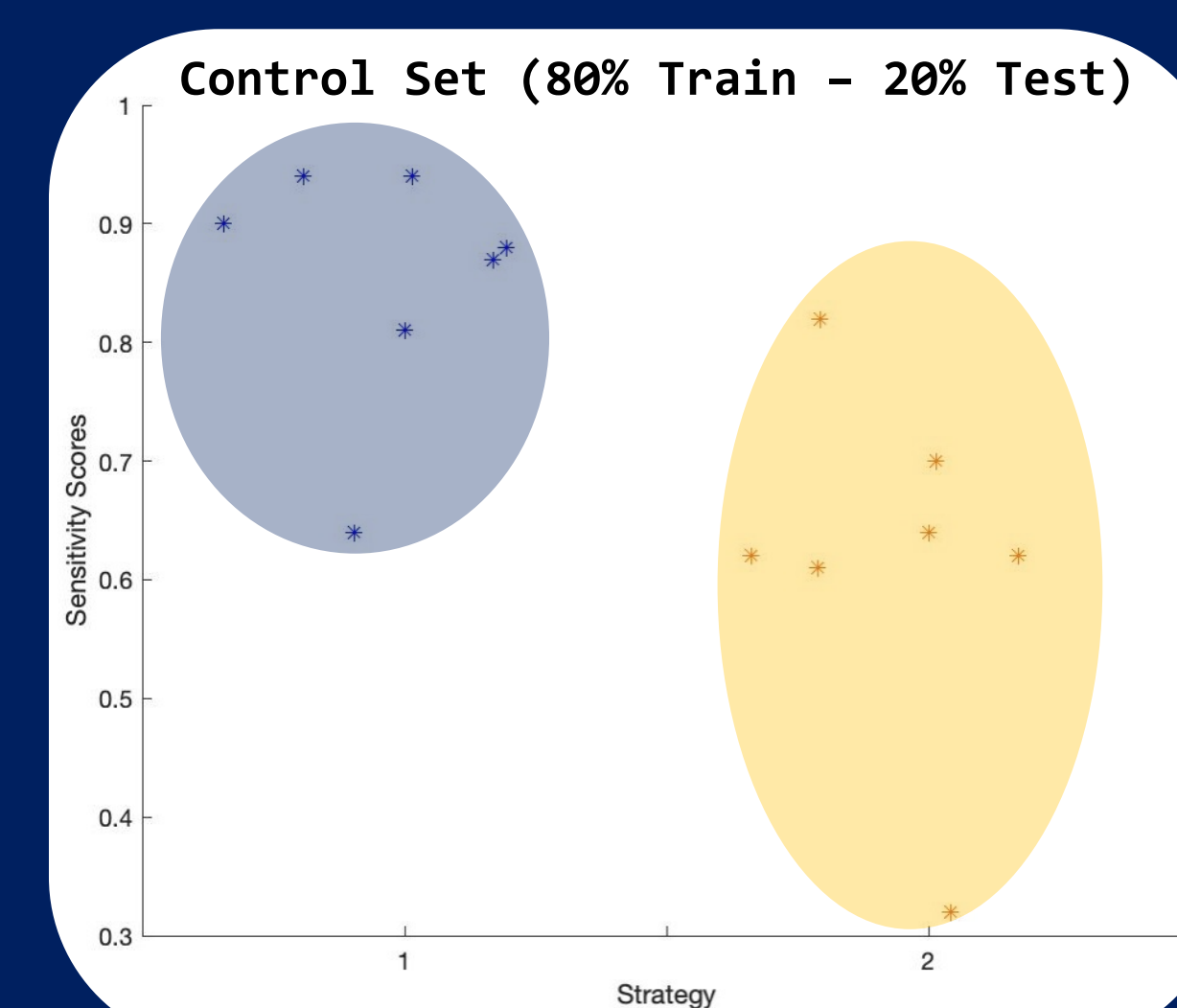
- 1 run : 8 min
- Feature selection : 5 min
- MI/Rest Task : 4s
- Red dot : Motor Imagery Task
- Blue dot Resting state
- White cross : selection of the target with gaze



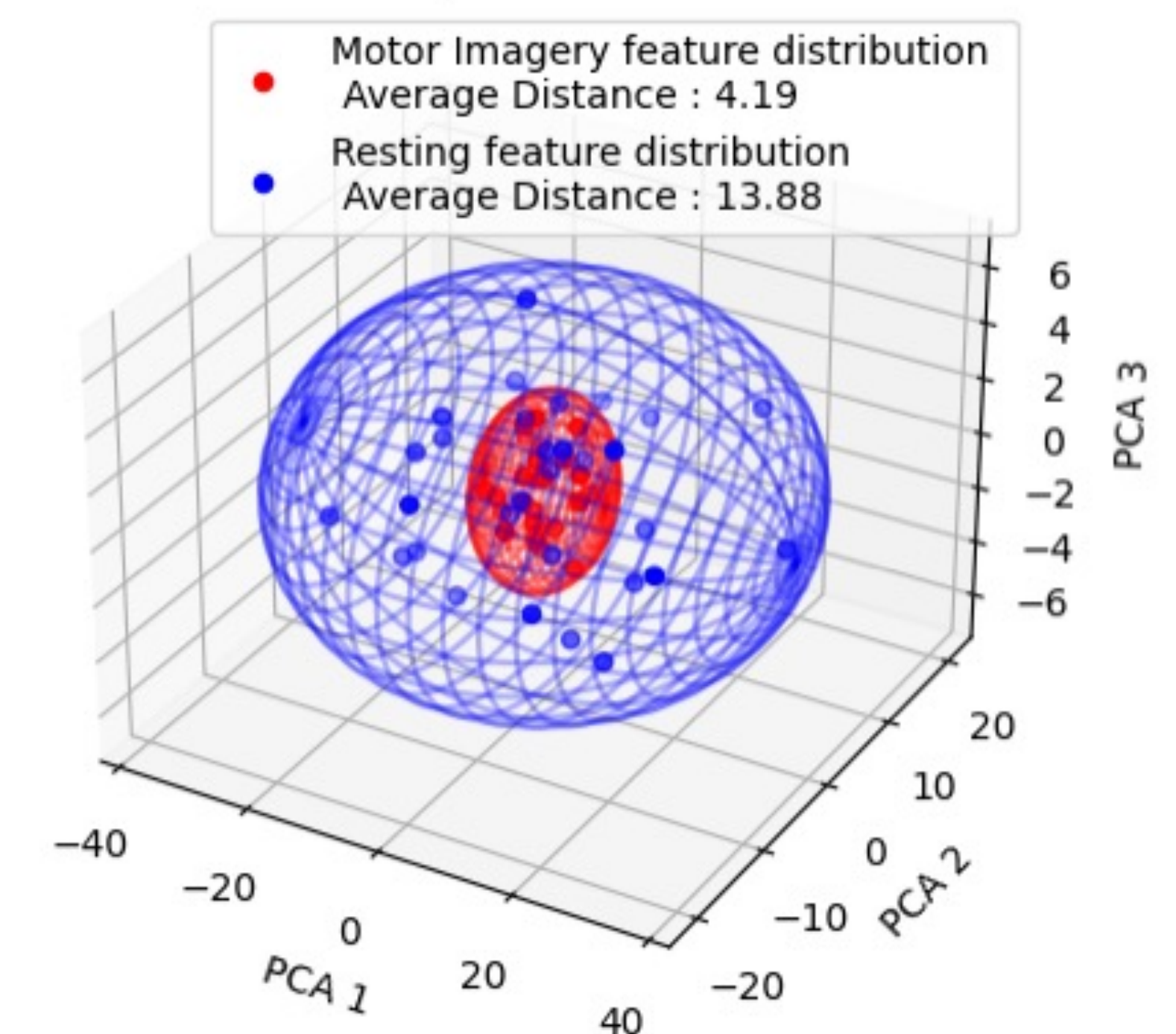
Classification Results



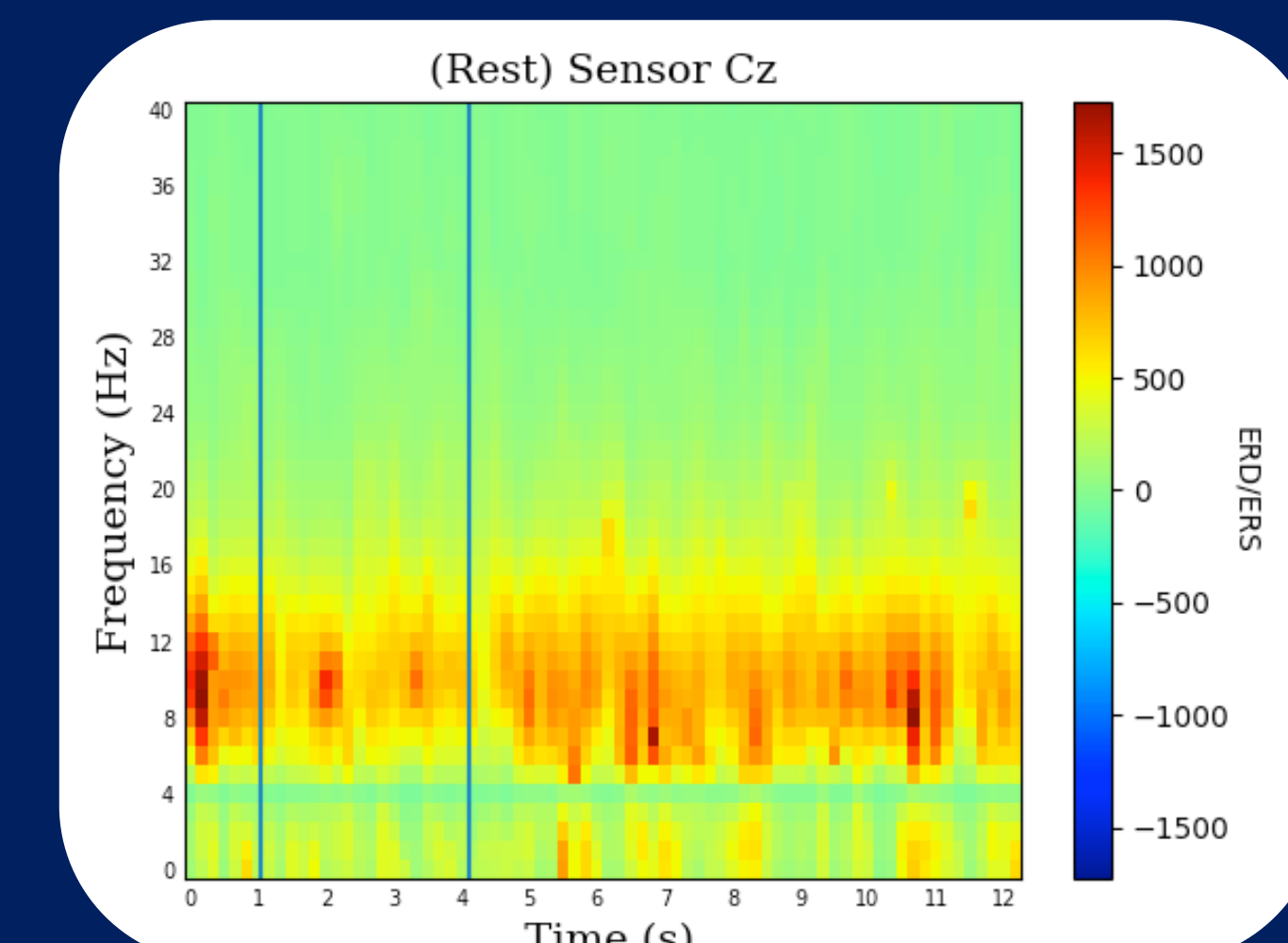
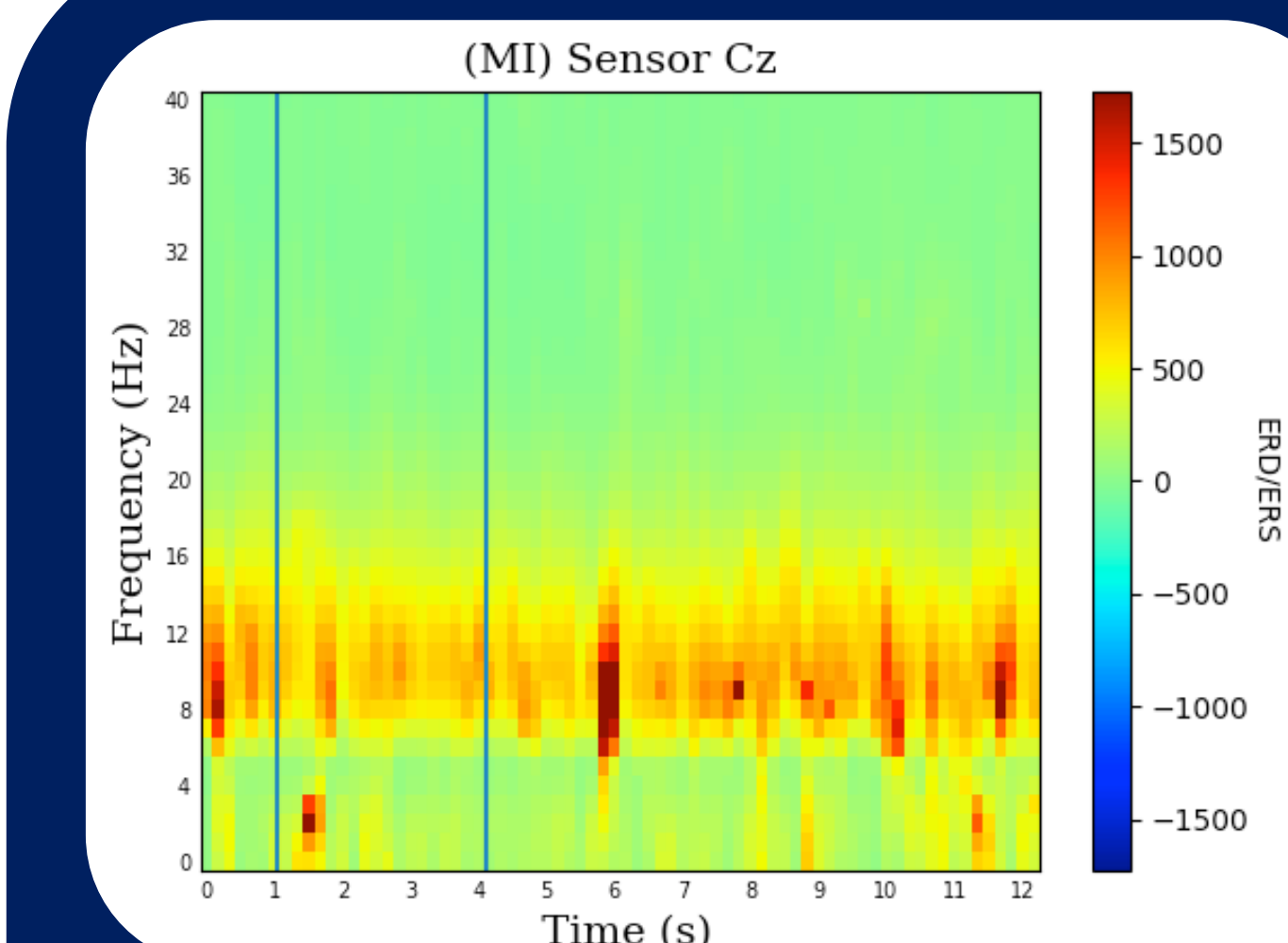
- No Statistical differences between sessions
 - No Effect of learning
- Statistical differences for SVM
 - Trend on LDA
 - 2 ways permuted ANOVA, $p < 0.01$



PCA Distribution of Power Spectrum Features between classes



- High variability within the resting state between trials
- Motor imagery task more redundant between trials
 - The Resting state instruction remains to tackle for more consistency



- Synchronization related to robotic arm movement,
 - A possible pattern of preparation/pre-trigger

Conclusion

- Differences between strategies: a way to improve the performances
- Being in control of the robot changes the statistical differences in frequency more than in intensity