

# Designing Brain-Computer Interfaces, from theory to real-life scenarios

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## Abstract / Short description

Open source tools for brain signal analysis have greatly matured in recent years. In this two half-days workshop, a guided tour will be proposed on the design of EEG-based Brain-Computer Interfaces (BCI) using open-source tools.

On day 1, we will explore real-world applications of BCI, the main paradigms used in the field, and the different types of variabilities to overcome. With HappyFeat, you will gain practical knowledge in extracting and selecting features from EEG signals. Additionally, you will learn how to assess machine-learning pipelines using MOABB, a powerful tool that prioritizes reproducibility and replicability.

On day 2, you will acquire practical experience through hands-on activities and tutorials. We will introduce Timeflux, a Python framework tailored for the development of real-time BCI applications. After delving into the challenges faced by end-users, we will unveil a novel BCI paradigm designed to streamline calibration time, prioritize visual comfort, and deliver high accuracy using dry EEG technology.

## Keywords

Brain Computer Interface, open source, feature selection, on-line pipeline, end-user related issue,

## Prerequisites

Background in EEG would be preferred, still open to clinicians/not specialist of signal processing

## Tentative Schedule

| Workshop/Tutorial Part 1 – chair: M.-C. Corsi |   |
|---|---|
| 3:00 pm - 3:15 pm                             | Welcome and introduction, by M.-C. Corsi  |
| 3:15 pm - 3:45 pm                             | What are BCIs, and how do they work? A guided tour, by M.-C. Corsi & A. Desbois |
| 3:45 pm - 4:15 pm                             | Classification features extraction and selection using HappyFeat, by A. Desbois |
| 4:15 pm - 4:45 pm                             | <i>Benchmarking EEG pipelines in BCI with MOABB</i> , by M.-C. Corsi            |
| 4:45 pm - 5:00 pm                             | Q&A   |

| Workshop/Tutorial Part 2 – chair: F. Dehais |   |
|---|---|
| 9 am - 9:10 am                              | Introduction and recap from part 1, by F. Dehais  |
| 9:10 am - 9:40 am                           | <i>Timeflux presentation</i> , by Pierre Clisson  |
| 9:40 - 10:00                                | <i>Obstacles in real-world applications and end user related issues</i> , by F. Dehais                                    |
| 10:00- 10:30                                | <i>Star-burst BCI hands-on and tutorial: pushing BCI out of the lab</i> by K. Cabrera Castillos, F. Dehais and P. Clisson |
| 10:30- 10:50                                | Discussion panel  |
| 10:50 am - 11:00 am                         | Concluding remarks  |