

# Pattern Recognition for NeuroImaging

## Organizers:

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The application of pattern recognition techniques to neuroimaging data has increased substantially in the last years leading to a large body of publications. Pattern recognition approaches consist of a whole family of tools coming from the “machine learning” community (at the border of statistics and engineering), which have been adapted to investigate neuroscience questions. Depending on the research question asked, experimental design and data modality, it is important that the experimenter knows which tools to use and how to draw reliable conclusions. The course will focus on subject and/or patient classification (for cognitive and clinical applications) but also on regression issues. The usual functional and structural MRI modalities will be covered but the presentations will also consider other types of data such as PET, EEG/MEG and network metrics. Model validation and statistical inference are particularly crucial as these notions somewhat differ from the standard univariate statistics usually applied to analyze neuroimaging data (e.g. General Linear Model) and should thus be specifically addressed. After introducing the theoretical foundations of pattern recognition in neuroimaging, the remaining talks will introduce more advanced methodological points as illustrated by specific applications and/or modalities. At the end of the course, the neuroscientist should have a global understanding of pattern recognition approaches, how to apply these tools to his/her own data to address new questions, and how to interpret the outcomes of these analyses as well as how to draw reliable conclusions.

## Course Schedule

8:00-8:30

### Pattern Recognition Fundamentals

*Christophe Phillips, University of Liège, Liège, Belgium*

8:30-9:00

### Strategies to improve the interpretability of whole-brain predictive patterns

*Janaina Mourão-Miranda, University College London, London, United Kingdom*

9:00-9:30

### A primer on permutation tests (not only) for MVPA

*Carsten Alletfeld, Charité – Universitätsmedizin Berlin / Bernstein Center for Computational Neuroscience Berlin, Germany*

9:30-10:00

### Introduction to machine learning with brain graphs

*Jonas Richiardi, University of Geneva, Geneva, Switzerland*

10:00-10:30

### Break

10:30-11:00

### Mapping Patterns Across Individuals: Decoupling Function from Anatomy

*Georg Langs, Medical University of Vienna, Vienna, Austria*

11:00-11:30

### Decoding cognitive concepts, not experimental artifacts

*Bertrand Thirion, Inria, Saclay, France*

11:30-12:00

**Population receptive field modeling**

*Marcel van Gerven, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands*

12:00-13:00

**Lunch**

13:00-13:30

**Learning from multimodal data for disease prediction**

*Olivier Colliot, ARAMIS Lab, Paris, France*

13:30-14:00

**Feature representations for anatomical MRI**

*John Ashburner, UCL Institute of Neurology, London, United Kingdom*

14:00-14:30

**M/EEG Decoding**

*Moritz Grosse-Wentrup, Max Planck Institute for Intelligent Systems, Tübingen, Germany*

14:30-15:00

**Machine learning and cognitive neuroimaging: new questions answered by new tools**

*Gael Varoquaux, INRIA, Gif-sur-Yvette*

15:00-15:30

**Break**

15:30-16:00

**Resources for practicing PR4NI -- pragmatic cursory overview**

*Yaroslav Halchenko, Dartmouth College, Hanover, NH, United States*

16:00-16:30

**Wrap Up and Discussion**