

The Hebrew University of Jerusalem

Syllabus

Predictive Processing in Cognition and Neuroscience - 76907

Last update 03-09-2021

HU Credits: 2

Degree/Cycle: 2nd degree (Master)

Responsible Department: Brain Science: Computation & Information Proc.

Academic year: 0

Semester: 2nd Semester

Teaching Languages: English

Campus: E. Safra

Course/Module Coordinator: Leon Deouell

Coordinator Email: leon.deouell@mail.huji.ac.il

Coordinator Office Hours: By appointment

Teaching Staff:

Prof Leon Deouell,
Mr. Omri Gilday

Course/Module description:

There is increasing interest in recent years in the theory of predictive processing or predictive coding, in the fields of neuroscience and cognition. By this model, the nervous system, rather than being simply reactive, generates predictions regarding the state of the world, calculates any differences between these predictions and the actual input, and comes up with prediction errors that shape the next prediction. This model has been applied to diverse functions including sensation and perception, action, and emotion. The model has a clear computational elegance, and in recent years many studies have tried to establish its validity by looking at the brain, from microscopic measurements in animals to macroscopic levels in humans. In doing so, these studies aim to delineate how predictive processing is actually implemented in the brain. Whereas some believe that the theory is revolutionary and might be the single governing principle of brain activity, others doubt the generality of the model or even its explanatory power. In this course, which will require active participation including paper presentations and weekly reading assignments, we will examine first the basic concepts and tenets of the theory (e.g. what is prediction? what is a hierarchy? What is a generative model?), and then turn to examine empirical findings which support or don't support the model in different domains.

Course/Module aims:

To present the major principles of the predictive processing framework and to examine its claims regarding cognition and the brain

Learning outcomes - On successful completion of this module, students should be able to:

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- Describe and define the components of different models for PrePro.
- Draw the proposed models of PrePro in neural circuit and network terms
- Analyse scenarios of perception and action in terms of PrePro.
- Propose experiments to test PrePro's main claims
- Examine critically the scope of the PrePro framework

Attendance requirements(%):

85%

Teaching arrangement and method of instruction: Lectures, critical and collaborative reading of papers through the Perusall platform, and oral discussions in class.

Course/Module Content:

*Introduction – PrePro: what’s new?
Intro to cortical anatomy - cell types, layers, and connectivity
Intro to related mathematical principles
Neuronal circuits for PrePro
Empirical findings
What is attention?
What is action?
Interoception*

Required Reading:

Will be provided on the course site on Moodle

Additional Reading Material:

Course/Module evaluation:

*End of year written/oral examination 0 %
Presentation 50 %
Participation in Tutorials 25 %
Project work 0 %
Assignments 0 %
Reports 25 %
Research project 0 %
Quizzes 0 %
Other 0 %*

Additional information:

The course format is a discussion group and it requires ongoing reading and active contribution of the participants