NEURL-UA 302/ GA 3042

Special Topics: Computational Psychiatry, Fall 2017

Course directors: Xiao-Jing Wang (xjwang@nyu.edu) and Lucas Sjulson (Lucas.Sjulson@nyumc.org)

Objectives: this is an advanced undergraduate/graduate Special Topic course on an emerging field that emphasizes a cross-level approach to mental illness, integrating systems neuroscience with theory and computational modeling, and all put in a clinically-relevant context.

Prerequisites: Introduction to neuroscience, Behavioral and Integrative Neuroscience calculus, linear algebra or permission of instructor.

Faculty: Dora Angelaki, Paul Glimcher, Robert Machold, Neville Sanjana, Lucas Sjulson, Xiao-Jing Wang (NYU); Michael Halassa (MIT/NYU); Nathaniel Daw (Princeton); Mike Shadlen and Sean Escola (Columbia); John Murray (Yale).

Format: 2 h lecture once per week.

Readings: Typically 2 papers from the scientific literature each week.

Time: Wednesdays 10-12am.

Location: Meyer 808 (Center for Neural Science), 4 Washington Place, New York.

Evaluation: Mid-term paper (10 pages for undergrads, 15 for grads; 20% of grade), Final: a choice between either a paper (20 pages for Undergrads, 30 pages for Grads) or a model simulation project (plan must be reviewed and approved by the faculty; 60%). The midterm paper is expected to be on a particular topic (e.g. autism and impaired global brain functional connectivity, deficits of working memory associated with schizophrenia). The end of the term paper will be on a synthesis of a computational idea related to a psychiatric disorder (e.g. Impaired dopaminergic signaling as a substrate for addiction by impacting valence-related computations in striato-thalamo-cortical loops). Alternatively, a student can choose to carry out analysis and simulation of a model (e.g. reinforcement learning model of OCD, neural circuit model of working memory deficits). The final 20% of the grade is for in-class participation.

No textbook exists yet. There will be assigned readings (a combination of primary research papers and review articles) by the lecturers, ~2 papers per week.

Week 1 (9/6): What is Psychiatry? (Lucas Sjulson)

Week 2 (9/13): What is Computational Psychiatry? (Xiao-Jing Wang)

Week 3 (9/20): Genomic analysis and psychiatry (Neville Sanjana)

Week 4 (9/27): Cross-level neural circuit modeling (Xiao-Jing Wang)

Week 5 (10/4): Schizophrenia (Michael Halassa)

Week 6 (10/11): Neurodevelopment and psychiatric illness (Robert Machold)

Week 7 (10/18): Cortical mechanism of decision-making (Mike Shadlen, Columbia)

Week 8 (10/25): Biologically-based modeling applied to cognitive deficits in Schizophrenia (John Murray, Yale)

Week 9 (11/1): Reinforcement learning, choice behavior and addiction (Paul Glimcher)

Week 10 (11/8): Computational perspective on autism (Dora Angelaki)

Week 11 (11/15): Anxiety disorders (Lucas Sjulson)

Week 12 (11/29): Evaluation and its impairment in depression (Nathaniel Daw, Princeton)

Week 13 (12/6): Basal ganglia modeling and OCD (Sean Escola, Columbia)

Week 14 (12/13) Large-scale connectivity and global dynamics in mental illness (Xiao-Jing Wang)