

NOTE to prospective students: This syllabus is intended to provide students who are considering taking this course an idea of what they will be learning. A more detailed syllabus will be available later for enrolled students and there may be some changes.



## **Seminar in Visual Neuroscience (339.723)**

**3 Credits**

**Instructor: Sang-Hun Lee**

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### **Course Description:**

This is a graduate class, suitable for graduate students majoring and/or interested in visual neuroscience, human/animal perception, computational neuroscience or computer vision. In this semester, the class will concentrate on how the visual system changes ways of encoding (representation), decoding (read-out) and decision-making (linking perception to action) under ever-changing internal and external contexts, including attention, adaptation, learning and action. The class consists of several sections. Each section starts with a short introduction lecture, in which students will be introduced to key scientific concepts, research topics and methodological issues in a given topic. Then students will take turns presenting one of major articles covering the issues that were introduced by the introduction lecture and leading discussions of critical issues and methodological questions related to that article under supervision of the instructor. Students are (not required but) expected to have taken classes on Neuroscience and introductory-level Mathematics courses (calculus, linear algebra, etc) and be ready to invest 4-6 hours in reading research articles every week.

### **Reading materials:**

Selected Journal Articles

### **Grading criteria:**

Attendance (10%)

Class participation (25%)

Short essays (40%)

Oral presentation (25%)

Total (100%)

### **Schedule:**

Week 1: Class preview (“Encoding and decoding visual events in the uncertain world”)

Week 2: Introductory lecture on “Adaptive Encoding and Decoding of Visual Events by Visual Brain: Effects of adaptation, attention, learning, action on perception and neural activity”

Week 3: Adaptive coding of visual information in neural populations (Diego A. Gutnisky & Valentin Dragoi, 2008): Adaptation / Population coding / Noise correlation

Week 4: Attention to surfaces modulates motion processing in extrastriate area MT. (Wannig A, Rodríguez V, Freiwald WA., 2007): Attention / Motion

Week 5: The normalization model of attention. (Reynolds JH & Heeger DJ, 2009): Attention / Normalization

Week 6: Improved visual sensitivity during smooth pursuit eye movements. (Schütz AC, Braun DI, Kerzel D, Gegenfurtner KR., 2008): Eye movements / Sensitivity

Week 7: An empirical explanation of the flash-lag effect. (William T. Wojtach , Kyongje Sung, Sandra Truong, and Dale Purves, 2008): Position / Motion / Flash-lag effect

Week 8: Task difficulty and the specificity of perceptual learning (Ahissar & Hochstein, 1997): Perceptual learning / difficulty

Week 9: Rewards evoke learning of unconsciously processed visual stimuli in adult humans. (Seitz AR, Kim D, Watanabe T., 2009): consciousness / reward / perceptual learning

Week 10: Interval time coding by neurons in the presupplementary and supplementary motor areas. (Akihisa Mita, Hajime Mushiake, Keisetsu Shima, Yoshiya Matsuzaka & Jun Tanji, 2009): interval timing / perceptual decision

Week 11: Ready...Go: Amplitude of the fMRI Signal Encodes Expectation of Cue Arrival Time. (Xu Cui., Chess Stetson, P. Read Montague, David M. Eagleman, 2009): Expectation / time perception

Week 12: Changes of mind in decision-making. (Resulaj, Kiani, Wolpert & Shadlen, 2009): decision making / uncertainty

Week 13: Perceptual accuracy and conflicting effects of certainty on risk-taking behaviour. (Shafir S, Reich T, Tsur E, Erev I, Lotem A., 2008): perceptual decision / uncertainty

Week 14: Human Insula Activation Reflects Risk Prediction Errors As Well As Risk (Kerstin Preuschoff, Steven R. Quartz and Peter Bossaerts, 2008): Error prediction / uncertainty / risk