

Spring 2008

## **BME 671 LATE VISUAL PROCESSING**

Time and Place: T/TH 9:30 -10:50 AM, GFS 205

Course web site: <https://blackboard.usc.edu>

### **Overview**

This class will give students a broad view of modern vision research, with a focus on late visual processing. A companion course, BME 670, was offered in the fall of 2007, focusing on lower visual processing. To ensure both depth and breadth of perspective in the course, two or more instructors with experimental or modeling backgrounds will cover each of the main topics. These topics were chosen to emphasize the particular strengths of USC vision researchers. The topics include cortical circuitry, the computations of orientation, motion, color, contour, segmentation, 3D depth, and faces, as well as visual and auditory perception, recognition, reading, attention, and learning. In total, eleven USC lecturers from different schools, departments, and disciplines will participate in this vision course. In addition, the course will have four speakers from other institutions. These latter speakers will deliver lectures devoted to open questions in each of the main topic areas.

### **Prerequisites**

The courses will be limited to graduate students. Senior undergraduate students will be accepted only with prior approval of the instructors. Prerequisites will be either neuroscience (e.g., NEUR 524 or BME 502) or computer-vision (e.g., CSCI 574) courses.

### **Course Format**

Students will be expected to read one article and answer one question per lecture. Articles and questions will be posted on the course web site prior to each lecture. Questions will be synthetic and will require 300 word answers (approximate length of a scientific abstract). Answers should be typeset rather than handwritten, and answers longer than 300 words will not be

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graded. Answers must be turned in at the next class after the associated lecture, at the beginning of class. Late answers will not be accepted or graded. Example answers written by the instructor will be posted on the course web site.

## Exams

Exams will be closed book and will last approximately 90 minutes. They will be non-cumulative, covering material only since the previous exam, and will consist of both short-answer and synthetic questions. Exam dates are 2/21 (in class), 4/1 (in class), and 5/13 (during finals week, in the classroom).

## Grading

Course grades will be assigned as follows:

Homeworks: 25%

Exams: 25% each, = 75%

## Lecture Topics

- |     |      |   |                          |
|-----|------|---|--------------------------|
| 1.  | 1/15 | Introduction to Mid and High-Level Vision       | Bosco Tjan; Psychology   |
| 2.  | 1/17 | Organization of the Visual Cortex               | Judith Hirsch; Biology   |
| 3.  | 1/22 | Anatomy and Physiology of Cortical Area V1      | Hirsch                   |
| 4.  | 1/24 | Direction and Orientation Selectivity           | Hirsch                   |
| 5.  | 1/29 | Computational Models of Orientation Selectivity | Bartlett Mel; BME        |
| 6.  | 1/31 | Open Questions in V1 Physiology                 | Dario Ringach, UCLA      |
| 7.  | 2/5  | Neurally Inspired Models of Contour Extraction  | Mel                      |
| 8.  | 2/7  | Cortical Measurement of Motion                  | Norberto Grzywacz; BME   |
| 9.  | 2/12 | Perception of Motion: Psychophysics and Models  | Zhong-Lin Lu; Psychology |
| 10. | 2/14 | Decision Making in the Cortical Motion Pathway  | Grzywacz                 |
| 11. | 2/19 | Bayesian Models of Visual Inference             | Tjan                     |
| 12. | 2/21 | <b>Exam #1</b>                                  |                          |

- |     |      |   |  |
|-----|------|---|--|
| 13. | 2/26 | Open Questions in Bayesian Perceptual Inference         | Alan Yuille; UCLA                          |
| 14. | 2/28 | Visual Attention: Cortical Data and Models              | Mel  |
| 15. | 3/4  | Perceptual Models of Segmentation                       | Grzywacz                                   |
| 16. | 3/6  | Computer Vision Models of Segmentation                  | Laurent Itti; CS                           |
| 17. | 3/11 | Visual Memory and Learning                              | Lu   |
| 18. | 3/13 | Open Questions on the Role of Experience in Vision      | Anthony Norcia; Smith-Kettlewell Institute |
| 19. | 3/25 | Automatic Target Detection in Cluttered Scenes          | Itti                                       |
| 20. | 3/27 | Models of Visual Plasticity                             | Grzywacz                                   |
| 21. | 4/1  | <b>Exam #2</b>  |  |
|     |      |   |  |
| 22. | 4/3  | fMRI of the Visual Word Form Area                       | Franklin Manis, Psychology                 |
| 23. | 4/8  | Reading   | Tjan                                       |
| 24. | 4/10 | Audio-visual Mirror Neurons: Recognition of Actions     | Michael Arbib, CS                          |
| 25. | 4/15 | Participation in USC Vision Symposium                   |  |
| 26. | 4/17 | Visual Speech Perception                                | Lynne Bernstein, House Institute           |
| 27. | 4/22 | The Neural Basis of Object Recognition                  | Irving Biederman; Psychology               |
| 28. | 4/24 | Visual-recognition Impairments with Focal Brain Lesions | Jessica Wisnowski, Psychology              |
| 29. | 4/29 | The Neural Basis of Face Recognition                    | Biederman                                  |
| 30. | 5/1  | Open Questions in Adaptation and Face Recognition       | Michael Webster; U. Nevada                 |
| 31. | 5/13 | <b>Final Exam</b> , 8:00 a.m. - 10:00 a.m.              |  |