

Spring 2005

BME 671 LATE VISUAL PROCESSING

T/TH 9:30 -11:00 AM, 100 Hedco Neurosciences Building
Course web site: <https://totale.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 offered in the fall focuses on lower visual processing. To ensure both depth and breadth of perspective, two or more instructors with experimental or modeling backgrounds will cover each of the main topics, which were chosen to emphasize the particular strengths of USC vision researchers. Topics include cortical circuitry, the computations of orientation, motion, color, contour, segmentation, 3D depth, and faces, as well as perception, recognition, reading, attention, and learning. In total, ten USC scientists from different schools, departments, and disciplines will cover these topics. In addition, five lectures will be given by outside vision scientists. And students will participate in an all-encompassing USC vision symposium. A subset of the lectures will be devoted to open questions in each of the main vision-research 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 and 525, or BME 502) or computer-vision (*e.g.*, CSCI 574) courses.

Course Format

Students will read one article and answer one question per lecture. (They will also answer one question on the lectures given at the USC Vision Symposium during class hours.) We will post articles and questions on the course website before 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 graded. Students must turn answers 1 week after the associated lecture, at the beginning of class; we will not accept late answers. The course website will include example answers written by the instructor after the deadline.

Exams

Exams will be closed book and will last approximately 90 min. These exams will be non-cumulative, covering material only since the previous exam, and will consist of both short-answer and synthetic questions. In the exams, there will be materials from lectures, articles, and talks at the vision symposium. Exam dates are 2/22 (in class), 3/31 (in class), and Tuesday 5/10 (during finals week, in the classroom), 11 am-1 pm.

Grading

Course grades will be assigned as follows:

Homeworks: 25%

Exams: 25% each, = 75%

Office Hours (Norberto Grzywacz)

Tu 6:15-7:15 PM; Th 6-7 PM (DRB 168)

Lecture Topics

1. 1/11 Cortical Connectivity and Dorsal Ventral Pathways (Irving Biederman; Psychology)
2. 1/13 Organization of the Visual Cortex (Judith Hirsch; Biology)
3. 1/18 Anatomy and Physiology of Cortical Area V1 (Hirsch)
4. 1/20 Direction and Orientation Selectivity (Hirsch)
5. 1/25 Computational Models of Orientation Selectivity (Bartlett Mel; BME)
6. 1/27 Computational Models of Binocular Disparity (Mel)
7. 2/01 Open Questions in V1 Physiology (Speaker: Matteo Carandini; Smith-Kettlewell Institute)
8. 2/03 Systems Analysis of Simple Cell Properties in Cat and Monkey Primary Visual Cortex (Speaker: Charles Anderson; Washington University, St. Louis)
9. 2/08 Cortical Measurement of Motion (Norberto Grzywacz; BME)
10. 2/10 Motion Measurement and Interpretation (Gérard Medioni; CS)
11. 2/15 Open Questions in Motion Research (Speaker: Charles Duffy; Univ. of Rochester)
12. 2/17 Perception of Motion: Psychophysics and Models (Zhong-Lin Lu; Psychology)
13. **1/22 Examination 1**

14. 2/24 Using Color to Segment Images and Recognize Stuff (Ione Fine; Ophthalmology)
15. 3/01 Neurally Inspired Models of Contour Extraction (Mel)
16. 3/03 Computer Vision Models of Segmentation (Christoph von Der Malsburg; CS)
17. 3/08 Bayesian Models of Visual Inference (Bosco Tjan; Psychology)
18. 3/10 Open Questions in Perceptual Inference (Speaker: Wilson Geisler; U. of Texas at Austin)
19. 3/22 Visual Memory and Learning (Lu)
20. 3/24 Automatic Target Detection in Cluttered Scenes (Laurent Itti; CS)
21. 3/29 Participation in USC Vision Symposium
22. **3/31 Examination 2**
23. 4/05 Dynamic Link Matching Models and Recognition (von der Malsburg)
24. 4/07 Computer-Vision Models of Face Recognition (Medioni)
25. 4/12 The Role of Experience in Sensory Processing (Fine)
26. 4/14 The Neural Basis of Object Recognition (Biederman)
27. 4/19 The Neural Basis of Face Recognition (Biederman)
28. 4/21 Reading (Tjan)
29. 4/26 Dyslexia (Lu)
30. 4/28 Open Questions in Object Recognition (Speaker: Roger Tootell; Harvard)
31. **5/10 Examination 3 from 11 am – 1 pm**