Fall 2005

BME 670 EARLY VISUAL PROCESSING

T/TH 9:30 -10:50 AM, Vivian Hall of Engineering 206
Course web site: https://totale.usc.edu

Overview

This class will give students a broad view of modern vision research, with a focus on early visual processing. A companion course, BME 671, will be offered in the spring of 2006, focusing on higher 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 phototransduction, retinal processing and development, retinal diseases, prostheses, and transplantation. In addition, the topics include computational and hardware models of early vision, and anatomical, physiological, and computational views of the lateral geniculate nucleus (LGN) of the thalamus. In total, thirteen USC lecturers from different schools, departments, and disciplines will participate in this vision course. Moreover, four lecturers will be given by outside speakers. A subset of the lectures will be 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 and 525, 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 graded. Answers must be turned in at the 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 9/27 (in class), 11/8 (in class), and Thursday 12/8 (during finals week, in the classroom),11 am - 1 pm.

Grading

Course grades will be assigned as follows:

Homeworks: 25%
Exams: 25% each, = 75%

Lecture Topics

1.	8/23	Introduction to Vision	Bartlett Mel; Biomedical Engineering
2.	8/25	Introduction to Phototransduction	Cheryl Craft; Ophthalmology
3.	8/30	Excitation in Phototransduction	Jeannie Chen; Ophthalmology
4.	9/1	Adaptation in Phototransduction	Jeannie Chen; Ophthalmology
5.	9/6	Computational Models of Phototransduction	Norberto Grzywacz; Biomedical Engineering
6.	9/8	Retinal Processing	David Merwine; Biomedical Engineering
7.	9/13	Open Questions in Phototransduction	Outside Speaker: Juan Korenbrot, UCSF
8.	9/15	Molecular Biology of Phototransduction	Cheryl Craft; Ophthalmology
9.	9/20	Diseases of the Retina	Mark Humayun; Ophthalmology
10.	9/22	Retinal Transplantation	Magdalene Seiler; Doheny Eye Institute, USC
11.	9/27	**Exam #1**	

12.	9/29	Retinal Development	Eun Jin Lee; Biomedical Engineering
13.	10/4	Retinal Prosthesis	James Weiland; Ophthalmology
14.	10/6	Hybrid Electronic/Photonic Implementations of Visual Proc.	Armand Tanguay; Electrical Engineering
15.	10/11	Computer-Vision Models of Edge Detection	Gerard Medioni; Computer Science
16.	10/13	Open Questions in Low-Vision Research	Outside Speaker: Elli Peli, Schepens ERI
17.	10/18	Edge Detection in the Retina: Physiology & Models	Norberto Grzywacz; Biomedical Engineering
18.	10/20	Computational Models of Color Processing	Bartlett Mel; Biomedical Engineering
19.	10/25	Color Processing in the Retina	David Merwine; Biomedical Engineering
20.	10/27	Open Questions in Retinal Research	Outside Speaker: Peter Sterling, U Penn
21.	11/1	Computer-Vision Models of Local-Motion Measurement	Gerard Medioni; Computer Science
22.	11/3	Motion Detection in the Retina: Physiology & Models	David Merwine; Biomedical Engineering
23.	11/8	**Exam #2**	
24.	11/10	From Retina to Thalamus: The Lateral Geniculate Nucleus	Judith Hirsch; Biology
25.	11/15	Gating of Vision by Sub-cortical Structures	Laurent Itti; Computer Science
26.	11/17	Physiology of LGN 1: Relay Cells	Judith Hirsch; Biology
27.	11/22	Physiology of LGN 2: Interneurons	Judith Hirsch; Biology
28.	11/24	**Thanksgiving Holiday – no class**	
29.	11/29	Open Questions in Thalamic Research	Outside Speaker: Martha Bickford, U Louisville
30.	12/1	Computational Models of the LGN	Bartlett Mel; Biomedical Engineering
31.	12/8	**Final Exam**, 11:00 a.m. - 1:00 p.m.	