CLPS 1520 Computational Vision
Fall 2012

Instructor:
Thomas Serre <thomas_serre@brown.edu>

Classes:
Metcalf 107
Tuesday and Thursday, 1:00-2:20pm

Office hours:
Metcalf 343
Tuesday and Thursday, 2:30-3:30pm

Optional MATLAB tutorials:
Metcalf 107
Wednesday 5:30-7:30pm

Course website:
https://canvas.brown.edu/courses/350884

Course description:
An introduction to computational models of biological vision summarizing traditional approaches and providing experience with state-of-the-art methods. We will sample topics from low- and mid-level vision including fundamental aspects of image, stereo, motion, surface and color processing to high-level vision including object and action recognition as well as scene understanding. Connections to contemporary research in computer vision and computational neuroscience will be emphasized highlighting how computational models may motivate the development of new hypothesis for the design of experiments in visual perception.

Course objective:
Computational modeling is one of the central methods in brain and cognitive science research, and recent developments in computational neuroscience, machine learning, and computer vision have provided a wealth of new tools for developing computational accounts of human cognition and perception. **The objective of this course is to provide students a toolkit (concepts, mathematical and computational methods) for modeling visual processes.** At the end of this course, students will be able to implement classical computational models of vision in MATLAB.

Who should take this course:
The course is designed for advanced students in cognitive science, psychology, neuroscience or computer science who are interested in developing computational models of visual perception. It is intended to provide an introduction to some current research issues in visual cognition, together with examples of the different research paradigms by which they might be investigated. The inherently interdisciplinary nature of the subject is reflected in the course,

which brings together issues relating to the disciplines of visual perception, neuroscience, computer science and machine learning.

Prerequisites:
No formal requirement. **Overall basic familiarity with MATLAB and/or previous work in the field and/or willingness to do extra work to learn is expected.** The course strongly emphasizes hand-on MATLAB homeworks where students will implement some of the computational models described in class. Last year, motivated students with no prior knowledge of MATLAB did very well in the course as weekly optional MATLAB tutorials will be offered.

Format:
There will be two 80 minutes sessions per week, consisting of a mixture of lectures and discussions as well as optional MATLAB tutorial sections. There will be four problem sets/ homeworks overall (about two weeks to complete each), a mid-term and a final project (oral presentation and short write-up). There is no textbook. Readings will consist of approximately one journal article or book chapter per class.

Breakdown of assessment:

Contribution	Percentage of final grade
Four problem sets (involving some programming)	40%
A mid-term	20%
A final project (involving an oral presentation on the last day of class as well as a short write-up)	30%
Participation	10%

Syllabus (will most likely change as the course progresses):

Lecture 1	Thu, Sep 6, 2012	Course overview	
Lecture 2	Tue, Sep 11, 2012	Foundations	
Lecture 3	Thu, Sep 13, 2012		
Lecture 4	Tue, Sep 18, 2012	Color	
Lecture 5	Thu, Sep 20, 2012		
Lecture 6	Tue, Sep 25, 2012	Computing with RFs	
Lecture 7	Thu, Sep 27, 2012		
Lecture 8	Tue, Oct 2, 2012	Hubel & Wiesel	HW1 due
Lecture 9	Thu, Oct 4, 2012		
Lecture 10	Tue, Oct 9, 2012	Visual Analysis	
Lecture 11	Thu, Oct 11, 2012		
Lecture 12	Tue, Oct 16, 2012		HW2 due
Lecture 13	Thu, Oct 18, 2012	Coding	
Lecture 14	Tue, Oct 23, 2012		
Lecture 15	Thu, Oct 25, 2012	Motion	
Lecture 16	Tue, Oct 30, 2012		HW3 due
Lecture 17	Thu, Nov 1, 2012	Binocular Vision	
Lecture 18	Tue, Nov 6, 2012	Shape	
Lecture 19	Thu, Nov 8, 2012		
Lecture 20	Tue, Nov 13, 2012	Theories of object recognition	HW4 due
Lecture 21	Thu, Nov 15, 2012		
Lecture 22	Tue, Nov 20, 2012		
	Thu, Nov 22, 2012	*No class*	
Lecture 23	Tue, Nov 27, 2012	Attention and eye movements	
Lecture 24	Thu, Nov 29, 2012		
	Tue, Dec 4, 2012	**EXAM**	
	Thu, Dec 6, 2012	**Project meeting**	
	Tue, Dec 11, 2012	**Project meeting**	
	Thu, Dec 13, 2012	**Project write-ups due**	
	Thu, Dec 20, 2012	**Project presentations**	