COGS 269: Human Motor Control, Fall 2015

Professor: Dr. Ramesh Balasubramaniam  
Email: ramesh@ucmerced.edu  
Phone: 209.228.2314  
Meeting times: Tu Th 12-1:15pm  
Location: COB 127  
Office hours: by appointment @ SSM 259A  

Prerequisites: Some knowledge of basic neurophysiology, perception and action.

Course Description:

This course is designed to give a comprehensive overview of human sensorimotor control research. The course will cover neurophysiological, computational and cognitive approaches to the study human motor control. The goal of this course is to prepare the student for conducting research in motor control neuroscience with a thorough overview of the literature, methodologies and debates in the field. Applications for motor learning and its broad relationship to general principles of human cognition will also be discussed.

Specific topics that will be covered include coordinated reaching, grasping, language & speech, interceptive actions, timing, bimanual coordination, posture/balance and mechanical/robotic control systems. Examples will be drawn from various movement pathologies to explain the function of the intact brain in movement organization & control. A strong emphasis will be placed on using laboratory tools and techniques including 3D motion-capture, dynamical systems modeling, TMS and EEG.

Specific Educational objectives:

- To provide a framework for the scientific study of human movement control & learning.
- To expose the student to the latest developments in the field of human motor control and underlying neurophysiology in relation to other cognitive systems.
- To apply this fundamental knowledge towards the study of specific functional behaviors using lab techniques learned during the semester.

Format of the course:

Although, bulk of the content of this course will be delivered through lectures, I am aiming for a fairly intimate atmosphere with lots of open discussions and debates. All course material will be made available on the web ahead of time.

- We will have lectures from September to mid-October. Every class will have a Socratic hour that typically lasts 1/2 hour (worth 10%).
• We will also have one class presentation per week on one of the major critical papers that we will be reading (worth 10%). We will draw up a schedule on the first day of class.
• Following this section you will do a comprehensive literature review of a topic in human motor coordination that is relevant to your own research. The review paper should be approximately 20 double-spaced pages + reference (worth 40%)
• From mid-Oct through December you will engage in hands-on research on an experimental topic of your choosing. You should ideally work with the Professor to arrive at a suitable topic (get necessary IRB clearances etc). You will finish this project, present it to the class during the last week of classes and write this up targeting a journal of your choice (worth 40%)

Content:

There will be no official textbook for the course.
The following books are recommended for reference


We will be following the structure of the following readings. You will be expected to read these ahead of the lectures. You will be responsible for procuring the readings from the list.

Week 1 & 2

KEY PROBLEMS & BASIC NEUROPHYSIOLOGY

Background readings:

Theoretical Issues:


Week 3

ACTION NETWORKS IN THE BRAIN:

Background readings:


**Critical readings:**


**Weeks 4,5,6**

**COMPUTATIONAL APPROACHES TO ACTION & PERCEPTION**

**General Computational Principles**


**Timing and Sequencing**


**Coordination Dynamics**


Postural Control & Noise properties


Week 7-8

TRANSCRANIAL MAGNETIC STIMULATION


Plus lots of practical guides/Manuals to be posted on course website.

Week 9

ELECTROPHYSIOLOGY AND BRAIN MEASUREMENT


Followed by EEG LAB and tutorial on EEG measurement.
Plus lots of practical guides/Manuals to be posted on course website.

Week 10 - Project synopsis presentations

Weeks 11-13 - Project/data collection/getting hands dirty
Week 14 - Class presentations

FINAL PAPER due end of term.