PSYCH112R/LR – Cognitive Robotics
Winter 2021

Course website: https://canvas.eee.uci.edu/courses/33397

Lecture and Instruction: Tuesdays and Thursdays from 2PM until 3:20PM

Lab Section 1: Tuesdays from 3:30PM until 6:20PM

Lab Section 2: Thursdays from 3:30PM until 6:20PM

Instructor: Jeff Krichmar - jkrichma@uci.edu
Office Hours – Zoom by Appointment

Teaching Assistants:
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Course Description:

Neurorobots are robots whose control has been modeled after some aspect of the brain. Since the brain is so closely coupled to the body and situated in the environment, neurorobots can be a

powerful tool for studying neural function in a holistic fashion. It may also be a means to develop autonomous systems that have some level of biological intelligence. The motivation to study neurorobotics comes from both a desire to understand cognition as well as to improve autonomous applications. In this course, we will explore the field of neurorobotics. Each week we will cover topics related to neurorobotics, look at a neurorobot case study, and learn concepts using a virtual robot simulator.

This will be a virtual remote class. Lectures have been pre-recorded and will be available on Canvas via YuJa. During the lecture portion of the class, we will go over the lecture materials and answer any questions students may have. We will also teach fundamentals of programming in Python and using the Webots robot simulator.

This course fulfills the Psychology Lab Requirement. **NO PROGRAMMING EXPERIENCE IS REQUIRED.**

Prerequisites: Students need familiarity with mathematical concepts and experimental psychology.
Psychology 9A, B, C (or Psychology and Social Behavior P11A, B, C)
Psychology 10A-B-C, or Mathematics 2A-B and 7

Textbook:

Neurorobotics: Connecting the Brain, Body and Environment.
Tiffany Hwu & Jeff Krichmar, MIT Press, Expected publication Summer 2021.

Software: Webots: Open source robot simulator

1. Can be installed on your computer. Download from: https://www.cyberbotics.com/
2. Can be accessed remotely by following the instructions at:
   - https://www.oit.uci.edu/labs/remote-computer-access/
   - Software is installed in MSTB 210 (only available during course hours)
   - https://remoteaccess.labstats.com/University-of-California-Irvine-mstb210-w21psych112
   - Software is installed in GSC (drop-in computer lab)

Grading and Course Requirements:

Weekly Lab Reports	25%	**DROP THE LOWEST GRADE FROM THE AVERAGE**
Mid-term examination	25%	**NO MAKEUP EXAMINATIONS. NO EXCEPTIONS**
Final examination	25%	**NO MAKEUP EXAMINATIONS. NO EXCEPTIONS**
Final project	25%	**REPORTS AND FILES MUST BE IN THE DROPBOX BEFORE THE DEADLINE. NO EXCEPTIONS.**

Course Schedule

Week	Lecture	Case Study	Lab Assignment
1 – Jan 5 & 7	Introduction to Neurorobotics	Installing Webots	
2 – Jan 12 & 14	Chapter 1 - Neurorobotics: Origins and Background	Python in Webots	Vehicles
3 – Jan 19 & 21	Chapter 2 - Neuroscience: Background for Creating Neurorobots	Visual Navigation in Insects and Mammals	RoboBee Navigation
4 – Jan 26 & 28	Chapter 3 - Learning and Memory		Robot Conditioning
5 – Feb 2 & 4	Chapter 4 - Reinforcement Learning and Prediction	Conditioning in a Brain-Based Device	Midterm Exam
6 – Feb 9 & 11	Chapter 5 - Neurorobot Design Principles, Part 1 - Every Action has a Reaction	Action Selection in Neurorobotic Model of Basal Ganglia	Robot Maze Learning
7 – Feb 16 & 18	Chapter 6 - Neurorobot Design Principles, Part 2 - Adaptive Behavior to Change for the Better	Schemas and Memory Consolidation in Robots	Basal Ganglia Action Selection
8 – Feb 23 & 25	Chapter 7 - Neurorobot Design Principles 3: Behavioral Tradeoffs Since Life is Full of Compromises	Anxious and Curious Behavior in a Neurorobot	Final Projects
9 – Mar 2 & 4	Chapter 8 - Neurorobotic Navigation	Spiking Wavefront Propagation	Final Projects
10 – Mar 9 & 11	Chapter 9 – Social Robots, and Evolutionary Robotics	Place learning and RatSLAM	Final Projects Due on March 11th
Finals – Mar 18	Final Exam on Thursday, March 18th from 1:30PM until 3:30PM		