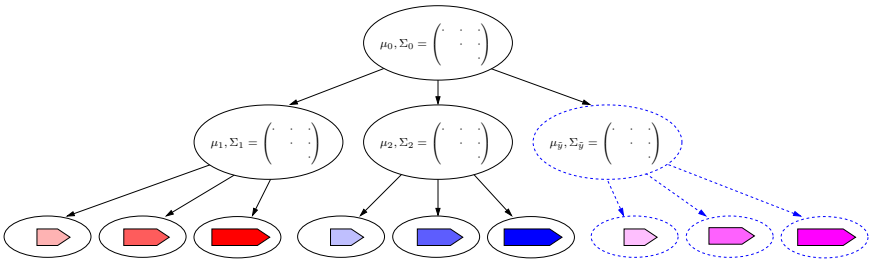
PSYC S410: Computational Psychology

Fall 2019



1 Course information

Class schedule Section 01: M/T/Th/F 3:00–3:50 pm
Section 02: M/T/Th/F 4:00–4:50 pm
Room O233

Instructor Alan Jern
Office: B103A
Email: jern@rose-hulman.edu

Office hours Thursdays 1:00–2:50 pm, and by appointment

2 Overview

One of the limitations of current psychological science is that many theories are qualitative in nature. That is, they can make general predictions about things like whether people are more likely to take one action or another or remember one word or another, but they have difficulty making specific quantitative predictions. For example, exactly how much more likely is it that someone will take an action or what is the precise mathematical relationship between how many times one sees a word and well someone will remember it? The goal of computational psychology is to develop theories of cognition and behavior that are precise enough that they can be implemented as computer programs and make precise quantitative predictions.

In this course, you will learn how to think like a computational psychologist. You will also learn how mathematical and computational tools from probability, statistics, and machine learning can be used to develop models of human learning and reasoning. By the end of this course, you should be able to:

- Explain the similarities and differences between machine learning / AI and computational psychology
- Read, understand, and critique an academic journal article describing a computational model
- Recognize the differences between several types of computational modeling approaches and identify their unique limitations
- Implement a computational model from a specification in a published journal article
- Interpret the predictions of a computational model
- Design and build a simple behavioral experiment and compare the data you collect to model predictions

3 Assessment

Component	Points
Homeworks (5)	350
Project	350
Reading responses (11)	110
Paper presentation	100
Participation	90
Total	1000

3.1 Homeworks (35%)

Homework assignments will consist of coding assignments and experiment data collection. They will generally be based on material you learned in the preceding week.

3.2 Project (30%)

At the end of the quarter, you will complete a group project. More details about the scope and expectations for this project will be posted online. There is time allocated during Weeks 9 and 10 for you to work on your projects in class.

Assignment	Points
Project proposal	50
Presentation	50
Report	250
Total	350

3.3 Reading responses (11%)

You will learn about most of the specific computational models in this class by reading published papers that we will discuss in class. To ensure that you come to class prepared for discussion, you must submit a reading response before class on days when papers are assigned.

For each paper, I will post one or two questions online that will help to guide your reading. You will submit a response to these questions before class on the specified date. Your response does not need to be longer than 2–3 paragraphs. There are 13 assigned reading responses, but your score for this category will be based only on your 11 best responses (i.e., your two lowest scores will be dropped).

3.4 Paper presentation (10%)

You will be randomly assigned to a group that will lead one paper discussion. The days with student discussion leaders are identified by asterisks (*) next to the readings in the course schedule below. On your group's assigned day, you will be expected to summarize the main questions raised by the paper, the methods used in the paper, the results, and come prepared with some discussion questions for the rest of the class. On the class day before your assigned day, I will spend half of the class period meeting with your group to clarify details of the paper, answer your questions, and help guide your presentation. Therefore, you are required to attend on the day **before** your scheduled presentation day having already thoroughly read through your assigned paper (even if you didn't understand every part of it).

3.5 Participation (9%)

Because this course involves lots of discussion, I expect you to be an active participant, both asking and answering questions in class, though not necessarily every day. I also expect you to have good attendance and to show up to class on time. Because this class does not have a textbook, attendance is especially important because there is no way to make up for time in class by reading a book.

I will assign participation scores three times over the quarter. Your final participation score for the quarter will be the sum of these scores.

3.6 Final grade

Grades will be assigned as follows.

Points	Grade
≥ 900	A
870–899	B+
800–869	B
770–799	C+
700–769	C
670–699	D+
600–660	D
< 600	F

4 Course policies

4.1 Piazza

All homework questions must be asked through Piazza. You can sign up for the class Piazza page here: http://piazza.com/rose-hulman/fall2019/psyc410. If you are unfamiliar with Piazza, it's basically a discussion board for homework questions. The main benefits are: you can ask questions anonymously, everyone gets to see my answers, and other students can answer questions. It's a much better system than asking me questions privately over email, and it has worked very effectively when I've taught this class in the past. For this reason, I will NOT answer any homework questions over email. Instead, any time I receive a homework question over email, I will direct you to re-post it on Piazza so everyone can see my answer.

4.2 Late assignments

You have **two free late days** that can be used for any **homework assignments ONLY**. They may not be used for reading responses or project submissions. Assignments will be considered one day late if they are submitted any time after the submission deadline up to 24 hours later. Assignments will be considered two days late if they are submitted any time between 24 and 48 hours after the submission deadline. You don't need to notify me in advance if you plan to use one of your late days—I will keep track of your late days and notify you by email when you have no late days remaining.

Any assignments submitted after your using your late days will not be accepted. The purpose for this policy is to help me grade and return your work in a timely fashion.

4.3 Academic integrity

Academic misconduct will be addressed according to the policies described in the Rose-Hulman student handbook (see here). Academic misconduct includes: (1) submitting work that is not your own; (2) copying ideas, words, or graphics from any source without appropriate citation; (3) misrepresenting your work or yourself (i.e., deliberately submitting the wrong assignment or lying to explain a late assignment); (4) collaborating with other students when this is not permitted; and (5) submitting the same work for credit in two courses without prior consent of both instructors. If you are unsure whether something qualifies as academic misconduct, please check with me before engaging in the behavior.

5 Course schedule

The following schedule lists topics, readings, and due dates for the quarter. This schedule is tentative. Schedule changes will be announced in class and will be posted online. I will give you plenty of notice when such changes are made.

Week	Date	Topic	Reading	Due
0	9/5	Introduction		
	9/6	Basics	Farrell & Lewandowsky	Response
1	9/9	Basics	Scholarpedia: RW model	
	9/10	Basics	Perfors et al pp 1–16	
	9/12	Cognitive science	Lake et al	Response
	9/13	Generalization	Tenenbaum & Griffiths	Response
2	9/16	Generalization	Sanjana & Tenenbaum	HW 1; Response
	9/17	Generalization		
	9/19	Concept learning		
	9/20	Concept learning	Nosofsky	Response
3	9/23	Concept learning	Perfors et al pp 16–23	HW 2
	9/24	Concept learning		
	9/26	Concept learning		
	9/27	Concept learning	Kemp et al (*)	Response
4	9/30	Sampling assumptions		HW 3
	10/1	Sampling assumptions	Shafto et al (*)	Response
	10/3	Sampling assumptions	Frank & Goodman	Response
	10/4	Sampling assumptions		
5	10/7	Sampling assumptions		
	10/8	Sampling assumptions	Markant & Gureckis (*)	Response
	10/10		Fall break	
	10/11		Fall break	
6	10/14	Social cognition		HW 4
	10/15	Social cognition	Jern et al	Response
	10/17	Social cognition		
	10/18	Social cognition		
7	10/21	Social cognition	Bridgers et al (*)	Response
	10/22	Sequential learning		HW 5
	10/24	Sequential learning		
	10/25	Sequential learning	Brown & Steyvers (*)	Response
8	10/28	Causal learning		Project proposal
	10/29	Causal learning		
	10/30	Causal learning	Griffiths & Tenenbaum (*)	Response
	11/1	TBD		
9	11/4	Project time		
	11/5	Project time		
	11/7	Project time		
	11/8	Project time		
10	11/11	Project time		

Week	Date	Topic	Reading	Due
	11/12	Presentations		
	11/14	Presentations		
	11/15	Conclusion		
Finals	11/18			Project report