

COGSCI 190: Data Science and Cognition (Fall 2016)

Instructor: Yang Xu

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Description: This course develops computational thinking and technical skills for senior undergraduates and graduate students who wish to pursue data-driven approaches to cognitive science and related disciplines. It introduces core ideas from probability theory, information theory, statistics, and machine learning, and explores the nature of human cognition from a computational perspective. The course emphasizes hands-on analysis of data and involves a combination of lectures, discussion, labs, and research-oriented project clinics.

Prerequisite: Basic programming skills, preferably in Python.

Units: 3.

Readings: No single textbook will be used for instruction. Instead, the course will rely on: 1) published work in cognitive science and related disciplines; 2) publicly accessible technical references or textbooks that are available in the UC libraries. Suggested publicly available references: Exploratory Data Analysis (cf. Tukey, '77), Information Theory, Inference, and Learning Algorithms (Mackay, '05), Elements of Statistical Learning (Hastie et al., '09). Additional reading materials will be posted on bcourses syllabus as the course progresses.

Grade distribution:

Lab assignments	50%
Project	40%
In-class participation	10%

Letter grade distribution:

>96.90	A+	77.00 - 79.90	C+
93.00 - 96.90	A	73.00 - 76.90	C
90.00 - 92.90	A-	70.00 - 72.90	C-
87.00 - 89.90	B+	67.00 - 69.90	D+
83.00 - 86.90	B	63.00 - 66.90	D
80.00 - 82.90	B-	60.00 - 62.90	D-
		<60.00	F

Policies:

- **General**

- Collaborations should be explicitly acknowledged in all assignments and projects.
- Exploitation in any collaborative assignment or project is prohibited.
- Plagiarism in any form is prohibited.

- **Labs**

- Students are expected to work in pairs or independently as instructed during labs.
- Students are responsible for all missed assignments or other forms of work.
- Lab assignments are always due at the beginning of (immediate upcoming) sessions.
- Lab assignments beyond due hour will receive a deduction of *1 point per delayed hour*.
- No makeup of assignments is allowed without the instructor's consent *a priori*.

- **Project**

- Undergraduate students may choose to work in pairs or independently in a project.
- Graduate students are expected to work independently in a project.
- Students may work on an outside-the-class project under the instructor's permission.
- External sources of code or data should be referenced in full in the project report.
- Project reports beyond due hour will receive a deduction of *1 point per delayed hour*.
- Each student is expected to participate in the clinics sessions.
- Each student is expected to present and pose questions in the final presentation.

- **Attendance**

- Attendance to each session is required (1 point deduction per session absent).
- Temporary absence with the instructor's consent will not receive deduction of points.

Schedule:

The weekly schedule might be subject to minor adjustments as the course progresses. Assessed items are marked in *italics*.

Session	Description
1	<ul style="list-style-type: none">• Linking cognitive and data sciences• <i>Lab 0</i>
2	<ul style="list-style-type: none">• Case 1: Human irrationality and rationality• <i>Lab 1</i>
3	<ul style="list-style-type: none">• Bootcamp 1: Probability theory (discrete, continuous)• <i>Lab 2 (Lab 1 due)</i>
4	<ul style="list-style-type: none">• Case 2: Information processing capacity• <i>Lab 3 (Lab 2 due)</i>
5	<ul style="list-style-type: none">• Bootcamp 2: Information theory• <i>Lab 4 (Lab 3 due)</i>
6	<ul style="list-style-type: none">• Case 3: Cognitive economy in categorization• <i>Lab 5 (Lab 4 due)</i>
7	<ul style="list-style-type: none">• Bootcamp 3: Statistical inference (estimation)• <i>Lab 6 (Lab 5 due)</i>
8	<ul style="list-style-type: none">• Case 4: Cognitive economy in language• <i>Lab 7 (Lab 6 due)</i>
9	<ul style="list-style-type: none">• Bootcamp 4: Machine learning (logistic regression, pca)• <i>Lab 8 (Lab 7 due)</i>
10	<ul style="list-style-type: none">• Project announcement• Research topics
11	<ul style="list-style-type: none">• <i>Round-table presentation, Q&A</i>• <i>Project proposal due (Lab 8 due)</i>
12	<ul style="list-style-type: none">• <i>Milestone presentation</i>
13	<ul style="list-style-type: none">• <i>Concluding presentation, Q&A</i>• <i>Project report due</i>