

CSE 518A

Human-in-the-Loop Computation

Instructor: Chien-Ju Ho

Course Information

- Announcements and discussion
 - Website: <http://chienjuho.com/courses/cse518a/fa2019/>
 - Piazza: <http://piazza.com/wustl/fall2019/cse518a/home>
- Time and location
 - M/W 4:00-5:20pm
 - Cupples II / 230
- Graduate TA:
 - Wei Tang (w.tang@wustl.edu)

Plan for today

- Welcome and introduction
- What's the class about?
- Logistics

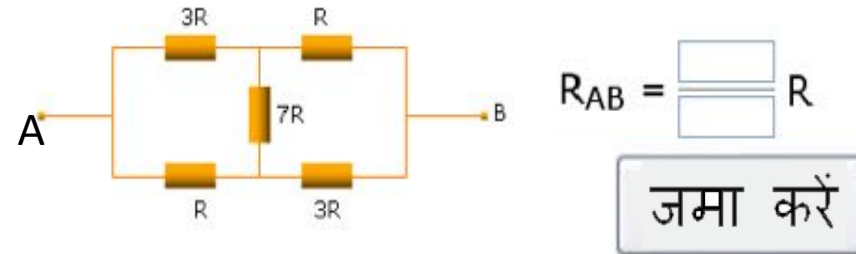
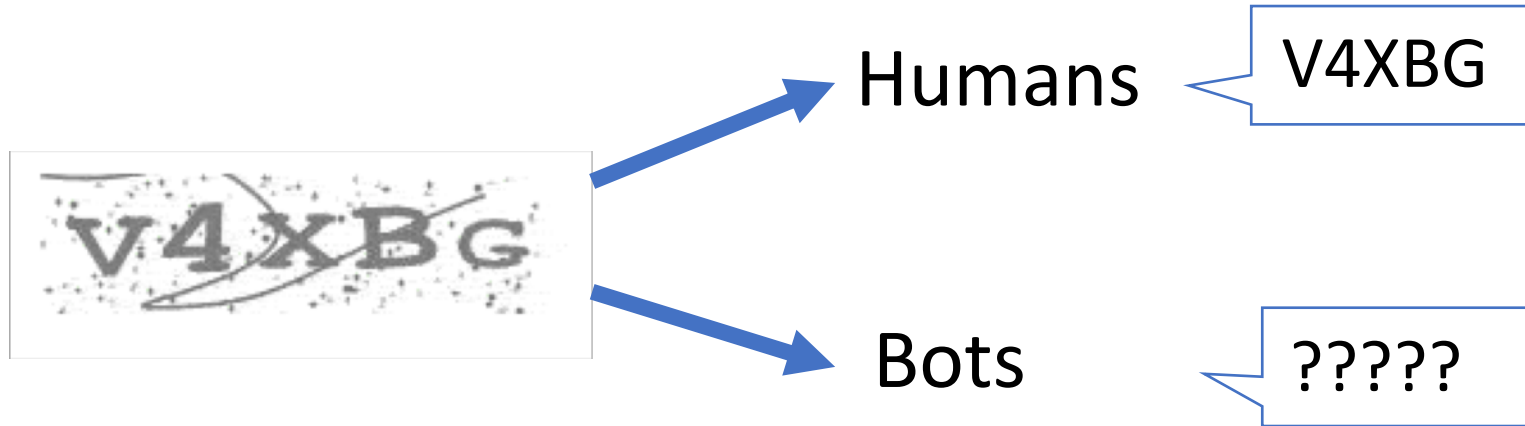
About Me

- Joined WashU in Fall 2017.
- Research interests:
 - Design and analysis of human-in-the-loop systems
 - Crowdsourcing and human computation, machine learning, game theory, optimization, online behavioral social science, and human-computer interactions.

Human-in-the-Loop Computation?

CAPTCHA

Completely **A**utomated **P**ublic **T**uring test to tell **C**omputers and **H**umans **A**part



Roughly 200 million CAPTCHAs are typed every day*

10s of human time per CAPTCHA

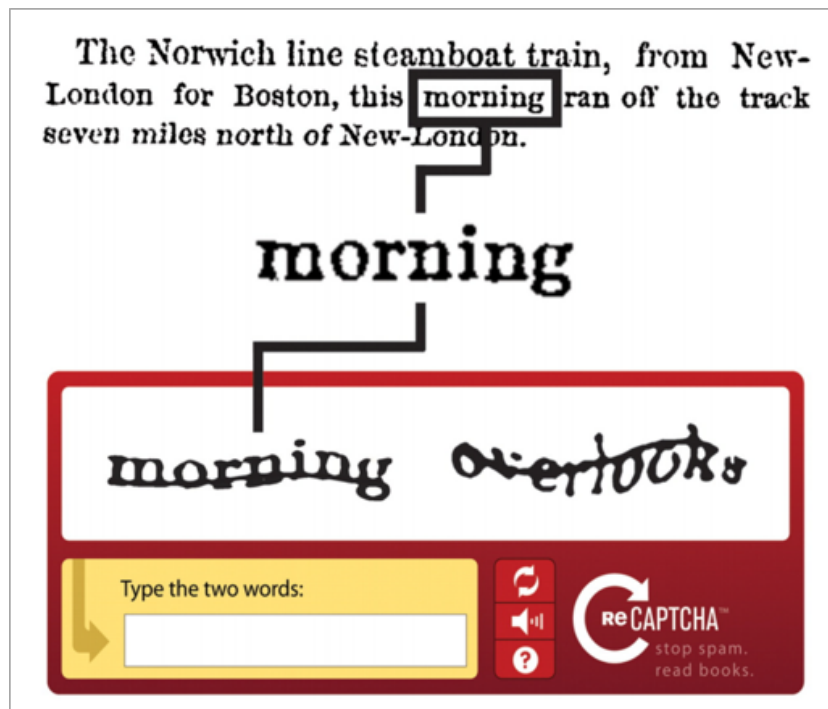
Can we utilize this wasted human computation power?

What tasks are humans solving in CAPTCHAs?

- Optical Character Recognition (OCR)

This aged portion of society were distinguished from

Can we utilize CAPTCHAs to help solve OCR tasks?

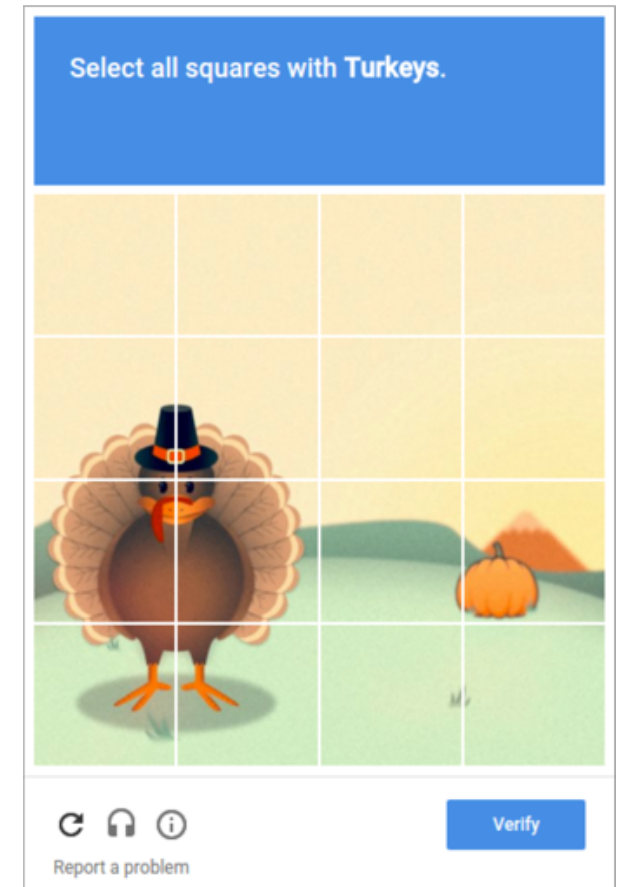


Word 1: an OCR task to solve
Word 2: tell apart humans and bots

“reCAPTCHA has completely digitized the archives of The New York Times and books from Google Books, as of 2011”

More than OCR

- Google acquired reCAPTCHA in 2009.

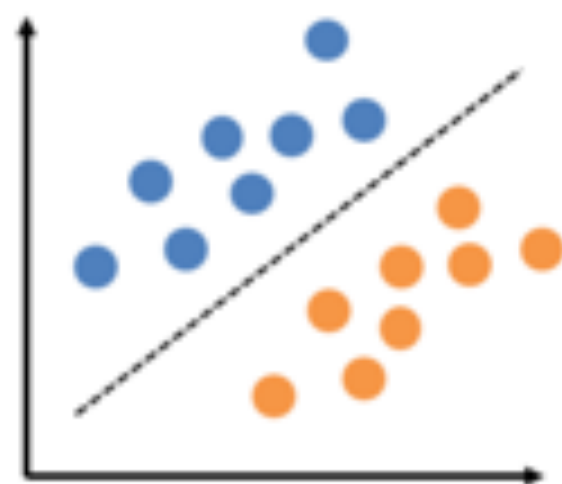




Training Data



Hard Tasks



Technology

Massachusetts woman's lawsuit accuses Google of using free labor to transcribe books, newspapers

The lawsuit was tossed by the judge. But ethical considerations (e.g., fairness, privacy) are important issues to consider in human-in-the-loop computation.

Are there other examples of
human-in-the-loop computation?

Article [Talk](#) [Read](#) [Edit](#) [View history](#)

Crowdsourcing

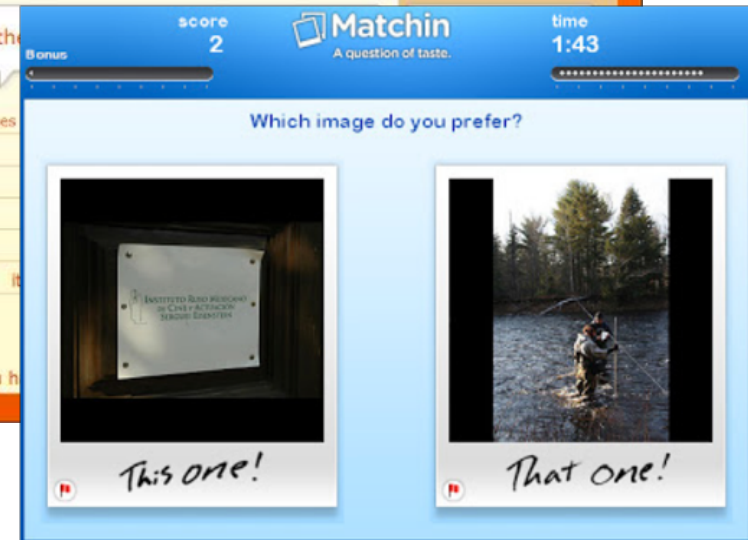
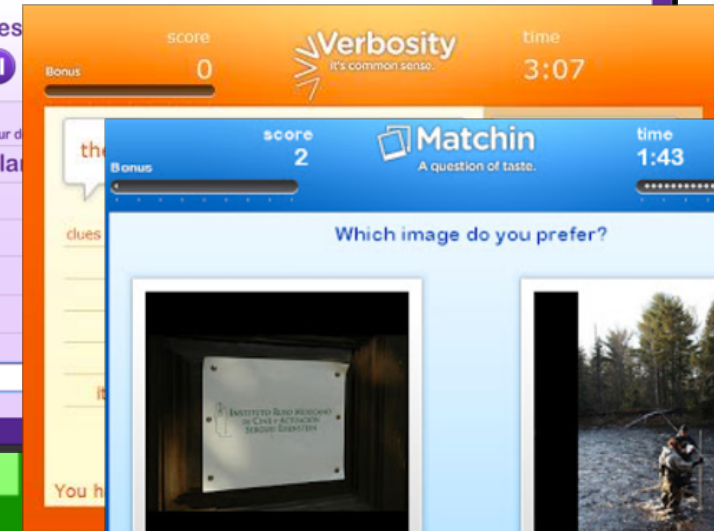
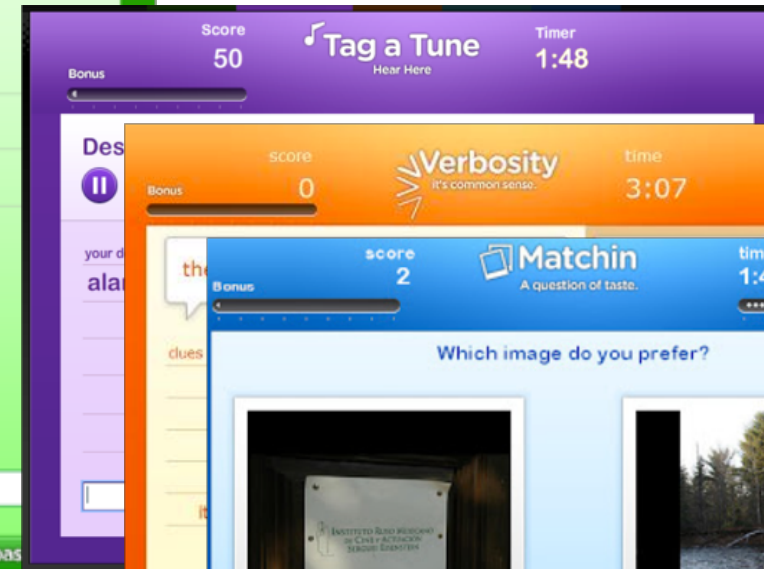
From Wikipedia, the free encyclopedia

Crowdsourcing is a [sourcing model](#) in which individuals or organizations obtain [goods and services](#). These services include ideas and finances, from a large, relatively open and often rapidly-evolving group of [internet](#) users; it divides work between participants to achieve a cumulative result. The word crowdsourcing itself is a [portmanteau](#) of [crowd](#) and [outsourcing](#), and was coined in 2005.^{[1][2][3][4]} As a mode of sourcing, crowdsourcing existed prior to the digital age (i.e. "[offline](#)").^[5]

There are major differences between crowdsourcing and outsourcing. Crowdsourcing comes from a less-specific, more public group, whereas outsourcing is commissioned from a specific, named group, and includes a mix of bottom-up and top-down processes.^{[6][7][8]} Advantages of using crowdsourcing may include improved costs, speed, quality, flexibility, scalability, or diversity.^{[9][10]}

Some forms of crowdsourcing, such as in "idea competitions" or "innovation contests" provide ways for organizations to learn beyond the "base of minds" provided by their employees (e.g. [LEGO Ideas](#)).^[11] Tedious "microtasks" performed in parallel by large, paid crowds (e.g. [Amazon Mechanical Turk](#)) are another form of crowdsourcing. It has also been used by [not-for-profit](#) organizations and to create [common goods](#) (e.g. [Wikipedia](#)).^[12] The effect of user communication and the platform presentation should be taken into account when evaluating the performance of ideas in crowdsourcing contexts.^[13]

Utilize the crowd of humans to help solve tasks that **computers/AIs cannot solve yet.**



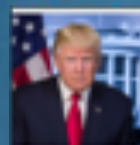
HEALTHY LIVING 09/19/2011 03:37 pm ET | Updated Nov 19, 2011

Gamers Decode AIDS Protein That Stumped Researchers For 15 Years In Just 3 Weeks

von Ahn and Dabbish. "Labeling Images with a Computer Game". 2004.

How often will Trump tweet this week?

PREDICT IT NOW!



39 or fewer

39.POTUSTWEETS.020717

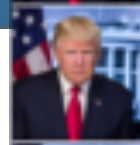
1¢ ↓ 1¢

2¢

1¢

99¢

98¢



40 - 44

40.POTUSTWEETS.020717

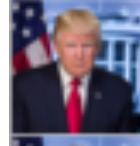
2¢ ↓ 5¢

3¢

2¢

98¢

97¢



45 - 49

45.POTUSTWEETS.020717

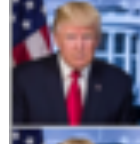
12¢ ↓ 11¢

14¢

12¢

88¢

86¢



50 - 54

50.POTUSTWEETS.020717

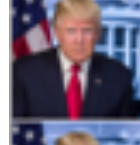
19¢ ↓ 7¢

21¢

19¢

81¢

79¢



55 - 59

55.POTUSTWEETS.020717

24¢ ↑ 1¢

25¢

23¢

77¢

75¢



60 - 64

60.POTUSTWEETS.020717

26¢ ↑ 12¢

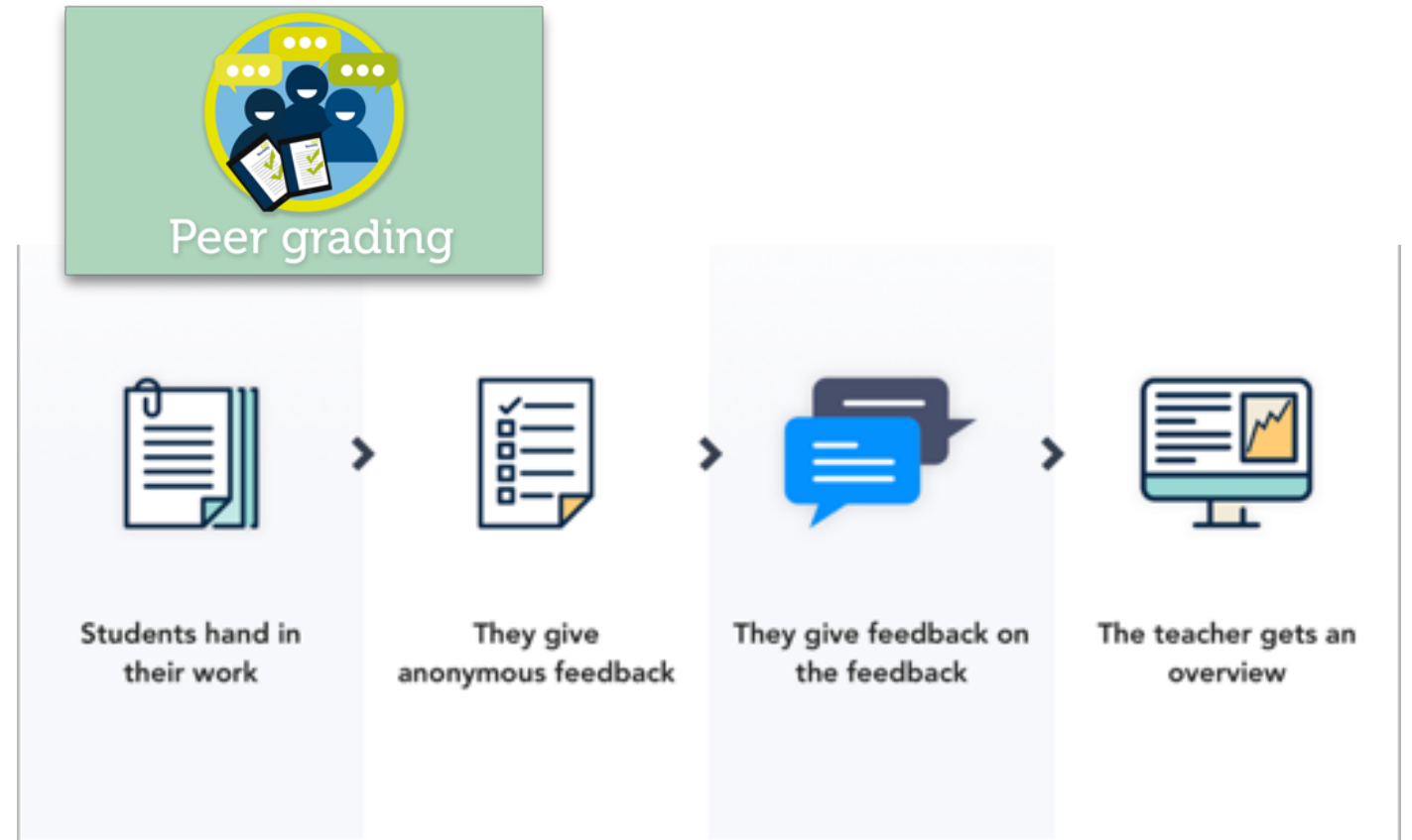
25¢

23¢

77¢

75¢

Education



In fact, a lot more...



General-Purpose Platform: Crowdsourcing Markets



HIT Groups (1-20 of 1318)

Show Details

Hide Details

Items Per Page:

20

Requester	Title	HITs	Reward	Created	Actions	
Megan	Categorization	45,696	\$0.01	1h ago	Preview	Quality
Berch Mturk	Kitchen Appliance Classification	14,958				
Dra Dodson	Find email address and first/last name of Office Manag...	9,327				Work
	Find email address and first/last name of Office Manag...	8,677	\$0.11	1d ago	Preview	Accept & Work
	Why is this review positive?	7,965	\$0.01	6d ago	Preview	Accept & Work
	Why is this review negative?	7,058	\$0.01	6d ago	Preview	Accept & Work
	Market Research Survey	6,680	\$0.01	1h ago	Preview	Accept & Work
	Find email address and first/last name of owners or ge...	4,511	\$0.11	1d ago	Preview	Accept & Work

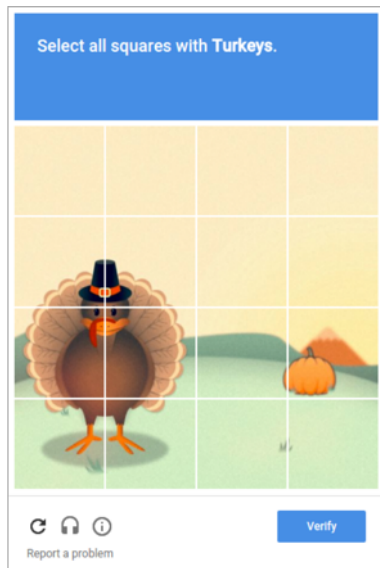
Post Tasks:

- Audio transcription
- Image tagging
- Relevance evaluation
- Handwriting recognition
- Product information collection

Specify payments

What is this course about?

- Study the design and analysis of human-in-the-loop computation.



Human as data sources:

Label aggregation

Probabilistic reasoning to aggregate noisy human data

Practical challenges:

Real-time and complex tasks

Studies on workflow and team designs from HCI perspective

Humans are “Humans”:

Incentive design

Game theoretical modeling of humans and incentive design

Selected recent topics:

Ethical issues of AI/ML, learning with strategic behavior, Human-AI collaborations.

- Will cover research papers from a wide spectrum of research fields, including machine learning, economics, optimization, and human-computer interactions.

Let's take a look at the course schedule

- <http://chienjuho.com/courses/cse518a/fa2019/>

Grading

- Course Project: 40%
- Homework assignment: 20%
 - 4 homework assignments
- Paper reviews and class participation: 20%
- Paper presentation and leading of discussion: 20%

Course Project

- The main component of the course.
- Could be an **original research project** or an **extensive literature survey**.
 - You are encouraged to start with a research project. You will have the chance to convert the project to literature review if things don't go well.
- Tentatively, you should work in groups of 2 (or 3 if the class size is large).
 - Will announce the detailed guidelines next week after the class size is finalized.

Tentative Timeline of Project

- Sep 20: Project proposal (and deciding team members)
 - Brief description of the proposed project (1~2 paragraph)
 - Citing at least one paper that's relevant to your proposal
- Oct 9: Milestone 1
 - A brief literature review and the description of your plan (one page)
 - Last chance to change the topic of the project
- Oct 30: Milestone 2
 - Summary of your current progress (up to 2 pages)
 - Last chance to convert the research project to (a more extensive) literature review
- Dec 2-4: In-class project presentations
- Dec 8: Project report due

Paper Reviews and Class Participation

- Finish the required reading and submit a review (including a summary and answering additional questions).
 - Due by the **midnight before each lecture.**
 - Exception: the review for next lecture is due at noon the day of the lecture.

Required The Rise of Crowdsourcing . Howe. Wired. 2006.	Submit Review (Due: Noon, August 28)
Optional Labeling Images with a Computer Game . von Ahn and Dabbish. CHI 2004. reCaptcha: Human-based Character Recognition via Web Security Measures . von Ahn et al. Science. 2008. Predicting Protein Structures with a Multiplayer Online Game . Cooper et al. Nature. 2010.	

- It is important to come to the class for participate in discussion.

Do you *really* need to read the whole paper?

- You are not expected to understand every detail or every proof in the papers that we cover.
- However, you should be ready to answer the following questions:
 - Summary the paper in 2~3 sentences.
 - What's the research question the paper is solving?
 - What's the proposed approach?
 - What are the results?
 - List 1~3 points you like about the paper.
 - Discuss potential future directions based on this paper.
 - It might be hard in the beginning. Try to think about what assumptions they make, and whether you can relax some of those? Can you apply the method/approach of the paper in different domains/applications, etc?

Paper Presentations and Leading of Discussion

- Take a look at the topics from remark [Student Presentations]
 - You will be asked to sign up to present the paper(s) and lead the discussion for one of the lectures, possibly in groups of 2~3 students (again, more to come next week).
- Presenters:
 - Read the required paper and at least one optional paper for the assigned class
 - Discuss with me (one week before class) about the presentation and the reading questions
 - Give a presentation for 70~80 minutes and lead the discussion in class
- Non-presenters:
 - Submit reviews on time and engage in the discussion in class.

Grading

- Course Project: 40%
- Homework assignment: 20%
 - 4 homework assignments
- Paper reviews and class participation: 20%
- Paper presentation and leading of discussion: 20%

Take another look at the syllabus

- Collaboration policy
 - You are encouraged to collaborate, but all assignments **must** be written down on your own.
- Late day policy
 - Assignments
 - 4 late days in total. No 2 late days per assignment.
 - Reviews
 - No late submissions. But you can skip 2 of them without penalty.
 - Project-related reports
 - No late submissions.

Next lecture:

- Read the required reading of next lecture and submit the review!

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- Please submit the review on time so I can get a better sense of how many students will stay in the course.
- You **cannot** apply the late-day rule for this review.

Another thing to do

- Register as a worker of Amazon Mechanical Turk or Figure Eight today
 - MTurk: <https://www.mturk.com/>
 - Figure Eight: <https://www.figure-eight.com/>
 - (MTurk is recommended for the assignment)
- You will be asked to be a worker yourself and complete tasks on crowdsourcing markets in Assignment 1
 - MTurk: After you successfully register, Amazon will send you invitation for working, which may takes several business days.
- Do it early, and let me know if there are any issues in the process.

Questions?