

CSE 518A

Human-in-the-Loop Computation

Instructor: Chien-Ju (CJ) Ho

Course Information

- Announcements and discussion
 - Website: <http://chienjuho.com/courses/cse518a>
 - Piazza: <http://piazza.com/wustl/fall2021/cse518a>
 - Please check the website and Piazza regularly.
- Time and location
 - Tue/Thu 4:00-5:20pm
 - Whitaker 218

Plan for today

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

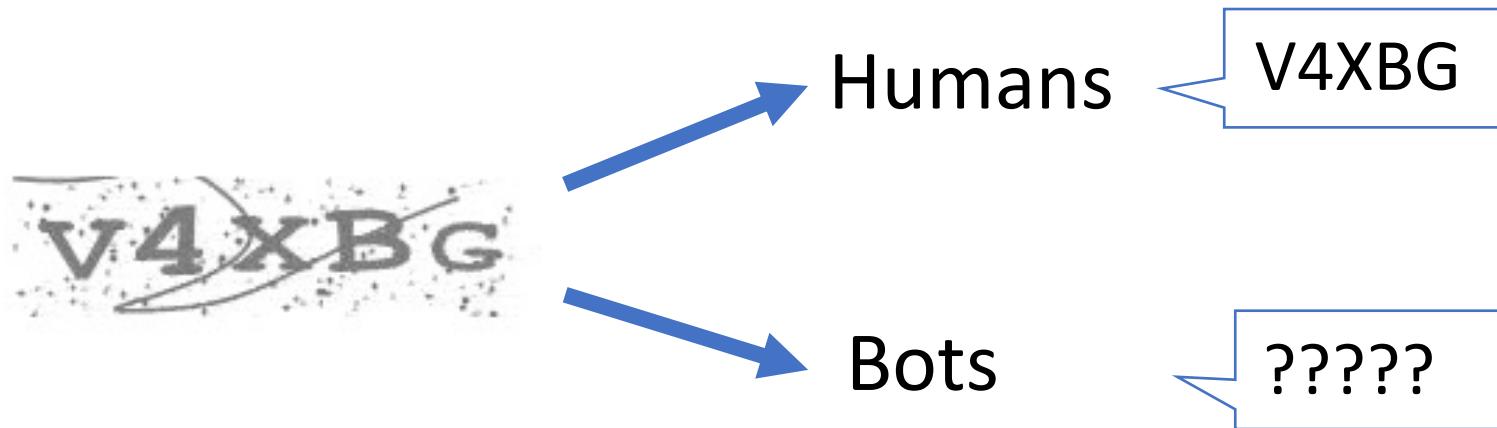
About Me

- 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



Показывать информацию обо мне

Всем
 Только зарегистрированным пользователям
 Никому

Защита от автоматической регистрации

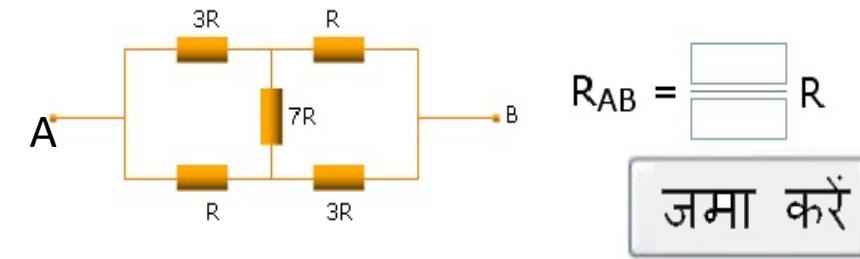
$\lim_{x \rightarrow 0} \ln \left(2 + \sqrt{\arctg x \cdot \sin \frac{1}{x}} \right)$

Введите ответ

X Очистить

Всё верно

<http://forum.academ.org/>



Humanity wastes about 500 years per day on CAPTCHAs. It's time to end this madness

05/13/2021



Thibault Meunier

Can we utilize this wasted human computation power?

What are humans doing for solving CAPTHCAs?

- Solving tasks that AIs cannot do well yet.
- Optical Character Recognition (OCR)
 - Hard for AI (at the time but not anymore)
 - Relatively Easy for humans

This aged portion of society were distinguished from

Can we utilize CAPTCHAs to help solve OCR tasks?



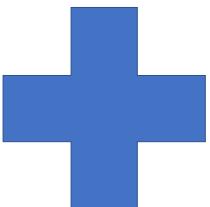
The Norwich line steamboat train, from New-London for Boston, this morning ran off the track seven miles north of New-London.

morning



Word 1: an OCR task to solve

Word 2: tell apart humans and bots



VOL. L., NO. 1.

NEW-YORK, THURSDAY, SEPTEMBER 18, 1851.

PRICE ONE CENT.

YORK DAILY TIMES
Every MORNINg. Daily excepted
in the winter. Price, 25c. Postage
paid at New-York, and postage
and a week's time, when they prefer that
they be sent by mail. Subscriptions
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begin at \$1.00 per year.

YORK DAILY TIMES
VS. FROM EUROPE.
P. T. THE EUROPEAN MAIL.
S. IN ENGLAND.

S. IN FRANCE.—ARRESTS, &c.
DISTURBANCES IN AUSTRIA.
ENRY EUROPE.

From the *American Standard*.

LOMBARDY!

TUESDAY, NOVEMBER 12, 1851.

THE TIMES.

More than OCR

- Google acquired reCAPTCHA in 2009.

Type the characters that appear in the picture below.
Or [sign in](#) to get more keyword ideas tailored to your account. 



eineedit

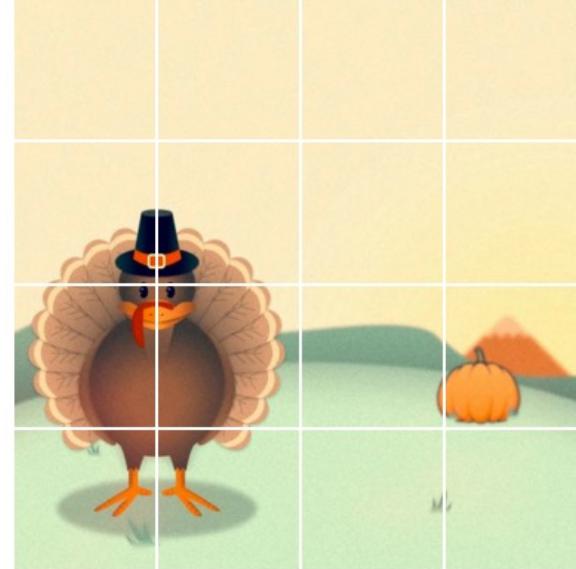
Select all images with sandwiches.



Report a problem

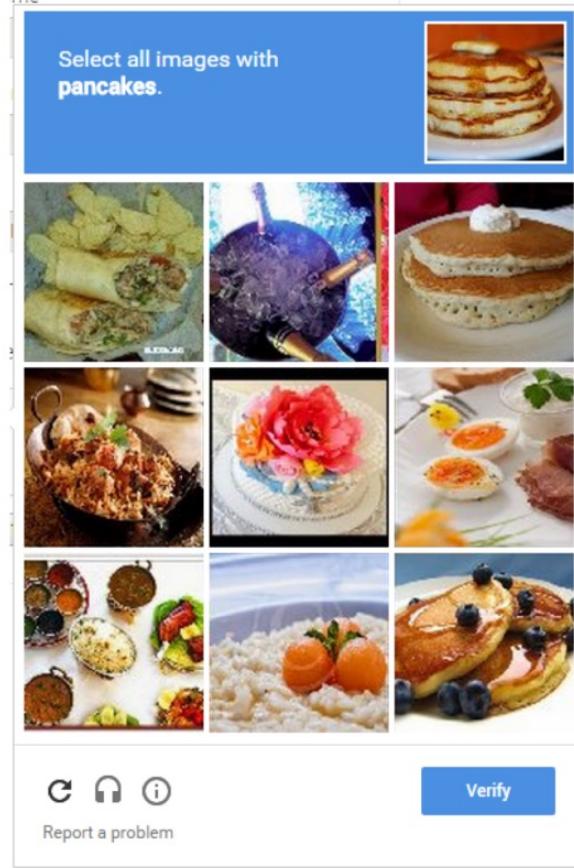
Verify

Select all squares with Turkeys.



Report a problem

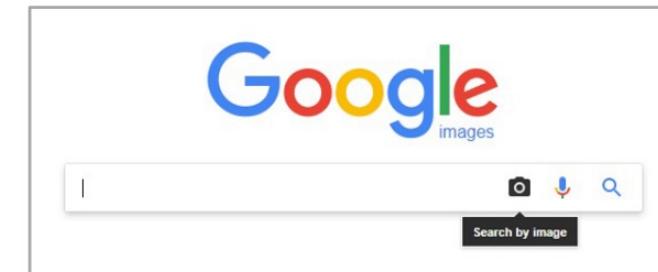
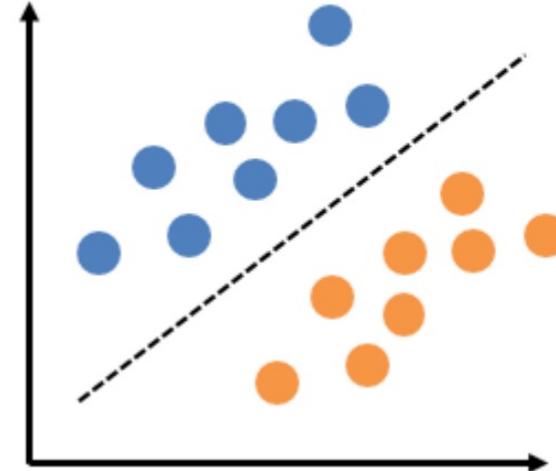
Verify



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?



WIKIPEDIA
The Free Encyclopedia

Article [Talk](#)

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

Search Wikipedia

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]}

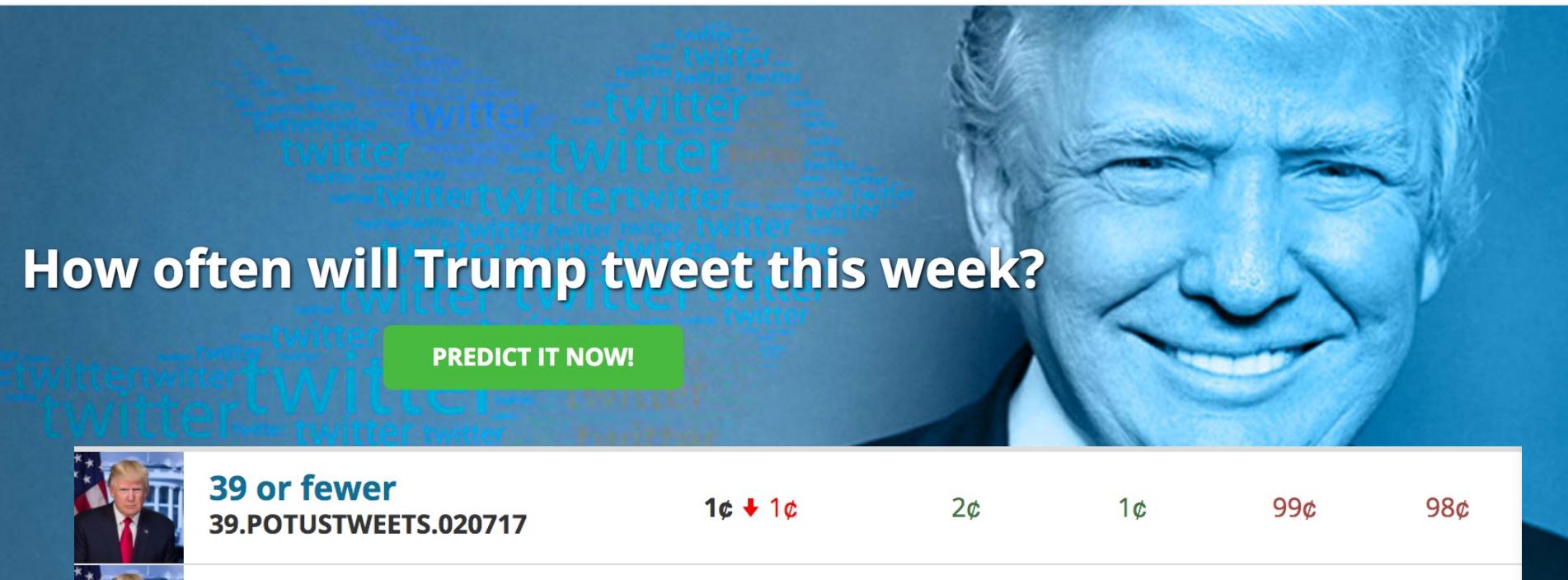
Some forms of crowdsourcing, such as in "idea competitions" or "innovation contests" provide ways for organizations to learn beyond the "base of minds" provided by their employees (e.g. [LEGO Ideas](#)).^[11] Tedious "microtasks" performed in parallel by large, paid crowds (e.g. [Amazon Mechanical Turk](#)) 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]



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.



39 or fewer
39.POTUSTWEETS.020717

1¢ ↓ 1¢

2¢

1¢

99¢

98¢



40 - 44
40.POTUSTWEETS.020717

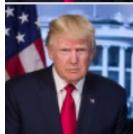
2¢ ↓ 5¢

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
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26¢ ↑ 12¢

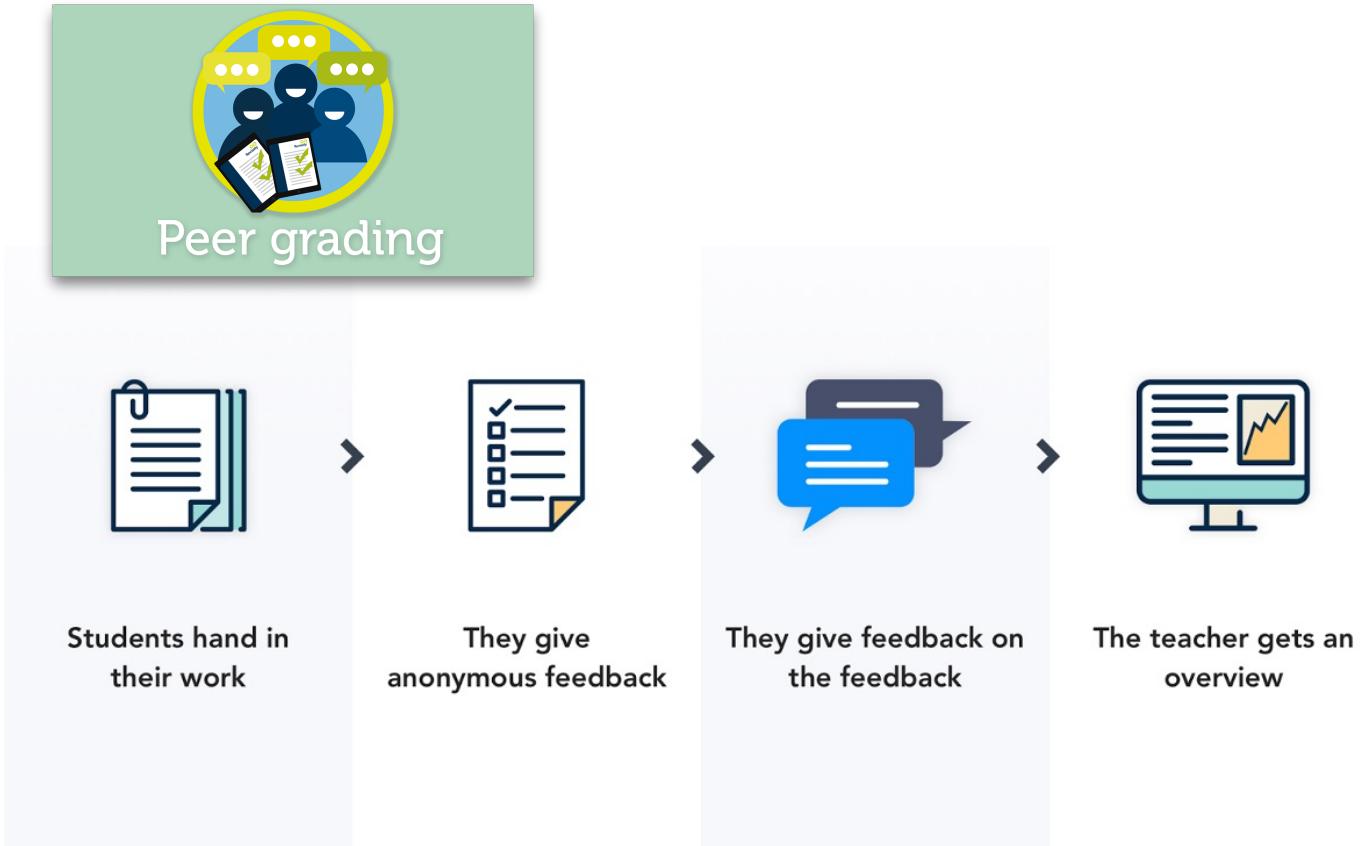
25¢

23¢

77¢

75¢

Education



General-Purpose Platform: Crowdsourcing Markets



HIT Groups (1-20 of 1318)

[Show Details](#)[Hide Details](#)

Items Per Page:

20

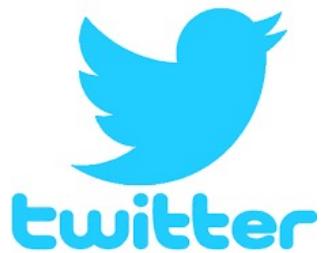
Requester	Title	HITs	Reward	Created	Actions
+ Megan	Categorization	45,696	\$0.01	1h ago	Preview Qualify
+ Perch Mturk	Kitchen Appliance Classification	14,958			Qualify
+ Sandra Dodson	Find email address and first/last name of Office Manager	9,327			Work
	Find email address and first/last name of Office Manager	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
	Classify Receipt	4,200	\$0.02	2m ago	Preview Qualify

Post Tasks:

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

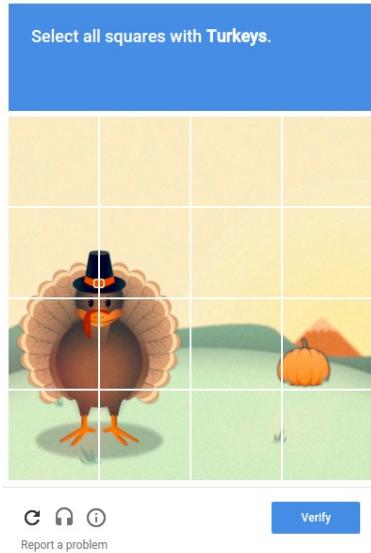
Specify payments

In fact, a lot more...



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:

Complex tasks and teams

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>

Logistics

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 24: 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 15: Milestone 1
 - A brief literature review and the description of your plan (one page)
 - Last chance to change the topic of the project
- Nov 5: 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 7/9: In-class project presentations
- Dec 12: Project report due

Grading

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- **Homework assignment: 20%**
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Homework Assignments

- Assignment 1
 - Be a crowdsourcing worker
 - Write a report on the experience and make suggestions
- Assignment 2
 - Programming assignment
 - Implement label aggregation algorithms covered in class on a given dataset
- Assignment 3
 - Math assignment
 - Using game theory to analyze some given human-in-the-loop mechanisms.
- Assignment 4
 - TBD

Grading

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

Paper Reviews and Class Participation

- Before each lecture, finish the required reading and submit a review (including a summary and answers to additional questions).
 - Due by the **midnight before each lecture**.
 - Exception: the review for next lecture is due at 2pm the day of the lecture.

Sep 2	Crowdsourcing: Background and Applications	Required The Rise of Crowdsourcing . Howe. Wired. 2006. 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.	Submit Review (Due: 2pm, Sep 2)
			Assignment 1 (Expected Due: Sep 17)

- It is important to come to the class for participate in discussion.
 - Participations will be part of your final grades

More on the Required Reading and Review

- You should be ready to answer the following questions:
 - Summary the paper in 3~4 sentences.
 - What's the research question the paper is solving?
 - What's the proposed approach?
 - What are the results?
 - Illustrate what you like/dislike about the paper.
 - Answer additional questions related to the paper.
- Try also to think about your project during reading
 - 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?

Grading

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

Paper Presentations and Leading of Discussion

- You will need to sign up to present the paper(s) and lead the discussion, in groups of 2~3 students (again, more to come next week).
 - Take a look at the current schedules
- Presenters:
 - Read the required paper and additional optional papers for the assigned class
 - Discuss with me (one week before class) about the presentation and the reading questions
 - We will talk more about the presentation format next week
- 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%

More on The Grades

- Homework assignments / reviews will be lightly graded
- Condition on you complete all other requirements satisfactorily, your final grades are determined by your final project
 - A+: Your project is close to be published in top venues
 - A: I'm happy to use your project as model projects in the future
 - A-: Overall good, but there are minor flaws (in reports/presentation/approaches/...)
 - B+ or lower: There are more significant flaws in the project (e.g., poorly motivated problems, etc)
- Your final grades will be decreased from the above for missing reviews / homework issues / non-participation using the grading scheme (following the standard mapping)

Collaboration and Late-Day Policy

- 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!

Sep 2	Crowdsourcing: Background and Applications	Required The Rise of Crowdsourcing . Howe. Wired. 2006.	Submit Review (Due: 2pm, Sep 2)
		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.	Assignment 1 (Expected Due: Sep 17)

- 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 and skip this review.

Another thing to do

- Register as a worker in one of the crowdsourcing platforms
 - Amazon Mechanical Turk: <https://www.mturk.com/worker>
 - Recommended, but they don't approve all registration requests
 - Appen: <https://appen.com/jobs/>
 - microWorkers: <https://www.microworkers.com/faq.php>
 - Clickworker: <https://www.clickworker.com/clickworker>
- You need to be a worker and complete tasks for Assignment 1
- Do it early, and let me know if there are any issues in the process
 - The registration process could take several business days

Is the course for you?

- Need to be comfortable with several math concepts and basic programming
 - Probability
 - linear algebra
 - calculus
 - basic concepts about computer science and ability to program
- If you are not sure, please take a peek at the papers from Sep 9 – 30
 - You should at least be able to understand the formulation and main results
 - You will need to implement some algorithms in these papers

Questions?