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/fall2022/cse518a
  - Please check the website and Piazza regularly

- Time and location
  - Tue/Thu 4:00-5:20pm
  - Hillman 70

Plan for today

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

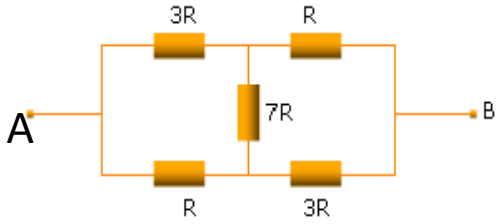
Human-in-the-Loop Computation?

CAPTCHA

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

Humans → V4XBG

Bots → ?????



$R_{AB} = \frac{\square}{\square} R$

जमा करें

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

05/13/2021

Thibault Meunier

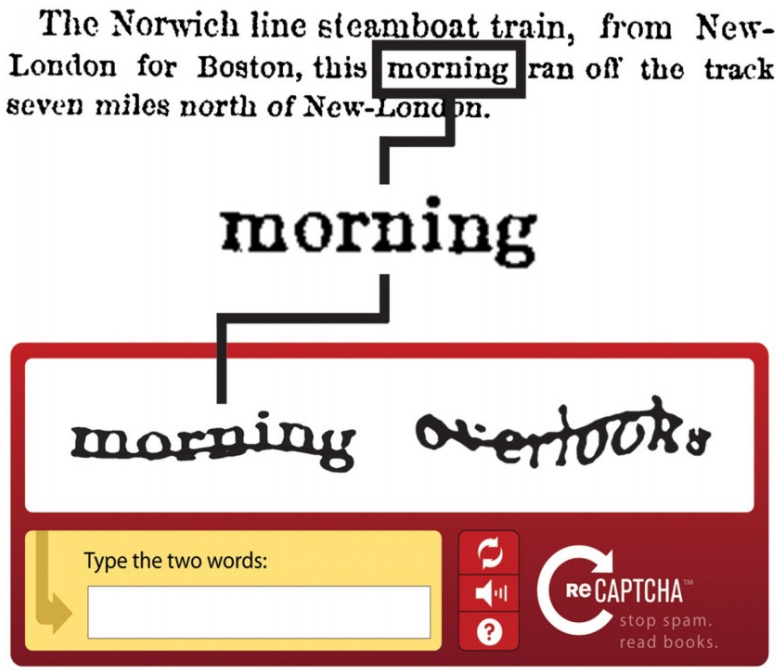
Can we utilize this wasted human computation power?

What are humans doing for solving CAPTHCAs?

- Solving tasks that AIs cannot do well yet

- Optical Character Recognition (OCR)
  - Hard for AI (used to be but not anymore)
  - Relatively Easy for humans

Can we utilize CAPTCHAs to help solve OCR tasks?



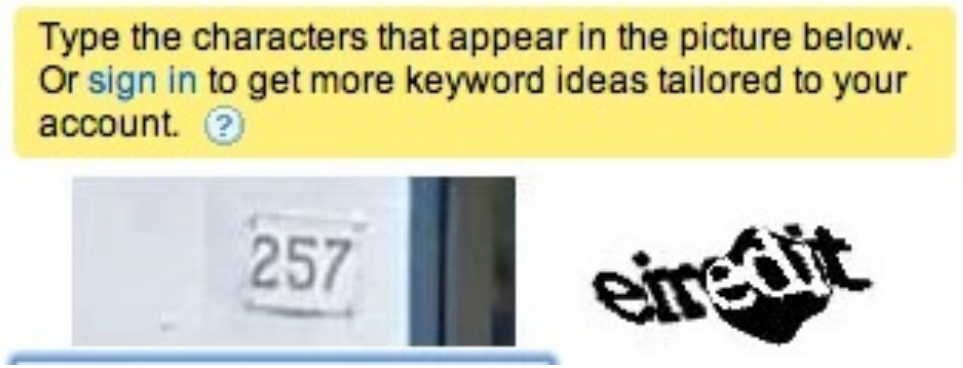
Word 1: an OCR task to solve
Word 2: tell apart humans and bots

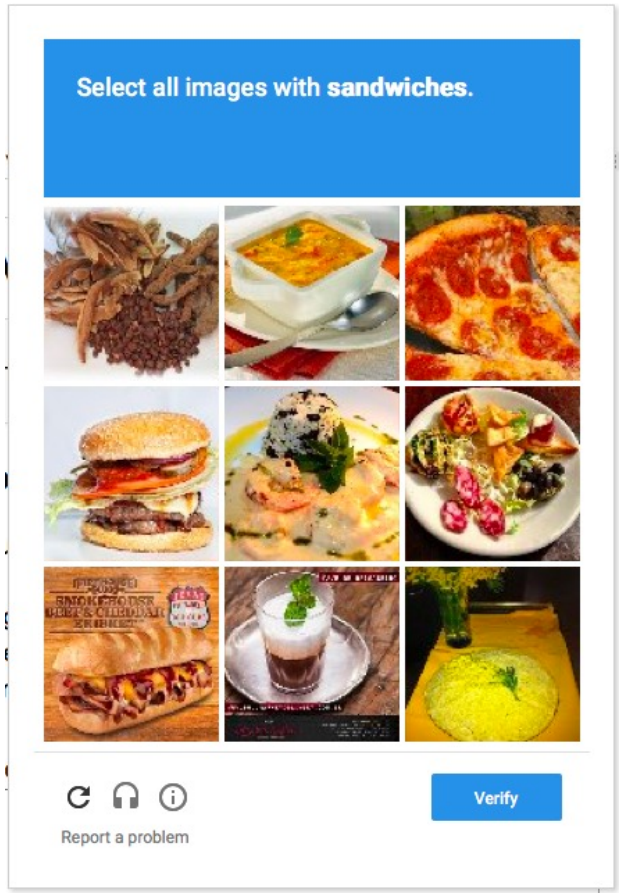
"reCAPTCHA has completely digitized the archives of The New York Times and books from Google Books, as of 2011"

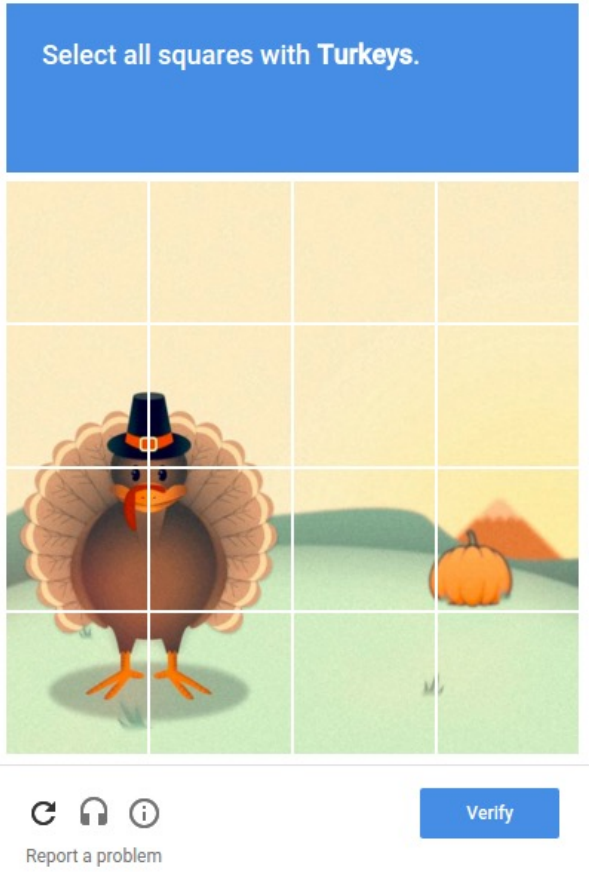
von Ahn et al. reCaptcha: Human-based Character Recognition via Web Security Measures. Science, September 2008

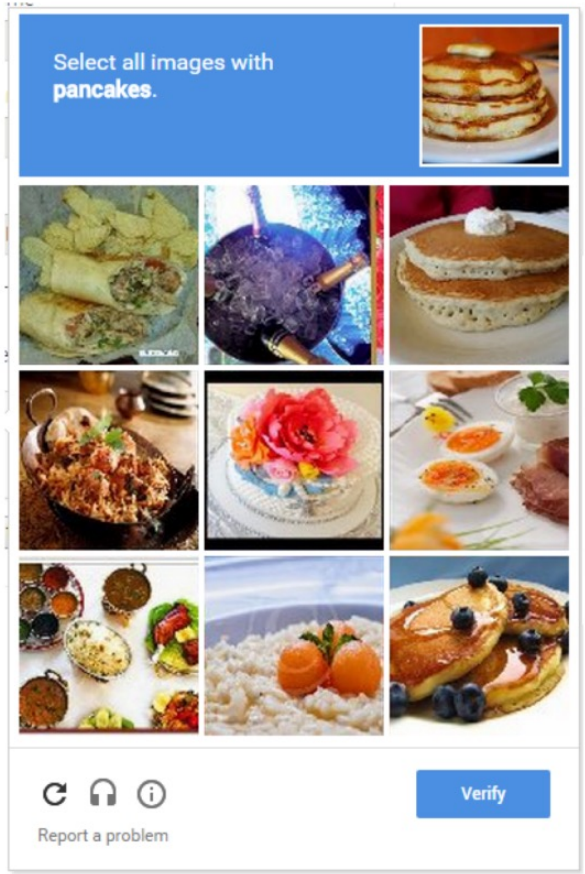
More than OCR

- Google acquired reCAPTCHA in 2009.



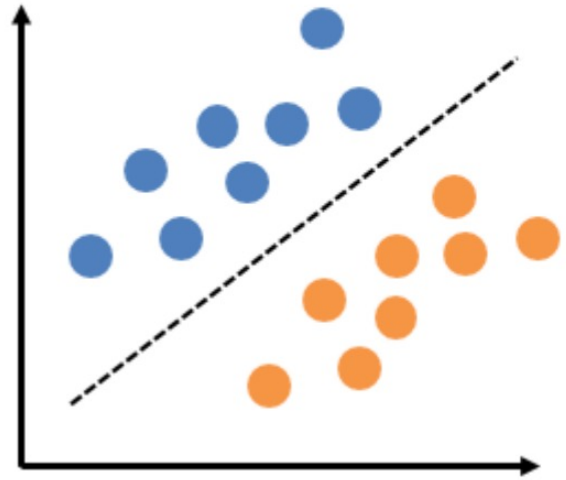






Training Data

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?

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]

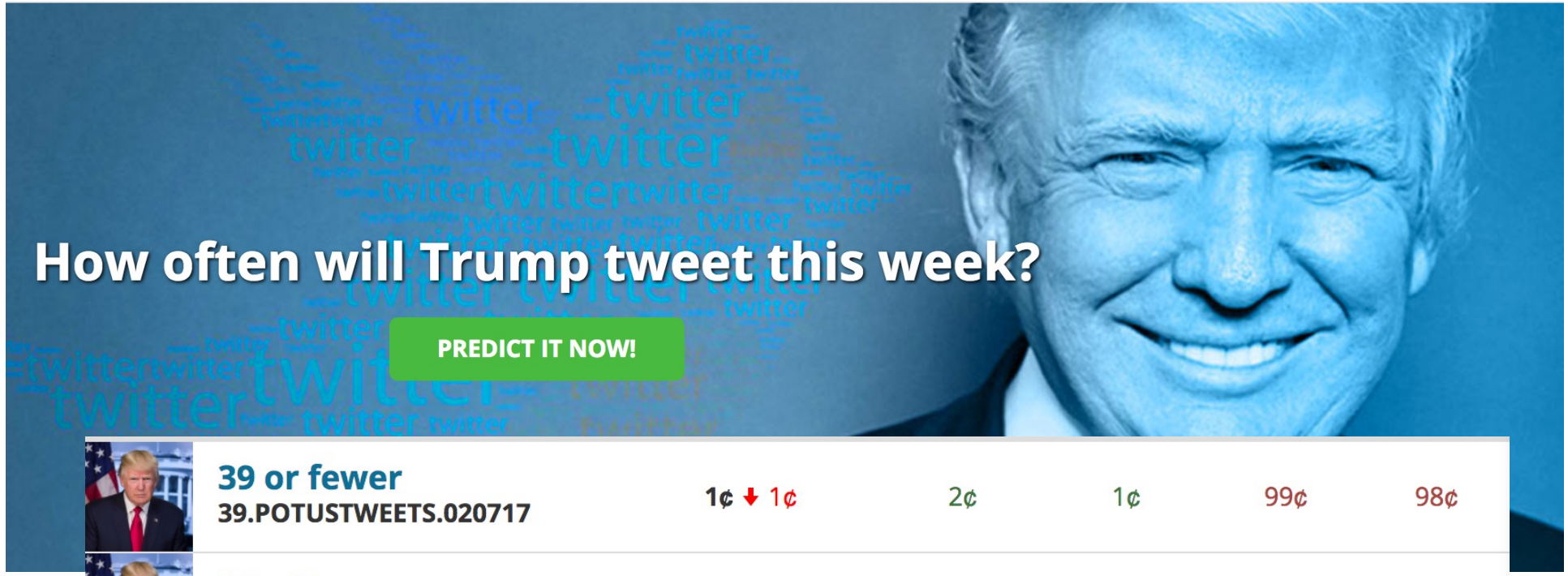
There are major differences between crowdsourcing and outsourcing. Crowdsourcing comes from a less-specific, more public group, whereas outsourcing is commissioned from a specific, named group, and includes a mix of bottom-up and top-down processes.[6][7][8] Advantages of using crowdsourcing may include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

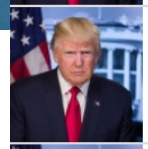
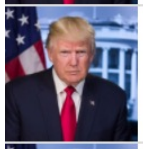
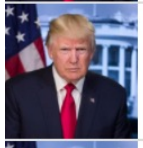
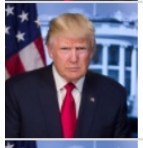
Some forms of crowdsourcing, such as in "idea competitions" or "innovation contests" provide ways for organizations to learn beyond the "base of minds" provided by their employees (e.g. LEGO Ideas).[11] Tedious "microtasks" performed in parallel by large, paid crowds (e.g. Amazon Mechanical Turk) are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

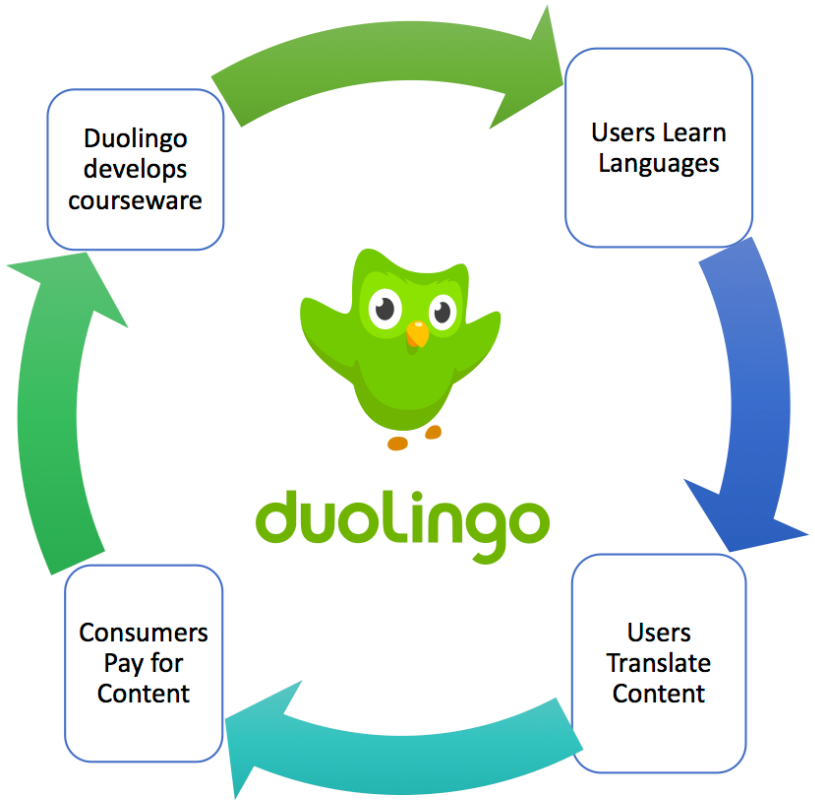
Gamers Decode AIDS Protein That Stumped Researchers For 15 Years In Just 3 Weeks

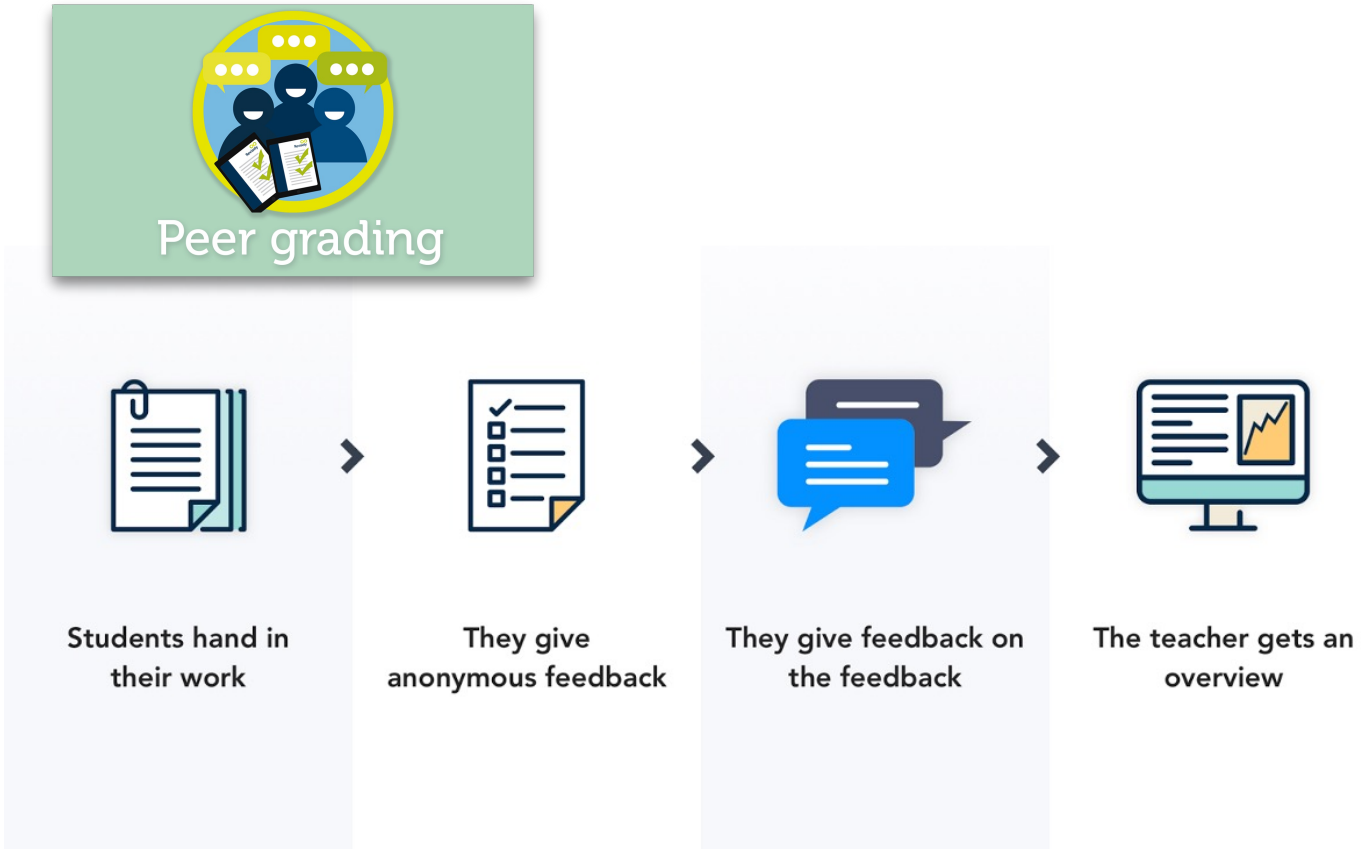
von Ahn and Dabbish. “Labeling Images with a Computer Game”. 2004.



	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** 60.POTUSTWEETS.020717	26¢ ↑ 12¢	25¢	23¢	77¢	75¢

Education


Duolingo develops courseware
Users Learn Languages
Users Translate Content
Consumers Pay for Content
duolingo


Peer grading
Students hand in their work
They give anonymous feedback
They give feedback on the feedback
The teacher gets an overview

General-Purpose Platform: Crowdsourcing Markets

amazon mechanical turk™
Artificial Artificial Intelligence

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			lify
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
Alexandra Dodson	Find email address and first/last name of owners or ge…	4,511	$0.11	1d ago	Preview Accept & Work
ScoutIt	Classify Receipt	4,200	$0.02	2m ago	Preview Qualify

Specify payments

Post Tasks:

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

In fact, a lot more…

Quora

Google

facebook

YAHOO! ANSWERS

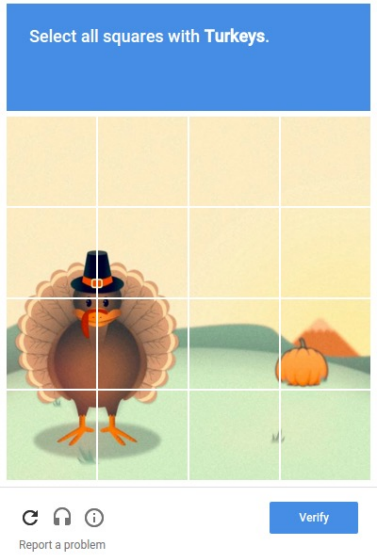
gwap

PredictWise

kaggle

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 14: Milestone 1
  - A brief literature review and the description of your plan (one page)
  - Last chance to change the topic of the project
- Nov 4: 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 6/8: In-class project presentations
- Dec 9: Project report due

Grading

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

Homework Assignments

- Assignment 1
  - Be a crowdsourcing worker and write a report
- 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

- No TA in this course
  - You are expected to be able to work independently

Grading

- Course Project: 40%
- Homework assignment: 20%
  - 4 homework assignments
- **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** **on** **Gradescope.**
  - Exception: the review for the next lecture is due at 2pm the day of the lecture

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.

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?

Class Participation

- Participation is important for this course

- I plan to enforce the participation requirement
  - A non-linear grading scheme
    - Most students will either get full credits or 0 credits for participation.
    - Examples:
      - Attend every lecture but rarely participate in discussion: 0 credits for participation
      - Attend less than 60~70% of the lectures: 0 credits for paticipation

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!

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.

- 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
  - It's likely Amazon will deny registration

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 8 – 29**
  - You should at least be able to understand the formulation and main results
  - You will need to implement some algorithms in these papers

Questions?