Classification System for Human Computation

- Motivation
- Quality Control
- Aggregation
- Human Skill
- Process Order
- Task-request Cardinality
Motivation

• How can we motivate people to participate?
• Even with a low barrier to entry (anyone with an computer can contribute) we still need to make a case why they should contribute.
Motivation: Pay

• Easiest way to recruit workers.
• Downside: provides incentive to cheat
• Problem might be exacerbated when the crowd workers are anonymous
• MTurk uses micropayments
• Online temping services provide higher wages: LiveOps, ODesk, etc
• CrowdFlower tried non-monetary payments (virtual goods and currencies, SwagBucks)
Motivation: Altruism

- People want to do good
- When Jim Gray went missing, volunteers searched 500k satellite images
- After the Haitian earthquake, diaspora translated 1000 messages per day
Was the College Marie Anne school destroyed? Thank you.

We can’t prevent the mosquitoes from biting because there are so many.

Please heart is breaking because I have no news of my mother.

The Doctors without Borders Hospital in Delmas 19 is closed. The Saint Louis Gonzaga hospital in Delmas 33 is taking in sick and wounded people for free.
Motivation: Reputation

• Sometimes people will contribute in order to build their profile within a community
• Example: stackoverflow
Motivation: Enjoyment

• Games with a purpose is a strategy to try to make a task fun
• In the ESP game two players look at an image and try to guess what words the other is thinking
• In doing so they label images on the web
What do you see?

taboo words

peace
lay

guesses

sheeps...
sheep

Penn Engineering
Luis Von Ahn

==

Tom Sawyer
Motivation: Implicit Work

• It is sometimes possible to make people do work alongside some other task
Select all squares with traffic lights. If there are none, click skip.
Motivation

- Pay
- Altruism
- Reputation
- Enjoyment
- Implicit Work
- Can you think of others?
Quality Control

Even if people are motivated to participate, how do we know that they are doing work conscientiously? Can we trust them not to cheat or sabotage the system?

Even if they are acting in good faith, how do we know that they’re doing things right?
Quality Control: Reputation Check

• Mechanical Turk uses a reputation system
• When a Turker submits poor work, Requesters reject it
• The Turker’s approval rate is displayed to all other Requesters
QC: Agreement and Redundancy

• The ESP game uses the labels that two players independently agree on.
• Similar technique is often used in MTurk, when each item is done independently.
• Redundancy allows a voting on ambiguous answers / opinions.
• It is also helpful for identifying workers who are consistently divergent.
QC: Gold Standard

• In MTurk we commonly mix in questions with a known answer alongside new questions
• This is similar to agreement, but now we check agreement against experts or trusted workers
• For multiple choice questions, gold standard allows for automatic grading
QC: Second-pass review

- Do second-pass grading when gold standard don’t allow automatic grading
- Often times the second-pass HIT can be automatically gradable
- This makes the whole pipeline fully automated and ensures high quality
Heather Locklear Arrested for driving under the influence of drugs

The actress Heather Locklear, Amanda of the popular series Melrose Place, was arrested this weekend in Santa Barbara (California) after driving under the influence of drugs. A witness viewed her performing inappropriate maneuvers while trying to take her car out from a parking in Montecito, as reported to People magazine by a spokesman for the California Highway Police. The witness stated that around 4:30pm on Friday, Locklear "hit the accelerator violently, making excessive noise while trying to take her car out of the parking with abrupt and forth maneuvers. While reversing, she passed several times in front of his sunglasses." Shortly after, the witness, who recognized the actress, saw her.

Why was Heather Locklear arrested?

- She was arrested on suspicion of driving under the influence of drugs.

  - Driving under the influence
  - Driving while medicated
  - DUI
  - Driving while using drugs
  - Medikamentos
QC: Defensive task design

• Try to design tasks so that they are nearly as hard to cheat as they are to complete
• For my translation HITs, people frequently would paste text into Google Translate
• I converted the text into images, then people had to transcribe it.
QC: Statistical models

• Sometimes it is possible to have prior knowledge about what the range of expected answers should be

• Use your statistical knowledge to throw out outliers
QC: Economic incentives

• When money is the motivator, it may be possible to use different incentive structures to illicit better results
• Pay people more when they reach a certain level of mastery, or when their output passes second pass reviews
• CastingWords uses bonuses to do this
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<th>Requester</th>
<th>HIT Title</th>
<th>Reward</th>
<th>Expired Date</th>
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Quality Control

• Reputation check
• Agreement and redundancy
• Gold standard + automatic reviewing
• Multi-level review
• Defensive task design
• Statistical filtering
• Economic incentives
• Others?
Aggregation

- Part of the process of human computation is to combine all contributions to solve a global problem.
- The class of problem may determine what strategy is best.
Aggregation: Statistical Data Processing

- In Wisdom of Crowds, Surowiecki argues that aggregating answers from a decentralized, disorganized group of people, all thinking independently yields more accurate answers than from individuals.
- Individual errors need to be uniformly distributed, so individual judgments must be made independently.
Aggregation: Collection

• Voting
• Prediction markets
Aggregation: Collection

- Sometimes aggregation collects discrete facts in a knowledge base
- A contribution may
  - add a new fact
  - improve quality by correcting, refuting, or confirming existing facts
I am thinking of a sentence ....

True  False  Don't know

Doesn't make sense

Engines are typically located in storage sheds.

Because I think it might be true.
Aggregation: Search

• Some human computation paradigms are simply asking people to find something in a large number of images

• Stardust@home project - people looked through images of aerogel to find dust from comet’s tail gathered by spacecraft
Stardust Search

above surface

← track

100 microns
Aggregation: Iterative Refinement

• One person’s output is shown to the next person, who is asked to improve upon it
• What would Surowiecki say? (WWSS?)
Please transcribe as many words as you can.
Put an * in front of words you are unsure about.

If a festival two me but is

Two TV shows. I think two TV shows are good.

If two If

*festval
• Please transcribe as many words as you can.
• Put a * in front of words you are unsure about.

Iteration 4: TV is* *festival _____ was *two *me _____ , *but ____
*is ____ ____ TV ____ . I *two ____ tv ____ ____ ___
*festival , ____ I ______ is* ____ it ____ *festival .

Iteration 6: TV is supposed to be bad for you , but I ____ watching
some TV *shows . I think some TV shows are *really
*advertising , and I_____ _____ is good for the __

Iteration 12: TV is supposed to be bad for you , but I am watching
some TV shows . I think some TV shows are really entertaining ,
and I think it is good to be entertained .
Aggregation

- Wisdom of Crowds
- Collection
- Search
- Iterative improvement
- Genetic algorithm
- None?
- Other?
Human Skill

“Human Computation is a paradigm for utilizing human processing power to solve problems that computers cannot yet solve.“
Human Skill

• What human skills have we seen so far?
• What others might be used for human computation tasks?
Process order

- Three roles in Human Computation: Requester, Worker, Computer
- **Requester** is the end user who benefits from the computation
- **Worker** is the person performing the task
- **Computer** only comes into play when it plays a role in solving the problem (not just aggregating results or being the information channel)
Process Order: CWR

• Computer ➔ Worker ➔ Requester
• In reCAPTCHA:
  • Computer first tries to perform OCR
  • Workers are presented with words that it fails to recognize
  • Their transcriptions are aggregated for the Requester (reader / library)
Process Order: WRC

- Worker $\rightarrow$ Requester $\rightarrow$ Computer
- In image labeling games:
  - Players (workers) provide labels
  - Web users (requesters) perform an image search
  - Computer searches the database of labels and presents matches
Process Order: CWRC

• Computer ➔ Worker ➔ Requester ➔ Computer
  • Cyc system has inferred a lot of facts by analyzing text
  • Sends its guesses to FACTory where Workers confirm/correct facts
• When a user (requester) queries Cyc
• The Cyc system performs AI inference
Process Order: RW

- Requester → Worker
- Some tasks require no (non-human) computation
- Audio transcription or text dictation
- For small jobs, might not need any sophisticated computer-mediated QC
Task-Request Cardinality

• When a service is powered by human computation, many human workers may produce the result.
• Sometimes, just one or a few workers may suffice. The structure of the problem dictates the cardinality.
Task-Request Cardinality

- One-to-one: ChaCha question answering
- Many-to-many: Image labeling / search
- Many-to-one: Search for Jim Gray
- Few-to-one: VizWiz has a few people respond to each blind person’s query
Opportunities for Growth in HComp

- Dimensions: Motivation, Quality Control, Aggregation, Human Skill, Process Order, Task-Request Cardinality
- Consider new pairings of dimensions
- Invent new values for dimensions
- Classify new work and consider variations