

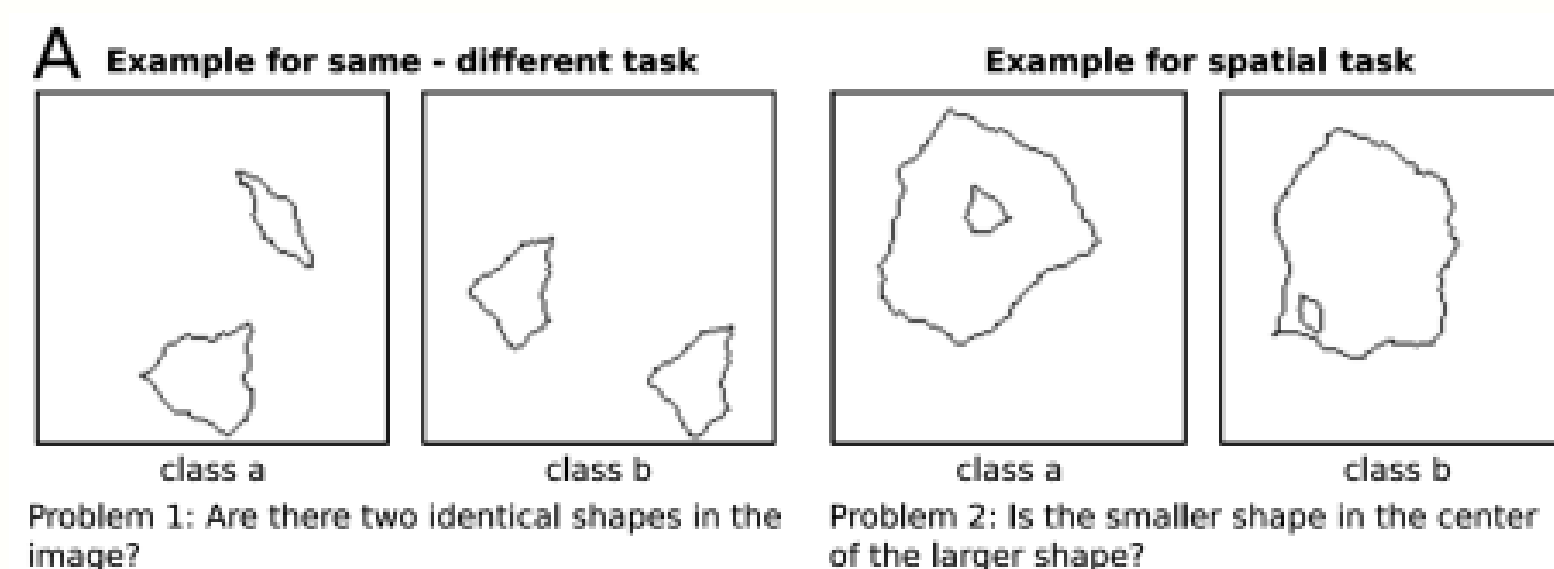
Investigating Data Collection and Aggregation for Improving Collective Intelligence

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Motivation

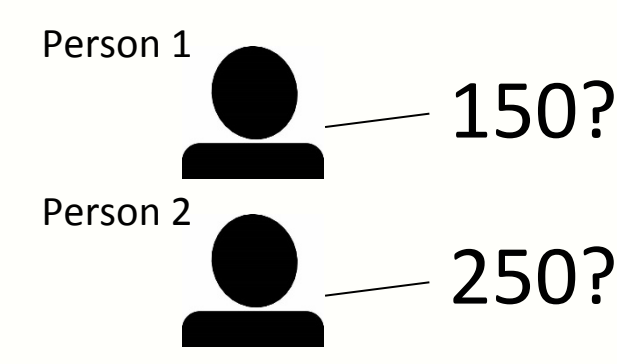
- Artificial intelligence struggles with a task humans excel at: reasoning
- When human intelligence remains superior, extracting it is valuable



Tasks simple for humans to complete
confuse costly computer vision AI models
[Five Points to Check when Comparing Visual Perception in Humans and Machines, Funke et al, 2020]

The Wisdom of Crowds

How many marbles?



Accuracies

Truth: 210
Person 1 Error: 60
Person 2 Error: 40
Average Error: 10

- A combined collective knowledge can be more accurate than the knowledge of each
- Some aggregation methods can outperform others at greater computational cost

Prior Research in WOC for Human Computation

- Crowd-based approaches collect and aggregate diverse information to yield more accurate estimates
- Aggregating ranked (ordinal) lists [Steiyvers et. al, 2009]
- Averaging numerical (cardinal) estimations of a quantity [Surowiecki, 2004]
- Combining ordinal and cardinal estimations through specialized techniques [Kemmer et. al, 2020]

Research Questions

- RQ1: Do the effects transfer to more challenging tasks?**
- RQ2: Will collective estimates maintain accuracy when aggregated via simpler, non-optimization methods?**

Proposed Experiment Interface



The Experiment

- Conduct a more cognitively challenging task: **line segment estimation**
- Elicit multiple modes of information from participants: **cardinal and ordinal**
- Q: What is the combined length of all lines of a particular color in the image?** (as a multiple of a unit length)
- Recruit participants via crowdsourcing platform Amazon Mechanical Turk

Data Analysis

- Two modes of data: list of estimations (counts) and list of indices (ranking)
CARDINAL (count) ORDINAL (ranking)
5 8 4 → 2 1 3
- Convert cardinal to ordinal by sorting
- Aggregate multiple ordinal vectors through voting rules (e.g., Borda Count)
- Does inaccuracy decrease as more individual vectors are aggregated?
- Does inaccuracy decrease more slowly, at a similar rate, or more quickly by incorporating both modes of data?