Collective Intelligence Strategies for Object Detection

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Abstract

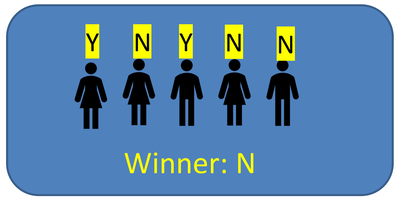
This work investigates how different methods of soliciting and aggregating input from multiple people best inform visual object detection tasks. A crowdsourced experiment is developed which asks study participants to identify if an object is or is not in an image. Then, aggregation techniques such as majority voting, confidence weighted voting, and the novel "surprisingly popular" voting method are tested to see how well they perform at determining correct classifications from multiple noisy answers. The results of this project seek to inform best-practice methodologies of using collective intelligence to inform challenging object detection tasks.

Background

Three collective intelligence methods were evaluated to see how well they could inform object detection tasks.

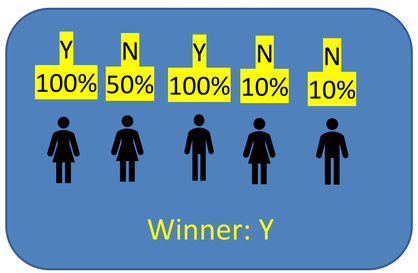
Majority Voting (MV)

Answer is determined by the majority.



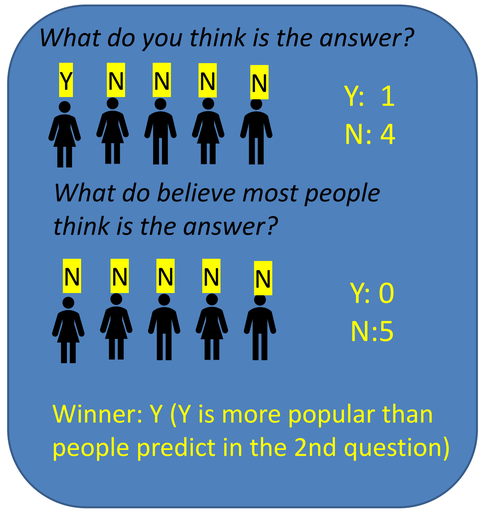
Confidence-Weighted (CW)

Individual answers are weighted differently based on confidence.



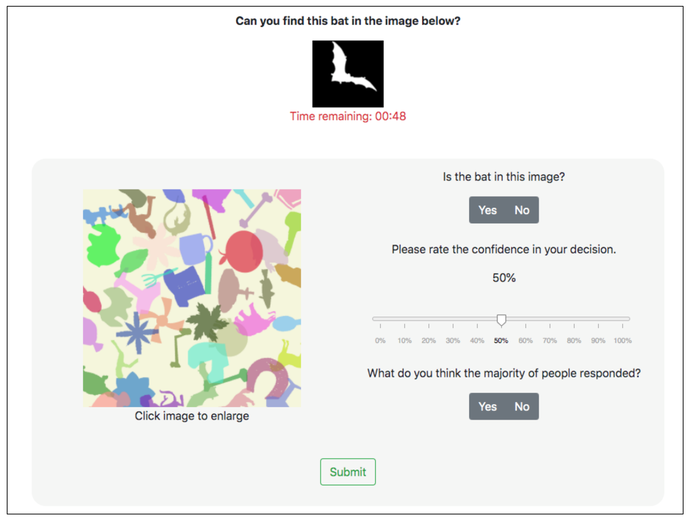
Surprisingly Popular (SP)

A novel voting technique that attempts to filter out "experts" by asking people what they believe the majority will choose. [6]



Experiment

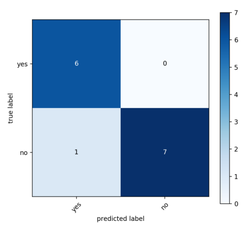
- A crowdsourced experiment was designed that asked participants to identify if a bat was/was not in **14 different images**.
- The experiment was developed using a MERN stack, a popular JavaScript stack for app development.
- **28 participants** were recruited to participate in this experiment.



User interface of online study

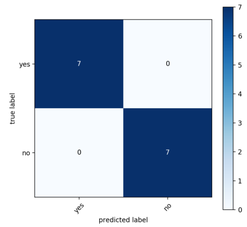
Results

MV



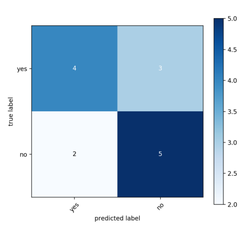
TP: 6 FP: 1 TN: 7 FN: 0

CW



TP: 7 FP: 0 TN: 7 FN: 0

SP



TP: 2 FP: 2 TN: 5 FN: 5

Discussion

- Confidence-weighted voting performed exceptionally well, predicting the correct answer 100% of the time
- Majority voting also performed very well, only yielding one incorrect answer
- Surprisingly Popular voting, shown to perform very well in a variety of real-world scenarios [4], performed relatively inaccurately with this object detection task

Conclusion

- Confidence-weighted voting is a promising method to inform object detection tasks
- Future work will involve investigating better methods to detect reliable/unreliable annotators and detect difficult/hard questions.

References

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[6] Prelec, Dražen & Seung, Hyunjune & McCoy, John. (2017). A solution to the single-question crowd wisdom problem. Nature. 541. 532-535.

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