Wisdom Of The Algorithmic Crowd

Encouraging The Adoption Of Ensemble Models By Leveraging Intuitions Of Crowd Wisdom

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Summary

Ensemble algorithms are used widely in consumer contexts (e.g., recommendation systems, financial forecasting, etc.) Despite the predictive benefits of algorithms, people often exhibit aversion towards them. **We propose a new way to enhance the adoption of ensemble models by leveraging lay beliefs in the "wisdom of the crowd."**

"Wisdom of the crowd" posits that groups of independent individuals often outperform single experts in predictions. Prior work has primarily focused on optimizing the accuracy of human crowds. Less work focuses on whether lay people appreciate crowd wisdom, but some suggests **people prefer the average of a crowd of humans over a single person.**

We believe machine crowds operate similarly to human crowds. Just as the wisdom of the crowd aggregates the predictions of multiple human experts to enhance performance, ensemble models combine the predictions of multiple algorithms to improve performance.

Therefore, we propose the **Crowd Framing Hypothesis: framing ensembles as a crowd of algorithms (vs. a single algorithm) would increase the perceived accuracy of these models.**

We show evidence of the Crowd Framing Hypothesis across 10 studies (9 preregistered). We also explore **two downstream benefits** of the Crowd Framing Hypothesis (Studies 4-7) and the **mechanisms** of the Crowd Framing Hypothesis (Studies 8-10).

Studies 1-2: The Crowd Framing Hypothesis

Method:

- Participants (N=91) imagined predicting the likelihood of rain on their wedding day.
- Participants were informed that 10 AI experts who specialized in weather predictions could each give an independent prediction of rain based on past weather trends.
- Participants rated the perceived accuracy of one randomly selected AI expert's advice, and the average prediction of the 10 AI experts (1=Extremely inaccurate; 9=Extremely accurate).

Results: Crowd (vs. single) framing boosts the perceived accuracy of the prediction (Figure 1).

We conceptually replicated the results in a sports betting context and using a different crowd size (Study 2).

Study 3: Crowd framing can reverse algorithm aversion

Method:

- Participants (N=89) imagined predicting the likelihood of getting cardiovascular disease in 5 years and were presented with three options for advice: 1 human expert, 1 AI expert, and the average of 10 AI experts.
- Participants rated the accuracy of each option in random order (1=Extremely inaccurate; 9=Extremely accurate)

Results: Crowd framing boosts perceived accuracy in comparison to a single model *and* a single human expert (Figure 2).

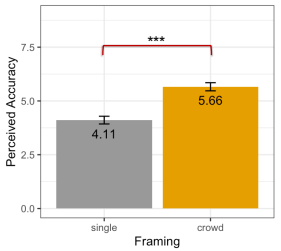


Figure 1: Study 1 Results

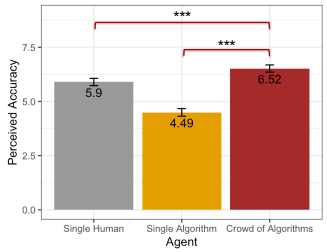


Figure 2: Study 3 Results

Studies 4-7: Crowd framing can boost consumer preferences and purchase intent

Method:

- Participants (N=96) imagined predicting the performance of their stock portfolio.
- Participants were presented with two robo financial advisors: Robo and Kiki. Participants first read the website of Robo and then Kiki. In the Single Condition, Kiki was described as "using ONE AI algorithm to predict the performance of stocks", in the Crowd Condition, Kiki was described as "using TEN AI algorithms to predict the performance of stocks".

Results: Crowd (vs. single) framing increased consumer preferences for Kiki relative to Robo (Figure 3).

We conceptually replicated the results in a medical choice setting (Study 5) and in an incentivized choice setting (Study 6). We also found crowd framing boosts purchase intent for Kiki (Study 7).

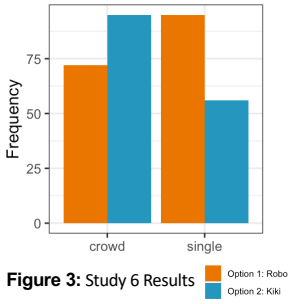
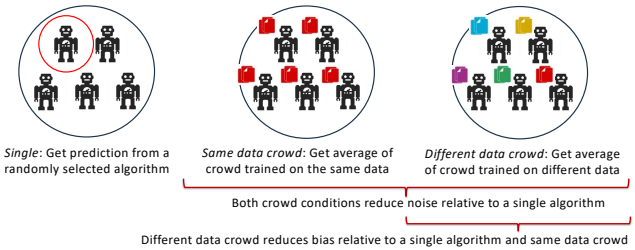


Figure 3: Study 6 Results

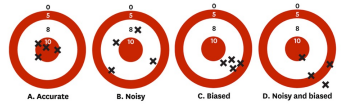
Studies 8-10: Crowd framing is driven by mistaken beliefs about bias vs. noise reduction

Method:

- Participants (N=799) imagined working for a music publisher and predicting a song's chance of making it to the Billboard Top 100.
- Participants were randomized into 3 conditions:

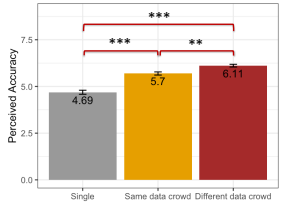


- Participants were explained the difference between noise and bias:

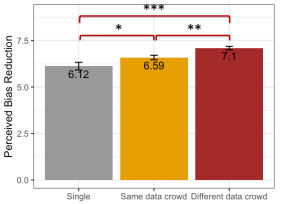


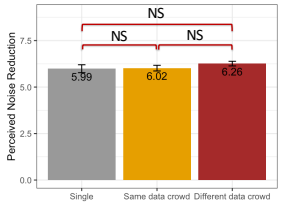
- Participants rated the perceived accuracy of the model (1=Extremely inaccurate; 9=Extremely accurate)
- Participants rated bias and noise perceptions: "The benefit of the prediction is that it reduces BIAS" and "The benefit of the prediction is that it reduces NOISE" (1=Strongly disagree; 9=Strongly agree).

Results: People appreciate crowd wisdom (Figure 4a) but sometimes for the wrong reasons. They acknowledge the bias reduction benefits of machine crowds (Figure 4b), but do *not* acknowledge the noise reduction benefits of machine crowds (Figure 4c).



Figures 4a (top figure), **4b** (bottom left), **4c** (bottom right)





We also identified data relevancy as a boundary condition of crowd framing (Study 10).

All error bars are +/-1 SE. * p < .05; ** p < .01; *** p < .001