Summary 25: Human Collective Intelligence as Distributed Bayesian Inference

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This paper presents a model of human social decision making. Human collective knowledge still lacks a formal coherent framework on which to study group cognition. This paper proposes a model of human intelligence in which collective human intelligence is distributed Bayesian inference. Individuals choose options based on popularity and then commit to options based on objective evidence. People try to figure out the best decisions by treating popularity as prior distribution. When a large group of people use this strategy, they collectively perform rational inferences.

Put more formally, a person first choses an option j to consider with probability proportional to current popularity at time t, $p_{j,t}$. The person then evaluates the quality of the option using a recent performance signal, $r_{i,j}$. The person chooses that option with probability η if the signal is good or $1-\eta$ if the signal is bad. The probability that the person chooses j at time t is $\frac{p_{i,j}\eta^{r_{j,t}}(1-\eta)^{1-r_{j,t}}}{\sum_l p_{k,t}\eta^{r_{k,t}}(1-\eta)^{1-r_{j,t}}}$.

This is called social sampling. The probability above can be interpreted as the posterior probability that option j is the best option. This can be viewed as rational under certain resource constraints. In addition, it can be proved that the behavior of an entire group is rational to treat popularity as a prior. If the entire population uses this strategy, the expected new popularity of each option is proportional to the previous posterior probability that this option was the best.

Next, the authors test the social sampling model using financial trading data. Users in this data are allowed to mimic each others trade. Users are more likely to mimic popular traders but only if those traders are performing well. They find that their empirical results are consistent with the Bayesian interpretation. They find that social sampling has unique benefits to group performance compared to models that don't give a Bayesian algorithm in aggregate. Incorporating performance information into decision making is better than ignoring it, suggesting that the benefits of social sampling are robust of a group having an inaccurate view of the world.

Overall, the findings are consistent with a distributed Bayesian inference view of collective intelligence. The authors also consider a variety of alternative models, such as Full Regression, Additive Model, and Performance Model, and Popularity Model. Then they discuss parameter fitting and checking inferred parameter values.They conclude by discussing methodological limitations, such as that the eToro interface plays a role in shaping user behavior on the side.