Metacognitive Bandits: When Do Humans Seek AI Assistance?

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Introduction

- Humans increasingly collaborate with AI systems to make complex decisions in the real world
- But how do humans decide when to seek AI assistance?

Experimental Setup

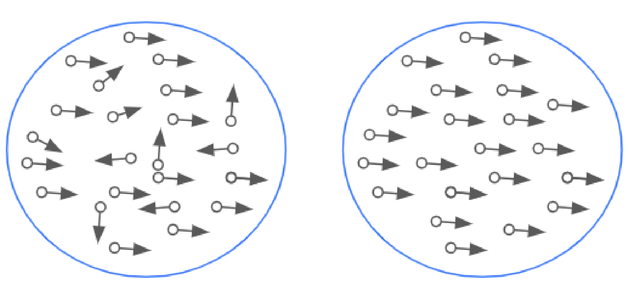

Figure: Random-Dot Kinematograms with varying coherence (inversely related to difficulty) were used as stimuli

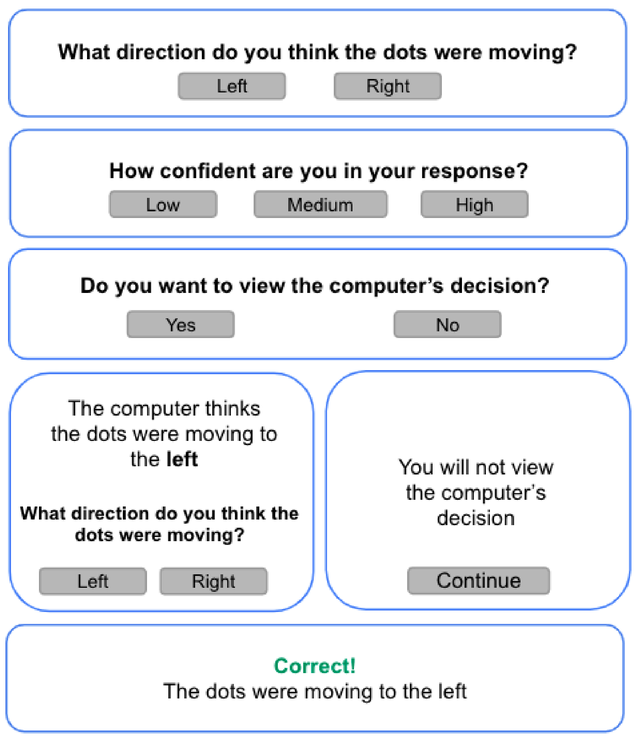

Figure: Sequence of events in the task

- Identify the dominant direction of movement in the kinematogram (left or right)
- AI advice was only show when solicited
- AI had higher accuracy (81%) than the average participant (69%)

Metacognitive Bandits

- Decision to solicit AI advice can be explained as a combination of **explore/exploit** sequential decision making and **metacognition**
- Two armed bandit framework: decision to seek help from AI is a pull of one of two arms: Self and AI
- Arm selection depends on history of both arms and perceived difficulty of the task
- Use a Bayesian UCB framework [1] as a solution to this metacognitive task

Generative Model of Confidence & Accuracy

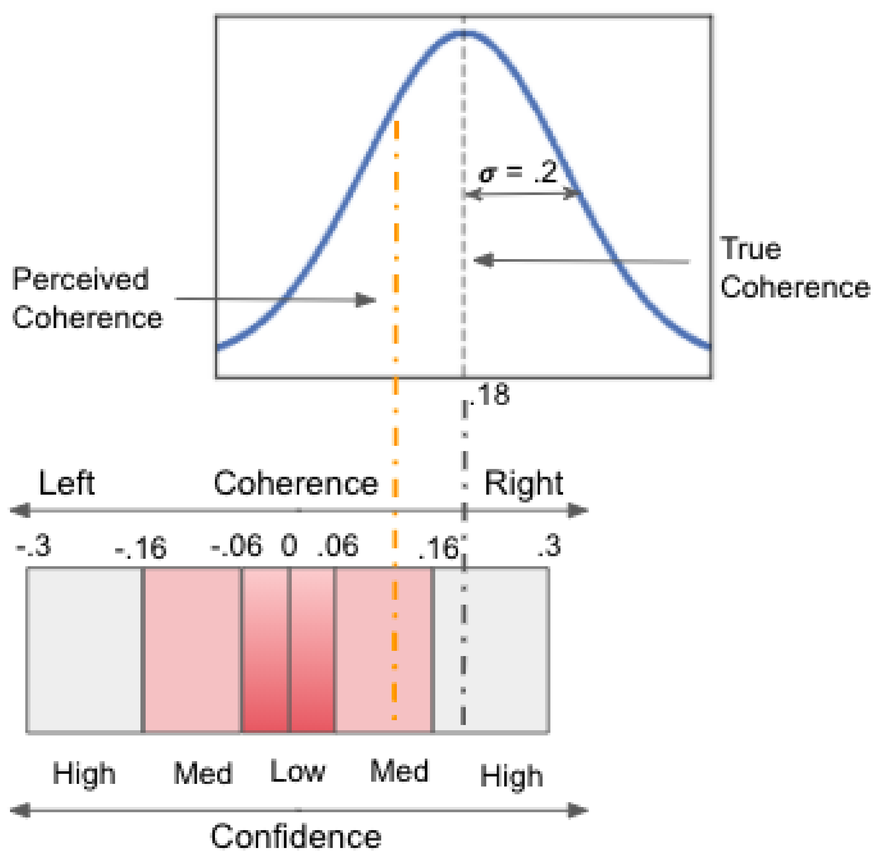

Figure: Proposed generative model for human response and confidence

- Estimated perceived coherence is used to simulate human's response and confidence on each trial
- If human's perceived coherence has the same sign as the true coherence, we predict that human gives a correct response
- Humans give higher (lower) confidence ratings for lower (higher) coherence trials

Observed & Predicted Advice Soliciting Behavior

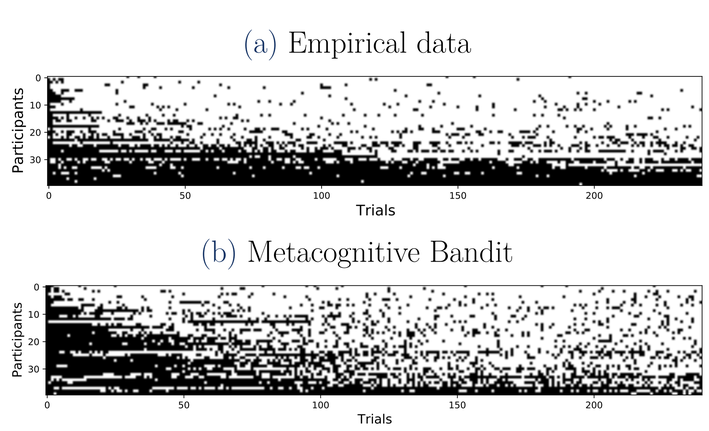

Figure: Advice soliciting behavior for actual and simulated participants on 240 trials; White corresponds to trials where a participant did not solicit AI advice.

Observed & Predicted Confidence Ratings

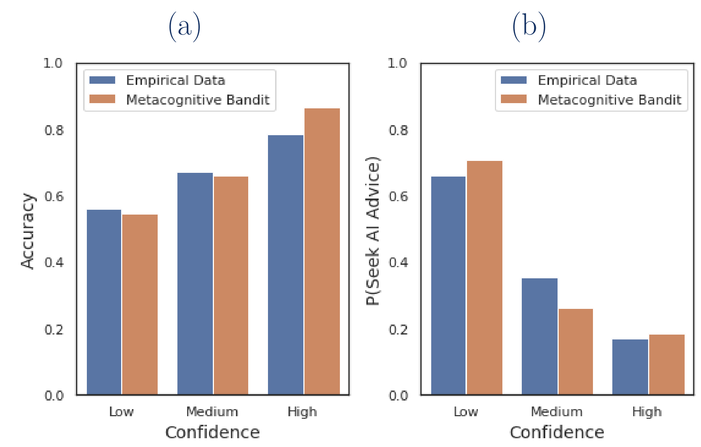

Figure: Relationship between the reported confidence of participants in their response and

- (a) the accuracy of response
- (b) probability of soliciting AI advice

Discussion & Future Work

- Currently, model only qualitatively captures trends in the data
- Look at more naturalistic decision-making settings while using a real AI in the loop
- Model how AI advice is integrated into the human's final decision

[1] Nicos G Pavlidis, Dimitris K Tasoulis, and David J Hand. Simulation studies of multi-armed bandits with covariates. In *Tenth International Conference on Computer Modeling and Simulation (uksim 2008)*, pages 493–498. IEEE, 2008.