Inferring Inference

Submission ID 3000281

Submission Type Poster

Topic Neuroscience

Status Submitted

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SUBMISSION DETAILS

Presentation Type Either Poster or Oral Presentation

Presentation Abstract Summary We describe a framework to infer canonical computations in distributed neural codes. Our method is based on the theory that the brain performs approximate inference by a message-passing algorithm operating on a probabilistic graphical model. We describe an analysis method that aims to identify this algorithm from neural data elicited during perceptual inference tasks. It simultaneously finds interactions between the decoded variables that define the brain's internal model of the world, along with global parameters that define the message-passing algorithm. The latter parameters are canonical, i.e. common to all parts of the graphical model regardless of interaction strength, so they generalize to new graphical models. We apply this analysis method to simulated neural recordings from a simple model brain that performs approximate inference using an advanced mean-field method, and indeed successfully recover the true inference algorithm. We conclude by discussing improvements needed to identify more complex message-passing algorithms.

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Keywords

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probabilistic inference
message-passing
population coding