Using additional data types to identify the unidentifiable components of cognition during decision-making

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Abstract

Drift-Diffusion Models (DDMs) are a widely-used class of models that assume an accumulation of evidence during a quick decision. These models are often used as measurement models to assess individual differences in cognitive processes, such as an individual's evidence accumulation rate and response caution. An additional underlying assumption of these models is that there is internal noise in the evidence accumulation process. However, fitting DDMs to experimental choice-response time data alone cannot yield estimates of an individual's evidence accumulation rate, caution, and internal noise at the same time. This is due to an intrinsic joint-unidentifiability of these parameters when fitting DDMs to behavioral data. We introduce methods of estimating these parameters at the same time with additional data types. The methods to estimate model parameters rely on Bayesian inference and simulation-based Bayesian inference. We show why these methods are useful without making strong assumptions.

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