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**The Deterministic Information Bottleneck** D.J. STROUSE, Princeton University, DAVID SCHWAB, Northwestern University — A fundamental and ubiquitous task that all organisms face is prediction of the future based on past sensory experience. Since an individual's memory resources are limited and costly, however, there is a tradeoff between memory cost and predictive payoff. The information bottleneck (IB) method (Tishby, Pereira, & Bialek 2000) formulates this tradeoff as a mathematical optimization problem using an information theoretic cost function. IB encourages storing as few bits of past sensory input as possible while selectively preserving the bits that are most predictive of the future. Here we introduce an alternative formulation of the IB method, which we call the deterministic information bottleneck (DIB). First, we argue for an alternative cost function, which better represents the biologically-motivated goal of minimizing required memory resources. Then, we show that this seemingly minor change has the dramatic effect of converting the optimal memory encoder from stochastic to deterministic. Next, we propose an iterative algorithm for solving the DIB problem. Additionally, we compare the IB and DIB methods on a variety of synthetic datasets, and examine the performance of retinal ganglion cell populations relative to the optimal encoding strategy for each problem.

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