Graduate School of Science and Technology Master's Thesis Abstract

Laboratory name (Supervisor)	Mathematical Informatics (Kazushi Ikeda (Professor))		
Student ID	2311407	Submission date	2025 / 7 / 23
Name	CAO SHIYI		
Thesis title	Adaptive Distortions of Confidence under Different Environments and Internal Constraints		

Abstract

Confidence judgments play a critical role in adaptive cognition, yet they are typically modeled as static functions of internal evidence. Here, we show that metacognitive sensitivity—the degree to which confidence reflects decision correctness —emerges from dynamic interactions among decision criteria, stimulus sampling, and evidence variance. Using simulations based on signal detection theory (SDT), we demonstrate that shifts in sampling priors and systematic variations in evidence variance distort metacognitive sensitivity. Crucially, we find that asymmetries in evidence variance and stimulus sampling systematically affect decision criteria, thus altering confidence judgments—effects that exist irrespective of the perceptual task's type. Neural network models trained under same conditions replicate these distortions, even when overall accuracy is preserved. These findings challenge current accounts of metacognition and point toward a more general framework in which metacognitive precision reflects the joint effect of stimuli statistics and decision policies.