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Vision Awareness of Computer Prediction Errors in Hierarchical Neural Systems

Abstract:

The cognitive paradigm of predictive processing is gaining immense theoretical footing, yet no attempts have been made to apply it in building artificial machines. We propose a novel approach to computer vision to investigate intrinsically motivated vision awareness created by top-down prediction errors between the algorithm's probabilistic, generative model and sensory stimuli. Humans perceive a structured world from infinite data inputs in this way; prediction errors are propagated through layers, and once they are resolved by changing the model or the environment, a sensory experience is perceived. We successfully reconstruct this biologically plausible approach to vision awareness using a hierarchical neural system and suggest a theoretical framework away from traditional vision approaches. While such approaches focus on the exact stimuli and perceived results, we suggest that for a computer algorithm to feasibly make sense of the infinitely large world humans live in, selection of unexpected stimuli through prediction errors is needed: vision awareness. This novel study marks an exciting first step towards integrating novel cognitive findings with computer science's drive towards agentic computer vision.

Biography

Derek (Yue) Yu, is a double HBSc candidate in cognitive science and computer science at the University of Toronto. In just his first year, he has gained extensive research experience as a research assistant for Dr. Nick Koudas, Dr. Jay Pratt, Dr. Daniel Wigdor. He is interested in computer applications of the predictive processing paradigm, creating novel cross-sections between cognitive and computer research.