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Title: Control Theory for Interfaces with Living Systems

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Abstract: Sensorimotor control models often start from the simplifying assumption that sensing, decision-making, and action form a sequential loop through the nervous system. Yet the models that result from this assumption describe only a fraction of the neuronal activity, neuronal connectivity, and neuronal diversity observed in nervous systems. Two key features of nervous systems are layered architectures, such as sensorimotor pathways that branch as signals flow away from the sensors and converge as they flow towards the muscles, and internal feedback, such as sensorimotor pathways that flow from motor areas to sensory areas. These features are observed across species and sensory modalities, yet their role in enabling complex behaviors has been unclear. To address these issues, we build on recent advances in the theory of feedback control and complex networks.