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An Attractor Neural-network Simulation of Decision Making

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Abstract

We apply an attractor neural-network model to experiments on monkeys who decided which direction tokens are moving, while firing rates of large numbers of neurons in premotor cortex are being recorded. Using pools of artificial excitatory and inhibitory neurons, our network model accurately simulates the neural activity and decision behavior of the monkeys. Among the simulated phenomena are decision time and accuracy, commitment, patterns of neural activity in trials of varying difficulty, and an urgency signal that builds over time and resets at the moment of decision. Predictive simulations of decision change are also presented, suggesting gradual passing through an uncertain region on the way to a new decision. The model shows that committed decisions need not involve any explicit threshold detection mechanism. Instead, competition, suppression, decision, and commitment naturally emerge from the dynamics of the system.