A spiking neural architecture for conscious chaining of mental operations

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Abstract

Flexible information routing in the brain is crucial to perform sequential tasks in which an operation takes as input the result of the preceding operation (e.g. add 2 to a given digit, then compare the result to 5). Experiments suggest that individual operations such as addition and comparison can proceed subliminally, while their chaining requires conscious perception. Here we use the semantic pointer architecture to model a global workspace and specialist processors with spiking neurons. Non-conscious information has limited spatio-temporal influence in our model, while information that is selected to enter the global workspace can be maintained over time and selectively routed to the processors whose role is to execute the operations. The model can perform three tasks that consist of different operation chains. Response times and accuracy are compared to human performance data.