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Latency-Based Motion Detection in Spiking Neural Networks

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Abstract : Understanding the neural mechanisms underlying motion detection in the human visual system has long been a fascinating challenge in neuroscience and artificial intelligence. This paper presents a spiking neural network model inspired by the processing of motion information in the primate visual system, particularly focusing on the Middle Temporal (MT) area. In our study, we propose a multi-layer spiking neural network model to perform motion detection tasks, leveraging the idea that synaptic delays in neuronal communication are pivotal in motion perception. Synaptic delay, determined by factors like axon length and myelin insulation, affects the temporal order of input spikes, thereby encoding motion direction and speed. Overall, our spiking neural network model demonstrates the feasibility of capturing motion detection principles observed in the primate visual system. The combination of synaptic delays, learning mechanisms, and shared weights and delays in SMD provides a promising framework for motion perception in artificial systems, with potential applications in computer vision and robotics.

Keywords : neural network, motion detection, signature detection, convolutional neural network
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