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CILIA

Customized Intelligent Life-Inspired Arrays

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COMPUTATIONAL MODEL FOR LOCALISING AND IDENTIFYING FLUTTERING INSECTS

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EXECUTIVE SUMMARY

To perform echolocation, so-called FM-bats emit short pulses i.e., with a duration of a few milliseconds, and analyse the echoes coming from their environment. One individual echo, due to its short duration, will cause neurons in the early auditory system to generate between 1 and 3 spikes only. Hence, we argue that it is advantageous for FM-bats to use spike-time rather than firing rate information. We present a simple spike-time model of the monaural and binaural pathways up to the midbrain to show that spike-time information can indeed be processed by the known neural architecture. In particular, we show that a First Spike Latency (FSL) code, as provided by the auditory nerves, can represent both the monaural and binaural intensity cues induced by the head-related transfer function in the peripheral system. We also show that ascending centres enhance the cues conveyed by such a FSL code. Finally, we present experimental results comparing the FSL code based model proposed here with a more classic firing rate code and we show that first-spike latency is a more biologically plausible alternative.