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Brain-inspired Models for Sensory Information Processing and Decision Making

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The modern Artificial Intelligence relays on artificial neural networks (ANNs). Although they achieved high performance due to increased power of modern computational resources, it is at the expense of huge dimensionality of the models as well as of increased energy consumption.

Our brain is still able to perform faster and low energy demanding computations that outperform in many tasks contemporary AI. Current development of neuromorphic hardware allows to implement much more realistic spike timing neuron models with lower energy consumption that soon will allow us to create biologically inspired AI.

In my talk I will present developed by our team spike timing model of human perception and decision making. It is based on neuro-biological theories how our brain perceives sensory information and what is structural organization of brain areas involved in its processing. The model was implemented using NEST Simulator library and was tested on realistic visual stimuli. It mimics brain areas involved in hierarchical visual information processing starting with retina ganglion cells through the sensory relay (thalamus), the primary visual cortex (V1) and other brain regions involved in further visual information processing as well as deeper brain structures (basal ganglia) responsible for decision making based on incoming sensory information and goal directed behavior.