Deep convolutional neural networks have proven to be enormously successful in solving a wide range of computer vision problems (LeCun, AlexNet, Goodfellow). Originally inspired by the receptive fields of neurons in the visual cortex (LeCun), these networks have been shown to correspond strongly to the activations in visual ventral stream in the human brain (Guclu and van Gerven 2015, Cichy et al, 2016) and in non-human primates (Yamins 2013, 2014, Kriegeskorte .. , DiCarlo and Yamins 2016). Relating the hidden representations of neural networks to non-invasive electrophysiological recordings in the human brain typically requires a (dis)similarity measure that collapses over time (Cichy et al., 2016, <https://www.nature.com/articles/s42003-018-0110-y>), thus disregarding the temporal dynamics of the sensory system. For instance, alpha oscillations dominate the temporal dynamics of the visual system and have been repeatedly linked to perception and attention. However, oscillations are rarely considered in artificial neural networks.

Here, we propose a small network that embraces these dynamics to allow a temporal segmentation of simultaneously presented, competing inputs. These semi-biologically plausible dynamics consisted of a relaxation term causing quasi-rhythmic activations in the units of the hidden and output layer and a 10 Hz pulsed inhibition, akin to neuronal alpha oscillations. When presented with

The network was first trained end-to-end to classify three different letters, presented in four quadrants. After training, we added semi-biologically plausible dynamics to the network using ordinary differential equations, where we introduced relaxation and a 10 Hz pulsed inhibition, akin to neuronal alpha oscillations. The relaxation term caused quasi-rhythmic oscillations in the units of the hidden and output layers. When adding the pulsed inhibition, the output nodes corresponding to the presented letters activated sequentially