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Neuroscience-Informed Neural Networks

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Despite the impressive accomplishments of deep learning systems in recent years, human-level AI still remains out of reach. The search space of possible solutions is vast and most likely very sparsely populated. So far, the human brain provides the only proof that a solution exists at all. Arguably, it can therefore provide us with valuable insights into the aspects necessary for achieving higher-level general intelligence. In this talk, we discuss two algorithms that take inspiration from neuroscientific theories to improve the capabilities of deep learning. First, we will present a training paradigm inspired by the local learning mechanisms found in the brain, that allows us to train a neural network without end-to-end backpropagation while achieving competitive performance. Second, we present an approach that takes inspiration from neuroscientific theories that relate oscillatory activation patterns in the brain (aka brain waves) to object representations. Implementing a similar encoding scheme in artificial neural networks yields an easy and efficient algorithm that we hope will eventually allow neural networks to reason about their environments.