Title: Bridging the gap between brains, cognition and deep learning

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Abstract

Connectionist ideas from three decades ago have fuelled a revolution in artificial intelligence with the rise of deep learning methods. Both the older connectionist ideas and the newer ones owe a lot to inspiration from the brain, but the gap between deep learning and neuroscience remains wide. We lay down some of these old ideas, based on learning distributed representations in order to jointly optimize by a gradient-based method all the modules of the system with respect to an objective function linked to a task or to capturing many aspects of the observed data. We also discuss the new ideas from deep learning, including a discussion of the newly acquired theoretical understanding of the advantages brought by jointly optimizing a deep architecture. Finally, we summarize some of the recent work aimed at bridging the remaining gap between deep learning and neuroscience, including approaches to implement functional equivalents to backpropagation in a more biologically plausible way, as well as ongoing work connecting language, cognition, reinforcement learning and the learning of abstract representations.


Equilibrium propagation: Bridging the gap between energy-based models and backpropagation, B Scellier, Y Bengio, Frontiers in Neuroscience, 2017