Deep Learning and Intelligence: Neuro-perspective and Recent Trends

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Abstract—Since its rise over ten years [1], deep neural networks (DNNs) have shown significant performance improvements in various fields, including image processing, audio processing, and natural language processing. This tutorial introduces deep learning from both neural-perspective and computational perspective. In the first part of the tutorial, we review the historical connections between neuroscience and computer science. In particular, we focus on the mechanism of the attention system that allows the artificial agents to focus on the task while keeping awareness of the surrounding. We demonstrate the advantage of this approach in two fields of research, 1) Robotic vision system in human environments, 2) Hard attention system with CNN to deal with large-size medical image analysis.

From the computational perspective, one often explains the power of DNNs by the term "representation learning", indicating that DNNs uncover the complicated variations in data to provide powerful representations that are useful for classification tasks. In the second part of this tutorial, we summarize the recent building blocks of DNNs, including convolutional operations, LSTMs, VAEs, GANs, and meta-learning and explain how DNNs learn meaningful representations by leveraging deep(hierarchical) priors and end-to-end training.

References