Deep Learning: A Comprehensive Overview

Deep learning is a subset of machine learning that is inspired by the structure and function of the human brain, specifically the interconnecting of many neurons. Artificial Neural Networks (ANNs) are algorithms that mimic the biological structure of the brain. In deep learning, each level transforms its input data into a slightly more abstract and composite representation. For instance, in an image recognition application, the raw input may be a matrix of pixels; the first representational layer may abstract the pixels and encode edges; the second layer may compose and encode arrangements of edges; the third layer may encode a nose and eyes; and the fourth layer may recognize that the image contains a face. Deep learning has produced results comparable to and in some cases surpassing human expert performance. It has been applied to various fields including computer vision, speech recognition, natural language processing, audio recognition, social network filtering, machine translation, bioinformatics, drug design, medical image analysis, and board game programs, where they have produced results comparable to and in some cases surpassing human expert performance. Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are two popular types of deep learning architectures. CNNs are primarily used for image processing and computer vision tasks, while RNNs are designed for sequential data like time series or natural language.