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## NEURAL NETWORKS AND DEEP LEARNING

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial in nature. Neural networks can adapt to changing input; so the network generates the best possible result without the necessity to redesign the output criteria. The concept of neural networks, which has its roots in artificial intelligence (AI), is swiftly gaining popularity in the development of trading systems.

Deep learning (also known as deep neural learning or deep neural network) is an AI function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in AI that has networks capable of learning unsupervised from unstructured or unlabeled data.

While traditional programs build analysis with data in a linear way, the hierarchical function of deep learning systems enables machines to process data with a nonlinear approach.

Deep learning is different from machine learning in the way each algorithm learns. Classical, or "non-deep", machine learning is dependent on human intervention to learn, requiring labeled datasets to understand the differences between data inputs. For example, if a person were to show you a series of images of different types of transport, he/she would label each picture with a transport type, such as “car,” “motorcycle,” or “bus.” The machine learning model would train and learn based on the labelled data fed into it, which is also known as supervised learning.

"Deep" machine learning can leverage labeled datasets to inform its algorithm, but it doesn’t necessarily require a labeled dataset; instead it can also leverage unsupervised learning to train itself. While supervised learning leverages labeled data, unsupervised learning uses unstructured, or unlabeled, data.

By observing patterns in the data, a machine learning model can cluster and classify inputs. Taking the same example from earlier, we could group pictures of cars, buses, and motorcycles into their respective categories based on the similarities identified in the images. With that said, a deep learning model would require more data points to improve its accuracy, whereas a machine learning model relies on less data given the underlying data structure. Deep learning is primarily leveraged for more complex use cases, like virtual assistants or fraud detection.

The “deep” in deep learning is referring to the depth of layers in a neural network. A neural network that consists of more than three layers – which would be inclusive of the inputs and the output – can be considered a deep learning algorithm.

Most deep neural networks are feed-forward, meaning they flow in one direction only from input to output. However, you can also train your model through backpropagation; that is, move in opposite direction from output to input. Backpropagation allows us to calculate and attribute the error associated with each neuron, allowing us to adjust and fit the algorithm appropriately.

Neural networks label data into classes by implicitly analyzing its parameters. For example, a neural network can analyse the parameters of a bank client such as age, solvency, credit history and decide whether to loan them money.

The algorithm has the ability to make predictions. For example, it can foresee the rise or fall of a stock based on the situation in the stock market.

Recognition is currently the widest application of neural networks. For example, a security system can use face recognition to only let authorized people into the building.

Deep learning and neural networks are useful technologies that expand human intelligence and skills. Neural networks are just one type of deep learning architecture. However, they have become widely known because neural networks can effectively solve a huge variety of tasks and cope with them better than other algorithms.