## Artificial neural network

Artificial Neural Network(ANN) uses the processing of the brain as a basis to develop algorithms that can be used to model complex patterns and prediction problems.

The network architecture has an input layer, hidden layer (there can be more than 1) and the output layer. It is also called MLP (Multi Layer Perceptron) because of the multiple layers.

The hidden layer can be seen as a “distillation layer” that distills some of the important patterns from the inputs and passes it onto the next layer to see. It makes the network faster and efficient by identifying only the important information from the inputs leaving out the redundant information

Characteristics :

ANNs have some key advantages that make them most suitable for certain problems and situations:

1. ANNs have the ability to learn and model non-linear and complex relationships, which is really important because in real-life, many of the relationships between inputs and outputs are non-linear as well as complex.

2. ANNs can generalize — After learning from the initial inputs and their relationships, it can infer unseen relationships on unseen data as well, thus making the model generalize and predict on unseen data.

3. Unlike many other prediction techniques, ANN does not impose any restrictions on the input variables (like how they should be distributed). Additionally, many studies have shown that ANNs can better model heteroskedasticity i.e. data with high volatility and non-constant variance, given its ability to learn hidden relationships in the data without imposing any fixed relationships in the data.

This is something very useful in financial time series forecasting (e.g. stock prices) where data volatility is very high.

**applications:**

1. ****Image Processing and Character recognition:****

Given ANNs ability to take in a lot of inputs, process them to infer hidden as well as complex, non-linear relationships, ANNs are playing a big role in image and character recognition. Character recognition like handwriting has lot of applications in fraud detection (e.g. bank fraud) and even national security assessments. Image recognition is an ever-growing field with widespread applications from facial recognition in social media, cancer detention in medicine to satellite imagery processing for agricultural and defense usage. The research on ANN now has paved the way for deep neural networks that forms the basis of “deep learning” and which has now opened up all the exciting and transformational innovations in computer vision, speech recognition, natural language processing — famous examples being self-driving cars.

1. ****Forecasting:****

Forecasting is required extensively in everyday business decisions (e.g. sales, financial allocation between products, capacity utilization), in economic and monetary policy, in finance and stock market. More often, forecasting problems are complex, for example, predicting stock prices is a complex problem with a lot of underlying factors (some known, some unseen). Traditional forecasting models throw up limitations in terms of taking into account these complex, non-linear relationships. ANNs, applied in the right way, can provide robust alternative, given its ability to model and extract unseen features and relationships. Also, unlike these traditional models, ANN doesn’t impose any restriction on input and residual distributions.

The algorithms of neural networks are part of the broader field of machine learning, and can be used in many applications to perform following tasks:

**Classification -**

to classify given pattern or data set into predefined class.

**Prediction -**

to produce outputs that are expected from given input.

**Clustering -**

to identify a unique feature of the data and classify them into different categories without any prior knowledge of the data.