1. **Artificial Neural Networks (ANN’s):**

It is based on a collection of connected units or nodes called artificial neurons. Each connection can transmit a signal to other neurons. The connections are called edges. Neurons and edges typically have a weight that adjusts as learning proceeds. Neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the input to the output layer

**Pattern Recognition** is the study of how machines can observe the environment, learn to distinguish patterns of interest from their background, and make sound and reasonable decisions about the categories of the patterns. Automatic recognition, description, classification, and grouping of patterns are important problems in a variety of engineering and scientific disciplines. A pattern could be a fingerprint image, a handwritten cursive word, a human face, or a speech signal.

**Examples:** Google Search, Baidu, Google Lens, Handwritten Characters Recognition

1. **Convolutional Neural Networks (CNN’s):**

The term convolutional means mathematical function derived by integration from two distinct functions. It includes rolling different elements together into a coherent whole by multiplying them. Convolution describes how the other function influences the shape of one function. The primary tasks of convolutional neural networks are the following: Classify visual content, recognize objects within is the scenery, Gather recognized objects into clusters

**Image Recognition**, CNN perceives an image as a volume, a three-dimensional object. Usually, digital color images contain Red-Blue-Green, aka RGB encoding. Convolutional networks understand images as three distinct channels of color stacked on top of each other. CNN groups pixels and processes them through a set of filters designed to get certain kinds of results. The number of filters applied usually depends on the complexity of an image and the purpose of recognition.

**Examples:** Yelp, Google Photos, Google Image Search, YouTube Video Analysis, NLP

1. **Deep Neural Networks (DNN’s):**

It is an artificial neural network (ANN) with multiple layers between the input and output layers. There are different types of neural networks but they always consist of the same components: neurons, synapses, weights, biases, and functions. These components functioning similarly to the human brain and can be trained like any other ML algorithm. Each mathematical manipulation as such is considered a layer, and complex DNN has many layers, hence the name "deep" networks. DNNs are typically feedforward networks in which data flows from the input layer to the output layer without looping back.

**Computer Vision** is an interdisciplinary scientific field that deals with how computers can gain a high-level understanding of digital images or videos. From the perspective of engineering, it seeks to understand and automate tasks that the human visual system can do. Computer vision tasks include methods for acquiring, processing, analyzing, and understanding digital images, and extraction of high-dimensional data from the real world to produce numerical or symbolic information, e.g. in the form of decisions.

**Examples:** Facebook Messenger, Chatbots, Oculus, Google Maps, Waymo, Object Detection

1. **Recurrent Neural Networks (RNN’s):**

It is a class of ANN’s where connections between nodes form a directed graph along a temporal sequence. This allows it to exhibit temporal dynamic behavior. Derived from feedforward neural networks, RNNs can use their internal state (memory) to process variable-length sequences of inputs. A finite impulse recurrent network is a directed acyclic graph that can be unrolled and replaced with a strictly feedforward neural network, while an infinite impulse recurrent network is a directed cyclic graph that can’t be unrolled

**Speech Recognition** enables the recognition and translation of spoken language into text by computers. Some speech recognition systems require "training". The system analyzes the person's specific voice and uses it to fine-tune the recognition of that person's speech, resulting in increased accuracy. Speech recognition applications include voice user interfaces such as voice dialing, call routing, search keywords, simple data entry, speech-to-text processing.

**Examples:** Google Translation, Text Conversion, Rhythm Learning, Music Composition

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**Long / Short Term Memory (LSTM):**

LSTM networks introduce a memory cell. They can process data with memory gaps. Above, we can notice that we can consider time delay in RNNs, but if our RNN fails when we have a large number of relevant data, and we want to find out relevant data from it, then LSTMs is the way to go. Also, RNNs cannot remember data from a long time ago, in contrast to LSTMs. **Applications:** Speech Recognition, Writing Recognition

**Auto Encoder (AE):**

An autoencoder neural network is an unsupervised machine learning algorithm. In an autoencoder, the number of hidden cells is smaller than the input cells. The number of input cells in autoencoders equals the number of output cells. On an AE network, we train it to display the output, which is as close as the fed input, which forces AEs to find common patterns and generalize the data. We use autoencoders for the smaller representation of the input.

**Applications:** Classification, Clustering, Feature Compression

**Markov Chain (MC):**

A Markov chain is a mathematical system that experiences the transition from one state to another based on some probabilistic rules. The probability of transitioning to any particular state is dependent solely on the current state, and time elapsed.

**Applications:** Speech Recognition, Information and Communication System, Queuing Theory, Statistics

**Generative Adversarial Network (GAN):**

GANs learn to generate new data with the same statistics as the training data. For example, if we train our GAN model on photographs, then a trained model will be able to generate new photographs that look authentic to the human eye. The objective of GANs is to distinguish between real and synthetic results so that it can generate more authentic results.

**Applications:** Generate New Human Poses, Photos to Emojis, Face Aging, Super Resolution, Video Prediction