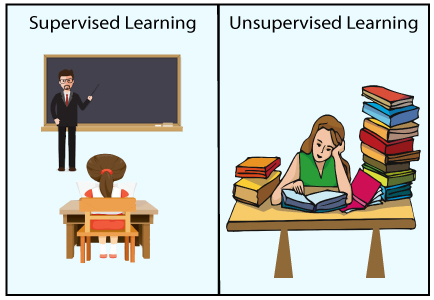
**Team id: PNT2022TMID08085**

**Title : Fertilizer Recommendation System for Disease Prediction**

|  |
| --- |
| **PRIOR KNOWLEDGE** |



## Supervised Machine Learning:

Supervised learning is a machine learning method in which models are trained using labeled data. In supervised learning, models need to find the mapping function to map the input variable (X) with the output variable (Y).

Supervised Machine learning

Supervised learning needs supervision to train the model, which is similar to as a student learns things in the presence of a teacher. Supervised learning can be used for two types of problems: **Classification** and **Regression**.

## Unsupervised Machine Learning:

Unsupervised learning is another machine learning method in which patterns inferred from the unlabeled input data. The goal of unsupervised learning is to find the structure and patterns from the input data. Unsupervised learning does not need any supervision. Instead, it finds patterns from the data by its own.

Unsupervised learning can be used for two types of problems: **Clustering** and **Association**.

**Regression classification and clustering :**

**Regression and Classification are types of supervised learning algorithms while Clustering is a type of unsupervised algorithm**.

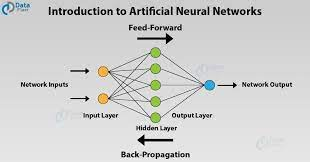
When the output variable is continuous, then it is a regression problem whereas when it contains discrete values, it is a classification problem.

# **Artificial neural network :**

**Artificial neural networks** (**ANNs**), usually simply called **neural networks** (**NNs**) or **neural nets**,[[1]](https://en.wikipedia.org/wiki/Artificial_neural_network#cite_note-1) are computing systems inspired by the [biological neural networks](https://en.wikipedia.org/wiki/Biological_neural_network) that constitute animal [brains](https://en.wikipedia.org/wiki/Brain).[[2]](https://en.wikipedia.org/wiki/Artificial_neural_network#cite_note-2)

An ANN is based on a collection of connected units or nodes called [artificial neurons](https://en.wikipedia.org/wiki/Artificial_neuron), which loosely model the [neurons](https://en.wikipedia.org/wiki/Neuron) in a biological brain. Each connection, like the [synapses](https://en.wikipedia.org/wiki/Synapse) in a biological brain, can transmit a signal to other neurons. An artificial neuron receives signals then processes them and can signal neurons connected to it. The "signal" at a connection is a [real number](https://en.wikipedia.org/wiki/Real_number), and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called *edges*. Neurons and edges typically have a [*weight*](https://en.wikipedia.org/wiki/Weighting) that adjusts as learning proceeds. The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that a signal is sent only if the aggregate signal crosses that threshold.

Typically, neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layers multiple times.



# **Convolutional neural network :**

In [deep learning](https://en.wikipedia.org/wiki/Deep_learning), a **convolutional neural network** (**CNN**, or **ConvNet**) is a class of [artificial neural network](https://en.wikipedia.org/wiki/Artificial_neural_network) (**ANN**), most commonly applied to analyze visual imagery.[[1]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-Valueva_Nagornov_Lyakhov_Valuev_2020_pp._232%E2%80%93243-1) CNNs are also known as **Shift Invariant** or **Space Invariant Artificial Neural Networks** (**SIANN**), based on the shared-weight architecture of the convolution kernels or filters that slide along input features and provide translation-[equivariant](https://en.wikipedia.org/wiki/Equivariant_map) responses known as feature maps.[[2]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-:0-2)[[3]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-:1-3) Counter-intuitively, most convolutional neural networks are not [invariant](https://en.wikipedia.org/wiki/Translation_invariant) to translation, due to the downsampling operation they apply to the input.[[4]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-:6-4) They have applications in [image and video recognition](https://en.wikipedia.org/wiki/Computer_vision), [recommender systems](https://en.wikipedia.org/wiki/Recommender_system),[[5]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-5) [image classification](https://en.wikipedia.org/wiki/Image_classification), [image segmentation](https://en.wikipedia.org/wiki/Image_segmentation), [medical image analysis](https://en.wikipedia.org/wiki/Medical_image_computing), [natural language processing](https://en.wikipedia.org/wiki/Natural_language_processing),[[6]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-6) [brain–computer interfaces](https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface),[[7]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-7) and financial [time series](https://en.wikipedia.org/wiki/Time_series).[[8]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-Tsantekidis_7%E2%80%9312-8)

CNNs are [regularized](https://en.wikipedia.org/wiki/Regularization_(mathematics)) versions of [multilayer perceptrons](https://en.wikipedia.org/wiki/Multilayer_perceptron). Multilayer perceptrons usually mean fully connected networks, that is, each neuron in one [layer](https://en.wikipedia.org/wiki/Layer_(deep_learning)) is connected to all neurons in the next [layer](https://en.wikipedia.org/wiki/Layer_(deep_learning)). The "full connectivity" of these networks make them prone to [overfitting](https://en.wikipedia.org/wiki/Overfitting) data. Typical ways of regularization, or preventing overfitting, include: penalizing parameters during training (such as weight decay) or trimming connectivity (skipped connections, dropout, etc.) CNNs take a different approach towards regularization: they take advantage of the hierarchical pattern in data and assemble patterns of increasing complexity using smaller and simpler patterns embossed in their filters. Therefore, on a scale of connectivity and complexity, CNNs are on the lower extreme.

Convolutional networks were [inspired](https://en.wikipedia.org/wiki/Mathematical_biology) by [biological](https://en.wikipedia.org/wiki/Biological) processes[[9]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-fukuneoscholar-9)[[10]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-hubelwiesel1968-10)[[11]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-intro-11)[[12]](https://en.wikipedia.org/wiki/Convolutional_neural_network#cite_note-robust_face_detection-12) in that the connectivity pattern between [neurons](https://en.wikipedia.org/wiki/Artificial_neuron) resembles the organization of the animal [visual cortex](https://en.wikipedia.org/wiki/Visual_cortex). Individual [cortical neurons](https://en.wikipedia.org/wiki/Cortical_neuron) respond to stimuli only in a restricted region of the [visual field](https://en.wikipedia.org/wiki/Visual_field) known as the [receptive field](https://en.wikipedia.org/wiki/Receptive_field). The receptive fields of different neurons partially overlap such that they cover the entire visual field.

CNNs use relatively little pre-processing compared to other [image classification algorithms](https://en.wikipedia.org/wiki/Image_classification). This means that the network learns to optimize the [filters](https://en.wikipedia.org/wiki/Filter_(signal_processing)) (or kernels) through automated learning, whereas in traditional algorithms these filters are [hand-engineered](https://en.wikipedia.org/wiki/Feature_engineering). This independence from prior knowledge and human intervention in feature extraction is a major advantage.

