Project Prior Knowledge

Team ID	PNT2022TMID08041
Project Name	Emerging Methods for Early Detection of Forest Fires

MACHINE LEARNING

Machine Learning is the science of making computers learn and act like humans by feeding data and information without being explicitly programmed!

Supervised Learning

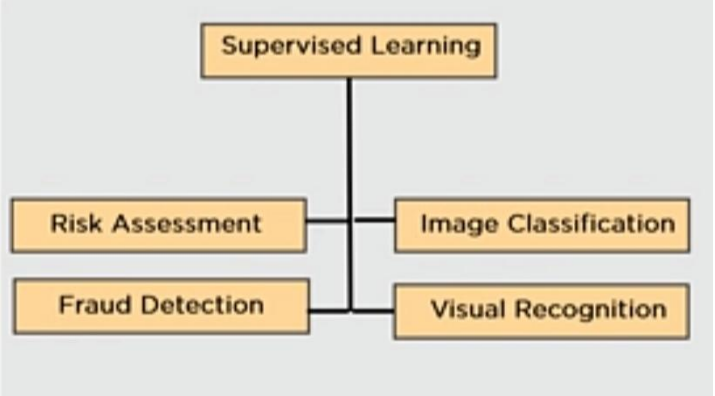
In Supervised Learning, a model is able to predict with the help of labeled dataset.

Types of Supervised Learning

- Classification: When the output variable is categorical ie, with 2 or more classes (yes/no, true/false), we make use of classification

- Regression: Relationship between two or more variables where a change in one variable is associated with a change in other variable

Application of Supervised Learning



Unsupervised Learning

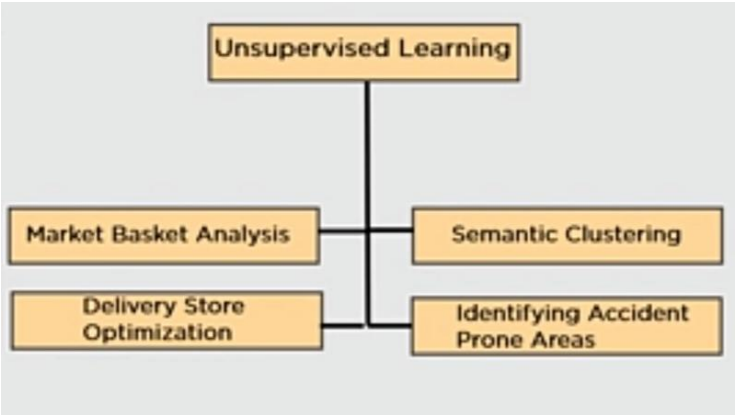
In Unsupervised Learning, the algorithm is trained using data that is unlabeled

Types of Unsupervised Learning

- Clustering: The method of dividing the objects into clusters which are similar between them and are dissimilar to the objects belonging to another cluster

- Association: Discovering the probability of the co-occurrence of items in a collection

Applications of Unsupervised Learning

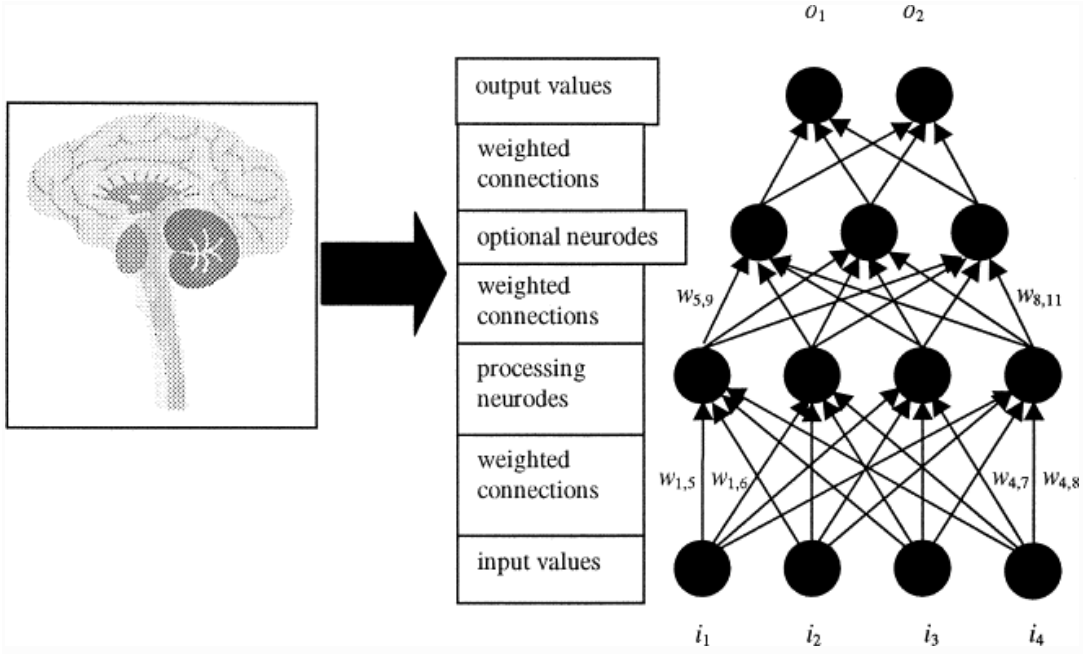


ARTIFICIAL NEURAL NETWORKS

Human brains interpret the context of real-world situations in a way that computers can't. Neural networks were first developed in the 1950s to address this issue. An artificial neural network is an attempt to simulate the network of neurons that make up a human brain so that the computer will be able to learn things and make decisions in a humanlike manner. ANNs are created by programming regular computers to behave as though they are interconnected brain cells.

How do Artificial Neural Networks learn?

Artificial neural networks are trained using a training set. For example, suppose you want to teach an ANN to recognize a cat. Then it is shown thousands of different images of cats so that the network can learn to identify a cat. Once the neural network has been trained enough using images of cats, then you need to check if it can identify cat images correctly. This is done by making the ANN classify the images it is provided by deciding whether they are cat images or not. The output obtained by the ANN is corroborated by a human-provided description of whether the image is a cat image or not. If the ANN identifies incorrectly then back-propagation is used to adjust whatever it has learned during training. Back-propagation is done by fine-tuning the weights of the connections in ANN units based on the error rate obtained. This process continues until the artificial neural network can correctly recognize a cat in an image with minimal possible error rates.



Types of Artificial Neural Network

- Feedforward Neural Network
- Recurrent Neural Network
- Convolutional Neural Network
- Modular Neural Network
- Radial basis function Neural Network

What are artificial neural networks used for?

There are several ways artificial neural networks can be deployed including to classify information, predict outcomes and cluster data. As the networks process and learn from data they can classify a given data set into a predefined class, it can be trained to predict outputs that are expected from a given input and can identify a special feature of data to then classify the data by that special feature. Google uses a 30-layered neural network to power Google Photos as well as to power its “watch next” recommendations for YouTube videos. Facebook uses artificial neural networks for its DeepFace algorithm, which can recognize specific faces with 97% accuracy. It’s also an ANN that powers Skype’s ability to do translations in real-time.And various other applications in,

- Social Media
- Marketing and Sales
- Healthcare
- Personal Assistants

Computers have the ability to understand the world around them in a very human-like manner thanks to the power of artificial neural networks.

CONVOLUTIONAL NEURAL NETWORK

A convolutional neural network (CNN or ConvNet), is a network architecture for deep learning which learns directly from data, eliminating the need for manual feature extraction.

CNNs are particularly useful for finding patterns in images to recognize objects, faces, and scenes. They can also be quite effective for classifying non-image data such as audio, time series, and signal data.

There are other types of neural networks in deep learning, but for identifying and recognizing objects, CNNs are the network architecture of choice. This makes them highly suitable for computer vision (CV) tasks and for applications where object recognition is vital, such as self-driving cars and facial recognition.

Using CNNs for deep learning is popular due to three important factors:

- CNNs eliminate the need for manual feature extraction—the features are learned directly by the CNN
- CNNs produce highly accurate recognition results.
- CNNs can be retrained for new recognition tasks, enabling you to build on pre-existing networks.

How CNN works?

A convolutional neural network can have tens or hundreds of layers that each learn to detect different features of an image. Filters are applied to each training image at different resolutions, and the output of each convolved image is used as the input to the next layer. The filters can start as very simple features, such as brightness and edges, and increase in complexity to features that uniquely define the object.

Feature Learning, Layers, and Classification

Like other neural networks, a CNN is composed of an input layer, an output layer, and many hidden layers in between.

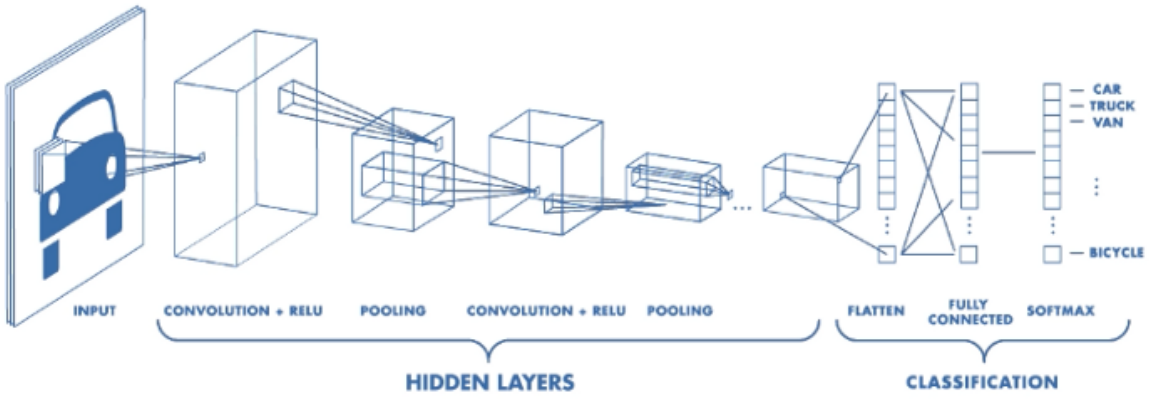
These layers perform operations that alter the data with the intent of learning features specific to the data. Three of the most common layers are: convolution, activation or ReLU, and pooling.

- Convolution puts the input images through a set of convolutional filters, each of which activates certain features from the images.

- Rectified linear unit (ReLU) allows for faster and more effective training by mapping negative values to zero and maintaining positive values. This is sometimes referred to as *activation*, because only the activated features are carried forward into the next layer.

- Pooling simplifies the output by performing nonlinear downsampling, reducing the number of parameters that the network needs to learn.

These operations are repeated over tens or hundreds of layers, with each layer learning to identify different features.



Applications of Convolutional Neural Network

The most common applications of CV and CNNs are used in fields such as the following:

- Healthcare. CNNs can examine thousands of visual reports to detect any anomalous conditions in patients, such as the presence of malignant cancer cells.
- Automotive. CNN technology is powering research into autonomous vehicles and self-driving cars.
- Social media. Social media platforms use CNNs to identify people in a user's photograph and help the user tag their friends.
- Retail. E-commerce platforms that incorporate visual search allow brands to recommend items that are likely to appeal to a shopper.
- Facial recognition for law enforcement. Generative adversarial networks (GANs) are used to produce new images that can then be used to train deep learning models for facial recognition
- Audio processing for virtual assistants. CNNs in virtual assistants learn and detect user-spoken keywords and process the input to guide their actions and respond to the user.