Deep learning

Forest Fire detection

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# Deep Learning

## What is deep learning

Deep learning is a subset of [machine learning](https://www.ibm.com/topics/machine-learning) that uses multilayered [neural networks](https://www.ibm.com/topics/neural-networks), called deep neural networks, to simulate the complex decision-making power of the human brain. Some form of deep learning powers most of the [artificial intelligence (AI)](https://www.ibm.com/topics/artificial-intelligence) applications in our lives today.

## Dl in data science

Deep learning is an aspect of data science that drives many applications and services that improve [automation](https://www.ibm.com/consulting/automation), performing analytical and physical tasks without human intervention. This enables many everyday products and services, such as digital assistants, voice-enabled TV remotes, credit card fraud detection, self-driving cars and generative AI.

## dl vs ml

Deep learning and Machine learning is the structure of the underlying neural network architecture. “Nondeep,” [traditional machine learning](https://www.ibm.com/think/topics/machine-learning-types) models use simple neural networks with one or two computational layers. Deep learning models use three or more layers, but typically hundreds or thousands of layers to train the models.

## How it works

Neural networks, or artificial neural networks, attempt to mimic the human brain through a combination of data inputs, weights and bias, all acting as silicon neurons. These elements work together to accurately recognize, classify and describe objects within the data

# What is Neural Network and It’s types?

A neural network is a method in [artificial intelligence (AI)](https://aws.amazon.com/ai/) that teaches computers to process data in a way that is inspired by the human brain. It is a type of [machine learning (ML)](https://aws.amazon.com/ai/machine-learning/) process, called [deep learning](https://aws.amazon.com/what-is/deep-learning/), that uses interconnected nodes or neurons in a layered structure that resembles the human brain. It creates an adaptive system that computers use to learn from their mistakes and improve continuously. Thus, artificial neural networks attempt to solve complicated problems, like summarizing documents or recognizing faces, with greater accuracy.

Types:

CNN ([Convolutional Neural Networks](https://www.ibm.com/topics/convolutional-neural-networks) ):

[Convolutional neural networks (CNNs or ConvNets)](https://www.ibm.com/topics/convolutional-neural-networks) areused primarily in [computer vision](https://www.ibm.com/topics/computer-vision) and image classification applications. They can detect features and patterns within images and videos, enabling tasks such as object detection, image recognition, pattern recognition and face recognition. These networks harness principles from linear algebra, particularly matrix multiplication, to identify patterns within an image.

RNN ([Recurrent Neural Networks](https://www.ibm.com/topics/convolutional-neural-networks) ):

[Recurrent neural networks (RNNs)](https://www.ibm.com/topics/recurrent-neural-networks)are typically used in natural language and [speech recognition](https://www.ibm.com/topics/speech-recognition) applications as they use sequential or time-series data. RNNs can be identified by their feedback loops. These learning algorithms are primarily used when using time-series data to make predictions about future outcomes. Use cases include stock market predictions or sales forecasting, or ordinal or temporal problems, such as language translation, [natural language processing (NLP)](https://www.ibm.com/topics/natural-language-processing), speech recognition and image captioning. These functions are often incorporated into popular applications such as Siri, voice search and Google Translate

# What is CNN?

A Convolutional Neural Network (CNN), also known as ConvNet, is a specialized type of deep learning algorithm mainly designed for tasks that necessitate object recognition, including image classification, detection, and segmentation. CNNs are employed in a variety of practical scenarios, such as autonomous vehicles, security camera systems, and others.

**Key Components of a CNN**:

* Convolutional layers
* Rectified Linear Unit (ReLU)
* Pooling layers
* Fully connected layers

**How CNNs Work?**

1. **Input Image**: The CNN receives an input image, which is typically preprocessed to ensure uniformity in size and format.
2. **Convolutional Layers**: Filters are applied to the input image to extract features like edges, textures, and shapes.
3. **Pooling Layers**: The feature maps generated by the convolutional layers are downsampled to reduce dimensionality.
4. **Fully Connected Layers**: The downsampled feature maps are passed through fully connected layers to produce the final output, such as a classification label.
5. **Output**: The CNN outputs a prediction, such as the class of the image.

# About Today’s pipeline

* 1. Data Collection and Data Loading
* Here data collection involves collecting of data from various sources which require for our project the recommended source is Kaggle
* This data is loaded into our working environment for further process we use google colab as our working environment
  1. Image Processing and image augmentation
* Image processing involves processing of image to ensure consistency e.g., resizing to 128X128
* Augmentation for diversity e.g., rotation, flipping
* Uses libraries like TensorFlow, Keras
  1. Build CNN
* This is used for image classification
* Train the model with labeled data
* Validate using validation dataset
  1. Test and evaluate
* Test the model on unseen data
* Evaluate accuracy/performance