

Use cases for Models

Statistical Models:

- **Linear Regression:** Linear Regression is a statistical and machine learning method which models the relationship between a dependent variable and one or more independent variables, by fitting a straight line or a plane to the data points for predicting future outcomes.
Use Case: Predicting a student's exam score based on the hours they study.
- **Logistic Regression:** It is a statistical and machine learning tool that models the probability of a binary (T/F) dependent variable, such as "yes/no" based on one or more independent variables.
Use Case: Predicting the probability of a patient developing a certain disease or not.

Machine Learning Models:

- **Decision Tree Classifier:** It is a supervised machine learning algorithm used for classification tasks. It employs a tree-like structure to model decisions and their possible outcomes. It consists of root nodes, internal nodes, branches and leaf nodes. This structure helps in classifying data points into pre-defined categories.
Use Case: Predicting whether a person will buy a house based on their age and income.
- **Support Vector Machines:** It is a supervised machine learning algorithm, primarily used for classification and also applicable to regression. Its core idea is to find the optimal hyperplane that separates different classes in the dataset, maximizing the margin between them.
Use Case: Classifying emails as "Spam" or "not Spam" based on the presence of certain keywords present in the email and the sender's reputation score.
- **Random Forest:** The Random Forest algorithm is a supervised machine learning algorithm used for both classification and regression tasks. It operates by constructing a multitude of decision trees during training and outputting the class that is the mode of the classes (for classification) or mean prediction (for regression) of the individual trees. It's an ensemble method that leverages the "wisdom of crowds" principle to achieve higher accuracy and stability than a single decision tree.
Use Case: Predicting whether a person will churn (cancel telecom service) based on the certain features like, data usage, monthly bill, contract type, etc.

Deep Learning Models:

- **Convolutional Neural Network (CNN):** Convolutional Neural Networks (CNNs) are a class of deep learning models primarily used for analyzing visual imagery. They are particularly effective in tasks such as image classification, object detection, and image segmentation due to their ability to automatically learn hierarchical features from raw pixel data.
Use Case: Consider training a CNN to classify images of animals into categories like "cat," "dog," or "bird".
- **Recurrent Neural Networks (RNN) :** RNN are a class of neural networks designed to process sequential data, where order of information is required. Unlike traditional feed-forward neural networks which treat input independently, RNNs have a “memory” which contains past information which they use when processing current information. This memory is achieved by feeding the output or hidden state from a previous time step back into the network as an input for the current time step.
Use Case: Predicting the next word in a sentence while typing.
- **Transformers:** A transformer is a neural network architecture, primarily known for its efficiency and effectiveness in processing sequential data particularly in the field of NLP. It revolutionized the field by introducing the "attention mechanism," which allows the model to weigh the importance of different parts of the input sequence when making predictions.
Use Case: Translating a sentence from one language to another.

Generative Models:

- **Generative Adversarial Network (GAN) :** It is a deep learning architecture composed of two neural networks, a generator, and a discriminator, that competes against each other in a zero sum game. The adversarial process drives both networks to improve, ultimately enabling the generator to generate highly realistic synthetic data.
Use Case: Training a GAN to generate a realistic Human face.
- **Diffusion Model:** Diffusion models are a type of generative artificial intelligence that creates new data (like images, audio, or text) by starting with random noise and then gradually removing it step by step for a better output.
Use Case: Image Generation, Audio Generation, Video Generation, etc.
- **Large Language Models (LLMs) :** A Large Language Model (LLM) is an advanced AI system trained on vast amounts of text and data to understand, interpret, and generate human-like language. Unlike earlier AI that relied on rigid rules, LLMs use deep learning to learn from patterns in their massive datasets. This enables them to perform a wide variety of natural language processing (NLP) tasks with impressive fluency and

contextual awareness.

Use Case: Writing an email, Creating a report, etc.