Types of AI and Machine Learning Models

Statistical Models

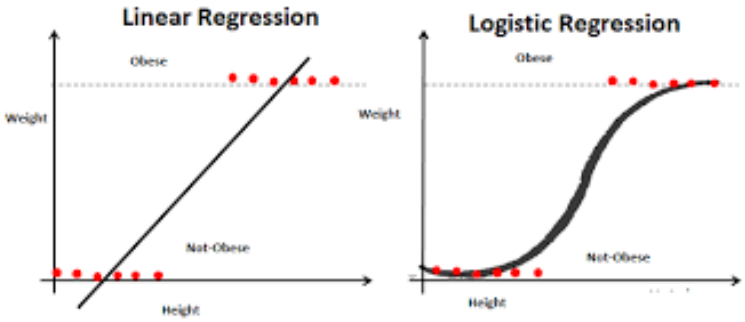
Statistical models are the foundation of predictive analytics. They use mathematical relationships between variables to make predictions based on **probability distributions**.

These models are interpretable, simple, and effective — especially when data is linear and assumptions hold true.

Key Examples & Use Cases

1. Linear Regression: Predicts a continuous numeric outcome based on one or more features.

- **Use Case:** *Housing Price Prediction*
  A real estate agency uses linear regression to predict house prices based on size, number of rooms, and location.



2. Logistic Regression: Predicts a binary outcome (yes/no, 0/1).

- **Use Case:** *Credit Card Fraud Detection*
  A bank uses logistic regression to determine if a transaction is fraudulent based on variables like amount, location, and time.

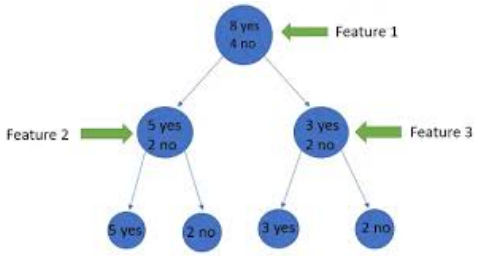
Machine Learning Models

Machine Learning (ML) models automatically learn from data without being explicitly programmed. They **adapt** and **improve** as more data becomes available.

These models are great for problems where data is non-linear, and pattern recognition is needed.

Key Examples & Use Cases

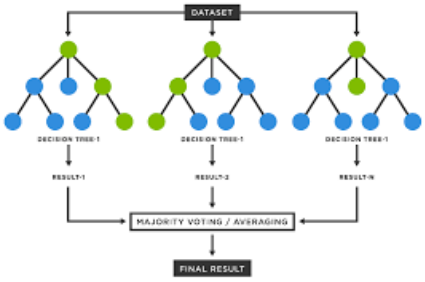
1. Decision Trees : Breaks down decisions into a tree structure based on feature splits.



- **Use Case:** *Fruit Sorting in Agriculture*

A farm uses decision trees to sort fruits (e.g., apple or orange) based on color, weight, and size.

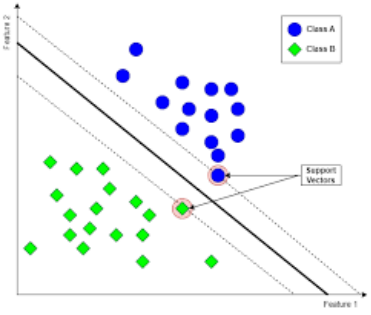
2. Random Forests: An ensemble of decision trees that improves accuracy and reduces overfitting.



- **Use Case:** *Patient Risk Prediction*

Hospitals use random forests to predict the risk of diseases based on patient history, lab results, and lifestyle.

3. Support Vector Machines (SVM): Finds the best boundary (hyperplane) to separate classes.



- **Use Case:***Email Spam Classification*

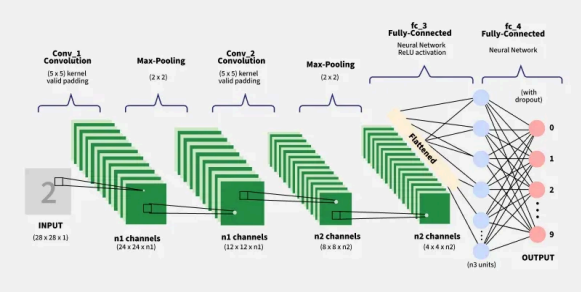
An email client uses SVMs to classify incoming messages as spam or not based on keywords and metadata.

Deep Learning Models

Deep learning models are built using **neural networks** with multiple layers, enabling them to learn complex, non-linear relationships. These models **mimic the human brain** and excel in processing **images, sound, and natural language**.

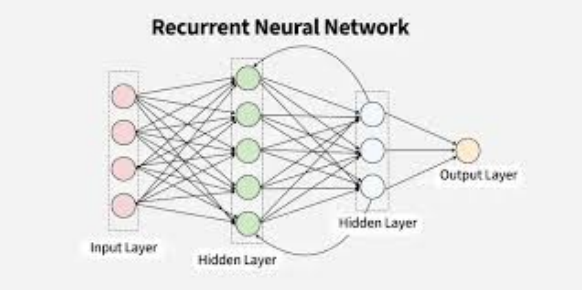
Key Examples & Use Cases

1. Convolutional Neural Networks (CNNs): Designed for image data; captures spatial hierarchies in images.



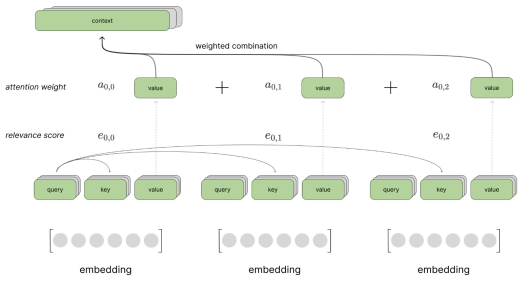
- **Use Case:** *Facial Recognition in Security Systems*
  CNNs identify and verify faces in surveillance footage or smartphone unlock systems.

2. Recurrent Neural Networks (RNNs): Designed for sequential data like time series or text.



- **Use Case:** *Speech Recognition Systems*
  Virtual assistants like Siri or Alexa use RNNs to convert spoken language into text commands.

3. Transformers: Handles long-range dependencies in text better than RNNs; forms the basis of modern NLP.



- **Use Case:** *Language Translation (Google Translate)*
  Transformers power translation engines that convert entire paragraphs accurately between languages.

Generative Models

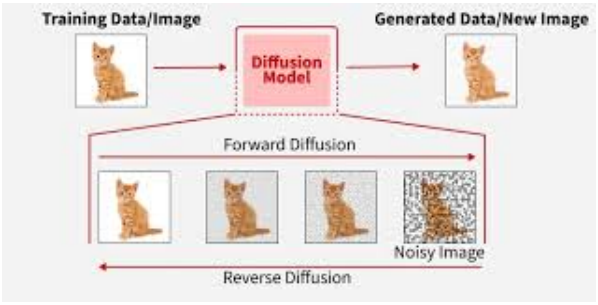
Generative models go beyond pattern recognition — they **create new data**. By learning the distribution of existing data, they can generate images, text, audio, and more.

Key Examples & Use Cases

1. GANs (Generative Adversarial Networks): Two networks (generator and discriminator) compete to produce realistic data.

- **Use Case:** *AI-Generated Art or Faces*
  GANs are used to create synthetic but realistic portraits or artworks for games, design, or avatars.

2. Diffusion Models: Start from random noise and iteratively "denoise" to create data.



- **Use Case:** *Image Generation (DALL·E, MidJourney)*
  Tools like DALL·E use diffusion to generate images from text prompts.

3. LLMs (Large Language Models): Generate and understand text using billions of parameters.

- **Use Case:** *Content Generation (ChatGPT)*
  LLMs like GPT-4 generate emails, essays, code, and more, based on a given prompt.