# Introduction to Machine Learning

What is Machine Learning?

- Machine learning is a method of data analysis that automates analytical model building.
- Using algorithms that iteratively learn from data, machine learning allows computers to find hidden insights without being explicitly programmed where to look.

What is it used for?

- Fraud detection.
- Web search results.
- Real-time ads on web pages
- Credit scoring and next-best offers.
- Prediction of equipment failures.
- New pricing models.
- Network intrusion detection.
- Recommendation Engines
- Customer Segmentation
- Text Sentiment Analysis
- Predicting Customer Churn
- Pattern and image recognition.
- Email spam filtering.
- Financial Modelling

Machine Learning Process
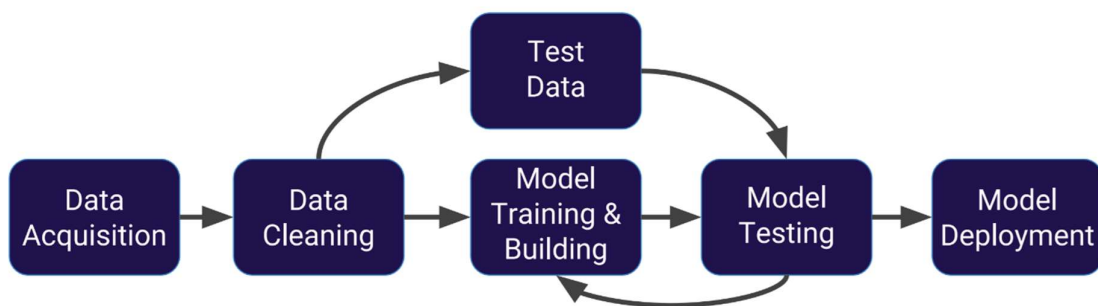
Supervised Learning

- **Supervised learning** algorithms are trained using labeled examples, such as an input where the desired output is known.
- For example, a piece of equipment could have data points labeled either "F" (failed) or "R" (runs).
- The learning algorithm receives a set of inputs along with the corresponding correct outputs, and the algorithm learns by comparing its actual output with correct outputs to find errors.
- It then modifies the model accordingly.
- Through methods like classification, regression, prediction, and gradient boosting, supervised learning uses patterns to predict the values of the label on additional unlabeled data.
- Supervised learning is commonly used in applications where historical data predicts likely future events.
- For example, it can anticipate when credit card transactions are likely to be fraudulent or which insurance customer is likely to file a claim.
- Or it can attempt to predict the price of a house based on different features for houses for which we have historical price data.

Unsupervised Learning

- Unsupervised learning is used against data that has no historical labels.
- The system is not told the "right answer." The algorithm must figure out what is being shown.
- The goal is to explore the data and find some structure within.
- Or it can find the main attributes that separate customer segments from each other.
- Popular techniques include self-organizing maps, nearest-neighbor mapping, k-means clustering, and singular value decomposition.
- These algorithms are also used to segment text topics, recommend items and identify data outliers.

Reinforcement Learning

- Reinforcement learning is often used for robotics, gaming, and navigation.
- With reinforcement learning, the algorithm discovers through trial and error which actions yield the greatest rewards.
- This type of learning has three primary components: the agent (the learner or decision-maker), the environment (everything the agent interacts with) and actions (what the agent can do).
- The objective is for the agent to choose actions that maximize the expected reward over a given amount of time.
- The agent will reach the goal much faster by following a good policy.
- So the goal in reinforcement learning is to learn the best policy.