**Name: MohammedAmman Chopadiya**

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* **How Machine Learning works:**
  + Build prediction models.
  + Learns from pervious data and predicts future outputs.
  + Helps get solution of complex problems in a simpler manner.
* **Features of Machine Learning:**
  + Use data to predict patterns
  + Improve automatically
  + Data-driven technology
  + Deal with huge amounts of data
* **Importance for Machine Learning:**
  + Rapid production of data
  + Solve complex problems
  + Optimized decision making
  + Identify hidden patterns and extract information
* **Types of data:**
  + Structured:
    - Stored in relational databases
    - Highly organized
    - Labelled
    - Well-defined
    - Example like names, dates, addresses, credit card numbers, stock information, geolocation
  + Unstructured:
    - No predefined format
    - Much more difficult to process
    - For example emails, word processing documents, PDF files, audio files, videos, images, etc
  + Semi-structured:
    - Organized but not highly
    - Not stored in relational databases
    - For example HTML, XML, JSON documents, NoSQL databases, etc.
  + Metadata:
    - Data about data
    - Describes data
* **Classification of Machine Learning Techniques:**

1. Supervised Machine Learning
   * Train on labelled data
   * Test model on sample data to predict accuracy
   * Map input data to output data
   * Types: Classification and Regression
2. Unsupervised Learning

* Learn without Supervision
* Data not labelled
* Restructure data into new groups
* Types: Clustering and Association

1. Semi-supervised Learning
   * Hybridization of supervised and unsupervised learning
2. Reinforcement Learning
   * Feedback based learning
   * Right action: reward, Wrong action: Penalty
   * Goal: get most reward points

* **Classification Analysis**
  + **Binary classification**
    - Have two classes
    - Differentiate in two things
  + **Multiclass classification**
    - Have more than two class labels
    - Works on range of specified classes
  + **Multi-Label classification**
    - One element associated with several classes
    - Hierarchically structured
  + **Naive Bayes (NB):**
    - Follow Bayes’ theorem
    - Works for both binary and multiclass.
    - Classify data and build model
    - Small amount of training data
  + **Linear Discriminant Analysis (LDA)**
    - Linear decision boundary classifier
    - Differentiate in two things
  + **Logistic Regression**
    - Probabilistic based statistical model
    - Uses a logistic function to estimate the probabilities
    - Can be used for both classification and regression problems
  + **K** **-nearest neighbors (KNN)**
    - Instance based learning algorithm
    - Differentiate in two things
  + **Support vector machine (SVM)**
    - Constructs a hyper-plane or set of hyper-planes
    - Behave differently based on different mathematical functions
    - Does not perform well on very noisy data
  + **Decision Tree**
    - Non-parametric supervised learning method
  + **Random forest (RF)**
    - Parallel ensembling on sub-samples
    - Series of decision trees
    - More accurate
  + **Adaptive Boosting**
    - Iterative approach to improve poor classifiers
    - Meta-learning
    - Combines many classifiers for accuracy
    - Learns from errors
  + **Extreme gradient boosting**
    - Generates a final model based on a series of individual models
    - Fast to interpret
    - Handles large-sized datasets well
  + **Stochastic gradient descent**
    - Iterative method
    - Optimize functions
    - Large scale models
  + **Rule-based Classification**
    - Makes use of IF-THEN rules for class prediction
    - Decision tree is rule-based classification algorithm
    - Easier to interpret
    - Used to produce descriptive models
* **Applications of Machine Learning:**
* Image Recognition
  + Deep Learning
  + Face Detection
  + Image Classification
* Speech Recognition
  + Communication
  + Convert voice to text
* Recommender Systems
  + Customized services
  + Recommend content based on search history and preferences
* Fraud Detection
  + Live detection of frauds
  + Alert Systems
* Self-Driving Cars
  + Automated driving
* Medical Diagnosis
  + Disease classification
  + Disease prediction and detection
  + Plant disease related tasks
* Stock Market Trading
  + Predict future trends and prices
  + Time series forcasting
  + Sequential data
* Virtual Try On
  + Identification of landmarks
  + Tracking objects
  + Virtual object placement
  + Artificial Reality