Fundamentals of Machine Learning

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Module 0. About the Course (3 min)

Module 1. Introduction to Machine Learning (19 min)

- *Humans and Machine Learning*
- *What Happens In ML*
- *What Is Machine Learning?*
- *Type Of Machine Learning*
    - Supervised Learning
    - Unsupervised Learning
    - Reinforcement Learning
    - Simple Cartoon
- *Learning Styles*
- *Machine Learning Algorithms*
- *Machine Learning Process*
- *Why Now?*
- *Applications of ML*
- *ML Example: Price Surging*

Module 2. Introduction to Statistical Learning Theory (22 min)

- *What Is Statistical Learning Theory?*
- *Decision Theory*
- *Machine Learning Action*
- *Sequence of Events*
- *Decision & Loss Functions*
    - Evaluating Decision Functions
- *Prediction Model Overview*
    - Predictive Modeling
    - Types of Predictive Modeling
    - Which Model to Use
- *Continuous Vs. Categorical Data*
- *Bias Variance Tradeoff*
- *Typology Of Errors*
    - Example About Errors: COVID Testing
- *Least Square Method*
    - Least Square Regression Line
    - Types Of Least Squares Fitting

Module 3. Supervised Learning (33 min)

- *Supervised Learning*
- *How Does Supervised Learning Work?*
- *Training Model*
- *Everyday Example*
- *Types of Supervised Learning*
- *Algorithms*
- *Linear Regression*
    - Finding The Best Fit Line

- *Logistic Regression*
- *Decision Trees (CART)*
    - Components of A Decision Tree
    - Implementation Steps of A Decision Tree
    - Criterion for Attribute Selection
    - Gini Index And Information
- *Ensemble Learning*
- *Random Forest*
    - Advantages/Disadvantages
- *Classification: K-Nearest Neighbor*
    - KNN and Number Of Neighbors
    - Advantages and Disadvantages
- *How to Select Algorithms?*
- *Finding The Best Algorithm*
- *Model Performance*

Module 4. Unsupervised Learning (34 min)

- *Unsupervised Learning*
- *How Unsupervised Learning Works*
- *Why Unsupervised Learning*
- *Applications of Unsupervised learning*
- *When Should You Choose Supervised Vs. Unsupervised?*
- *Types of Unsupervised learning*
    - Clustering
        - Types of Clustering
        - Most Used Clustering Algorithms
    - K-Means Clustering
        - K-Means Clustering – Process Map
        - Complexity/Variety Tradeoff
        - Applications
    - Association
        - Association Rule Learning Algorithms
        - Association Rule Mining
        - Measures of Effectiveness of the Rule
    - Dimensionality Reduction
        - Why Dimensionality Reduction?
        - Dimensionality Reduction Technique
        - Benefits of Performing Feature Selection
        - Methods of Dimension Reduction
        - What is Principal Component Analysis?
        - When to use PCA?
        - PCA Recap
    - Auto-encoders
        - Auto-encoders: Image Denoising

Module 5. Deep Learning (37 min)

- *What is Deep Learning?*

- *History of Deep Learning*
- *How Does Deep Learning Work?*
  - Neural Networks
  - Shallow Vs. Deep Neural Networks
  - Biological Neural Network (BNN)
  - Artificial Neural Network (ANN)
  - Comparison Between BNN and ANN
- *Components of Neural Networks*
  - Foundation of Neural Networks
  - Perceptron Learning Process
  - Backpropagation in Neural Networks
  - Neural Network Activation Functions
  - Role of the Activation Function
- *How Do You Train an Algorithm?*
- *What Kinds of Neural Networks Exist?*
  - Convolutional Neural Networks (CNN)
  - Capsule Neural Networks (CapsNet)
  - Recurrent Neural Networks (RNN)
  - Generative Adversarial Networks (GAN)
- *What Kind of Problems do NN's Solve?*
- *When to Use Deep Learning*
- *Programming Languages Used for Deep Learning*
- *Top 5 Learning Frameworks*
- *Deep Learning Uses*

Module 6. Business Applications (24 min)

- *Machine Learning Review*
- *Natural Language Processing (NLP)*
  - Natural Language Processing Definitions
  - Top Advantages of NLP
  - NLP Application
  - How Does NLP Work?
  - NLP Techniques: Syntactic Analysis
  - NLP Techniques: Semantic Analysis
  - Stopword Removal
- *Examples*
  - NLP Applications
  - Chatbot
  - Sentiment Analysis
- *Soft Clustering: Search Engine Indexing*
- *Clustering Example: Image Indexing*
- *Clustering Example: Market Segmentation*
- *Clustering Example: Recommendation Engine*
- *Classification Example: Disease Prediction*
- *Classification Example: Fraud Detection*
- *Regression Example: Financial Forecasting*
- *ML Across Industries*