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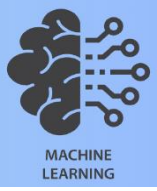
Artificial Intelligence and Machine Learning



Artificial Intelligence and Machine Learning Course Content

Module	Topics	Subtopics	Details
1. Introduction to AI & ML	Overview of AI	- History of AI - Applications of AI - AI vs ML vs Data Science	Understanding the basic concepts and evolution of AI and ML. Discussing real-world applications and differences between AI, ML, and Data Science.
	Introduction to Machine Learning	- Types of ML: Supervised, Unsupervised, Reinforcement - Key Concepts: Algorithms, Models, Features, Labels	Differentiating between types of ML and understanding fundamental concepts.
	Tools and Frameworks	- Python & Libraries (NumPy, Pandas, Scikit-Learn) - Jupyter Notebook - Introduction to TensorFlow & PyTorch	Getting familiar with tools and libraries commonly used in AI and ML.
2. Python for AI/ML	Python Basics	- Variables and Data Types - Control Structures - Functions and Modules	Building a foundation in Python programming.
	Data Handling with Python	- NumPy: Arrays and Operations - Pandas: DataFrames, Series, Data Cleaning - Data Visualization: Matplotlib, Seaborn	Learning data manipulation and visualization techniques essential for ML.
	Working with Datasets	- Loading and Exploring Datasets	Practical experience with real datasets, preparing them for ML models.

Module	Topics	Subtopics	Details
		- Data Preprocessing: Handling Missing Data, Encoding - Data Splitting: Train/Test Split, Cross-Validation	
3. Statistics & Mathematics for ML	Probability Theory	- Basic Probability Concepts - Conditional Probability - Bayes' Theorem	Understanding probability as it applies to machine learning.
	Statistics Basics	- Descriptive Statistics: Mean, Median, Mode - Inferential Statistics: Hypothesis Testing, Confidence Intervals	Learning how to describe and infer data.
	Linear Algebra	- Vectors and Matrices - Eigenvalues and Eigenvectors - Matrix Decomposition (SVD, PCA)	Mathematical foundations critical for understanding ML algorithms.
	Calculus	- Derivatives and Integrals - Gradient Descent - Partial Derivatives	Applying calculus to optimize machine learning models.
4. Supervised Learning	Regression Analysis	- Linear Regression - Polynomial Regression - Regularization Techniques (Ridge, Lasso)	Understanding regression models and techniques to improve model performance.
	Classification Algorithms	- Logistic Regression - K-Nearest Neighbors (KNN) - Support Vector Machines (SVM) - Decision Trees - Random Forests - Naive Bayes	Learning various classification algorithms and their applications.

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	Model Evaluation	- Metrics: Accuracy, Precision, Recall, F1-Score - ROC Curve and AUC - Cross-Validation - Hyperparameter Tuning	Techniques to evaluate and improve model performance.
5. Unsupervised Learning	Clustering Techniques	- K-Means Clustering - Hierarchical Clustering - DBSCAN	Exploring clustering methods to group data.
	Dimensionality Reduction	- Principal Component Analysis (PCA) - t-SNE - Autoencoders	Techniques to reduce the dimensionality of data while preserving its structure.
	Association Rule Learning	- Apriori Algorithm - Eclat Algorithm - Market Basket Analysis	Finding relationships between variables in large datasets.
6. Advanced Machine Learning	Ensemble Methods	- Bagging & Boosting - AdaBoost - Gradient Boosting - XGBoost - Stacking	Advanced techniques to combine multiple models for better performance.
	Neural Networks	- Introduction to Neural Networks - Activation Functions - Backpropagation - Deep Learning Basics	Understanding the architecture and training of neural networks.
	Deep Learning with TensorFlow/PyTorch	- Building Neural Networks - Convolutional Neural Networks (CNN) - Recurrent Neural Networks (RNN) - Transfer Learning	Hands-on experience with deep learning frameworks.
	Natural Language Processing (NLP)	- Text Preprocessing - Bag of Words & TF-IDF - Sentiment Analysis	Techniques to work with text data and build NLP models.

Module	Topics	Subtopics	Details
		- Word Embeddings (Word2Vec, GloVe) - Transformers and BERT	
7. Reinforcement Learning	Fundamentals of Reinforcement Learning	- Markov Decision Process - Exploration vs Exploitation - Policy Gradients	Understanding the basics of reinforcement learning and its applications.
	Q-Learning & Deep Q-Learning	- Q-Learning Algorithm - Deep Q-Networks (DQN) - Applications in Games and Robotics	Building intelligent agents using reinforcement learning techniques.
8. AI/ML in Practice	Model Deployment	- Model Saving and Loading - Deployment with Flask or FastAPI - Dockerizing ML Models - Model Monitoring & Maintenance	Learning how to deploy models in production environments.
	Case Studies & Projects	- Real-World AI/ML Case Studies - Capstone Project: End-to-End ML Solution	Applying the learned concepts to real-world problems.
	Ethical AI & ML	- Bias in AI - Fairness, Accountability, and Transparency - AI Regulations & Guidelines	Understanding the ethical implications of AI and ML technologies.