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## Course Title

AI for Data Scientists

## Course Description

This course provides a comprehensive introduction to Artificial Intelligence and Machine Learning tailored for data scientists. It focuses on practical techniques for preparing data, building machine learning models, and deploying AI solutions in real-world environments.

Participants will learn essential concepts such as data preprocessing, feature engineering, supervised and unsupervised learning, and deep learning fundamentals. The course also explores model evaluation, optimization techniques, and the deployment of AI models using modern MLOps practices.

Through real-world case studies and practical exercises, learners will gain the knowledge required to build scalable AI solutions and apply machine learning techniques to complex data problems across industries.

## Course Level

Intermediate (Basic knowledge of statistics, programming, and data analysis recommended)

## Duration

40 Hours (Lectures, demonstrations, and project-based learning)

## Course Objectives

By the end of this course, learners will:

- Understand the core concepts of Artificial Intelligence and Machine Learning.
- Learn how to prepare and process data for machine learning models.
- Apply feature engineering techniques to improve model performance.
- Build supervised and unsupervised learning models.
- Understand the fundamentals of deep learning and neural networks.
- Evaluate and optimize machine learning models for better accuracy.
- Apply AI techniques to large-scale datasets and real-world business challenges.
- Deploy machine learning models into production environments using MLOps practices.

## Module 1: Introduction to Artificial Intelligence & Machine Learning

Topics:

- Introduction to Artificial Intelligence and Machine Learning
- Evolution and history of AI technologies
- Differences between AI, Machine Learning, and Deep Learning
- Types of machine learning (supervised, unsupervised, and reinforcement learning)
- AI applications in modern data science and analytics
- Machine learning workflow and data science lifecycle
- Role of AI in business decision-making and predictive analytics



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## **Module 2: Data Preprocessing and Data Cleaning**

Topics:

- Understanding datasets and data structures
- Data collection methods and data sources
- Handling missing data and noisy datasets
- Data transformation and normalization techniques
- Data standardization methods
- Handling categorical and numerical variables
- Data encoding techniques
- Data quality and preparation for machine learning models

## **Module 3: Feature Engineering Techniques**

Topics:

- Importance of feature engineering in machine learning
- Feature selection methods
- Feature extraction techniques
- Handling high-dimensional data
- Dimensionality reduction techniques
- Principal Component Analysis (PCA)
- Encoding categorical features
- Feature scaling and normalization methods
- Improving model performance using engineered features

## **Module 4: Supervised and Unsupervised Learning**

Topics:

- Overview of supervised learning algorithms
- Regression models for prediction tasks
- Classification algorithms for categorical predictions
- Decision Trees and ensemble learning methods
- Overview of unsupervised learning techniques
- Clustering algorithms such as K-Means and hierarchical clustering
- Pattern discovery and data grouping
- Model training, testing, and validation processes

## **Module 5: Deep Learning Fundamentals**

Topics:

- Introduction to neural networks
- Structure and architecture of neural networks
- Activation functions and optimization techniques
- Training deep learning models
- Convolutional Neural Networks (CNNs)
- Applications of deep learning in image and text analysis
- Natural Language Processing fundamentals

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- Deep learning frameworks and tools

## **Module 6: Model Evaluation and Optimization**

Topics:

- Importance of model evaluation in machine learning
- Performance metrics for classification and regression models
- Confusion matrix and model accuracy evaluation
- Precision, recall, and F1-score
- Cross-validation techniques
- Hyperparameter tuning strategies
- Avoiding overfitting and underfitting
- Model improvement and optimization techniques

## **Module 7: AI for Big Data Analytics**

Topics:

- Introduction to big data concepts and technologies
- Role of AI in big data analytics
- Data pipelines and large-scale data processing
- Machine learning for large datasets
- AI-driven analytics for business intelligence
- Data visualization for large-scale data insights
- Real-world use cases of AI in big data environments

## **Module 8: Model Deployment & MLOps for Production Environments**

Topics:

- Introduction to MLOps and production AI systems
- Machine learning model deployment strategies
- Building APIs for machine learning models
- Monitoring and maintaining deployed models
- Version control for machine learning systems
- Continuous integration and continuous deployment (CI/CD) for AI
- Scaling machine learning models in production environments
- Real-world AI deployment case studies

## **Recommended Resources**

### **Books**

- Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow – Aurélien Géron
- Python for Data Analysis – Wes McKinney
- Deep Learning – Ian Goodfellow