1-Year Advanced Diploma Artificial Intelligence (AI) & Machine Learning (ML)

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48 Weeks (1 Year)

Industry-ready professional skilled for AI Engineer, ML Engineer, Data Scientist, and AI Research Associate roles.

Instructor-led + Hands-on Labs + Case Studies + Capstone Project

Module	Module Title
1	Foundations of AI & ML
2	Mathematics & Statistics for AI/ML
3	Machine Learning Algorithms – Part I
4	Machine Learning Algorithms – Part II
5	Neural Networks & Deep Learning
Revision & Internal Assessment	
6	Natural Language Processing (NLP)
7	Computer Vision
8	Reinforcement Learning
9	AI Deployment, Big Data & MLOps
10	Capstone Project & Career Preparation
Final Evaluation	

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Semester 1 (Month 1–6): Core AI & ML Foundations

Module 1: Foundations of AI & ML (Month 1)

Content:

- Introduction to Artificial Intelligence & Machine Learning

- Types of AI: Narrow AI vs General AI vs Super AI

- Types of ML: Supervised, Unsupervised, Reinforcement Learning

- Python for AI/ML: NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn

- Git, GitHub & Jupyter/Colab Setup

- Data Pipeline Overview

Labs:

1. Setup AI/ML environment in Jupyter & Colab
2. Import, clean & visualize real-world dataset
3. Train a simple regression model (predict house prices)
4. Use GitHub for version control of ML projects

Module 2: Mathematics & Statistics for AI/ML (Month 2)

Content:

- Linear Algebra: Vectors, Matrices, Matrix Multiplication

- Calculus for ML: Derivatives, Gradients, Partial Derivatives

- Probability & Statistics: Distributions, Bayes Theorem, Conditional Probability

- Hypothesis Testing & A/B Testing for business decisions

- Optimization: Gradient Descent, Cost Functions

Labs:

1. Implement linear regression from scratch (no libraries)
2. Apply gradient descent manually to minimize error
3. Simulate probability experiments (coin toss, dice, Bayes theorem)
4. Perform hypothesis testing using Python

Module 3: Machine Learning Algorithms – Part I (Month 3)

Content:

- Supervised Learning (Regression Models: Linear, Multiple, Ridge, Lasso)

- Classification Models: Logistic Regression, KNN, Decision Trees, Random Forest, SVM

- Model Evaluation Metrics: Confusion Matrix, Precision, Recall, ROC-AUC

- Data Preprocessing & Feature Engineering (Scaling, Encoding, Handling Missing Data)

Project:

- Predict customer churn using classification models

Labs:

1. Build regression models & compare performance
2. Train classification models on churn dataset
3. Compare decision tree vs random forest on accuracy
4. Feature scaling & encoding techniques

Module 4: Machine Learning Algorithms – Part II (Month 4)

Content:

- Unsupervised Learning: Clustering (K-Means, DBSCAN, Hierarchical)

- Dimensionality Reduction: PCA, t-SNE

- Ensemble Learning: Bagging, Boosting (XGBoost, AdaBoost, LightGBM)

- Introduction to Recommendation Systems

Project:

- Build a movie recommendation engine

Labs:

1. Perform K-Means clustering on customer segmentation dataset
2. Apply PCA on high-dimensional data & visualize
3. Implement XGBoost for structured data
4. Create a recommendation engine using collaborative filtering

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Module 5: Neural Networks & Deep Learning (Month 5–6)

Content:

- Basics of Artificial Neural Networks (ANNs)

- Backpropagation & Activation Functions

- Deep Learning Frameworks: TensorFlow, Keras, PyTorch

- CNNs (Convolutional Neural Networks) for Image Classification

- RNNs (Recurrent Neural Networks) & LSTMs for Sequential Data

Project:

- Image classification on CIFAR-10 / MNIST dataset

Labs:

1. Build a simple ANN from scratch with NumPy
2. Implement CNN in Keras/TensorFlow for digit classification
3. Apply transfer learning using pre-trained models
4. Train RNN on text-based dataset (sequence prediction)

Semester 2 (Month 7–12)
Advanced AI & Real-World Applications

Module 6: Natural Language Processing (NLP) (Month 7–8)

Content:

- Text Preprocessing: Tokenization, Stopwords, Stemming, Lemmatization

- Word Embeddings: Word2Vec, GloVe, FastText

- Transformer Models: BERT, GPT (basics)

- Applications: Sentiment Analysis, Text Classification

- Chatbot Development Basics

Project:

- Twitter Sentiment Analysis OR Build a Simple Chatbot

Labs:

1. Preprocess large text dataset with NLTK & SpaCy
2. Perform sentiment analysis with scikit-learn & transformers
3. Build a text classifier using BERT (Hugging Face)
4. Implement a rule-based chatbot in Python

Module 7: Computer Vision (Month 9)

Content:

- Image Preprocessing & Augmentation

- CNNs for Object Detection (YOLO, SSD, Faster R-CNN)

- Image Segmentation (U-Net, Mask R-CNN)

- Transfer Learning with Pre-trained Models (ResNet, VGG, Inception)

Project:

- Build a face recognition or object detection system

Labs:

1. Perform image preprocessing using OpenCV
2. Train CNN on object detection dataset (COCO/Tiny ImageNet)
3. Implement transfer learning with ResNet/VGG
4. Build a real-time face detection app using OpenCV + Deep Learning

Module 8: Reinforcement Learning (Month 10)

Content:

- Markov Decision Processes (MDPs)

- Q-Learning & Deep Q-Networks (DQN)

- Policy Gradient Methods

- Applications of RL in Robotics, Gaming & Finance

Project:

- Train an AI Agent to play a game (CartPole, Snake AI)

Labs:

1. Implement Q-Learning for grid-based environment
2. Train CartPole game agent with DQN
3. Visualize RL learning curves
4. Experiment with reward functions & exploration strategies

Module 9: AI Deployment, Big Data & MLOps (Month 11)

Content:

- Model Deployment: Flask/FastAPI, Streamlit, Docker
- Cloud Platforms: AWS Sagemaker, GCP AI Platform, Azure ML
- MLOps: CI/CD for ML Models
- Big Data & AI: Spark MLlib, Hadoop Integration
- Ethical AI, Bias & Fairness in AI Systems

Project:

- Deploy an ML model as a REST API

Labs:

1. Deploy ML model with Flask & Docker
2. Automate training pipeline with CI/CD tools
3. Use Spark MLlib for large-scale ML
4. Implement bias detection in ML models

Module 10: Capstone Project & Career Preparation (Month 12)

Content:

- End-to-End AI Project (Choose 1):

    1. Fraud Detection in Banking using ML

    2. AI-powered Recommendation System

    3. Healthcare AI: Predict Disease from Symptoms/X-Rays

    4. NLP-based Virtual Assistant

- Final Report & Presentation

- Resume Building & Portfolio Development

- Interview Prep: Coding, ML Algorithms, AI Case Studies

- Certification Mapping: TensorFlow, AWS ML, Azure AI, IBM AI Engineering

Labs/Projects:

1. Complete dataset preprocessing → model building → deployment
2. Present findings with visualizations & dashboards
3. Deploy project on cloud platform
4. Prepare AI/ML portfolio for hiring managers

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