

# MASTERING MLOPS

A Practical Guide to Scalable  
Machine Learning Deployment  
@Analogue shifts

# INTRO- DUCTION

This training program equips participants with the essential skills to streamline machine learning deployment, automation, and maintenance. Covering everything from model development to CI/CD pipelines and production monitoring, it provides a hands-on approach to implementing MLOps best practices. By the end of the course, you'll be ready to build, deploy, and manage ML models efficiently in real-world applications.



# MODULE 1: INTRODUCTION TO MLOPS (WEEK 1)

## Lesson 1: Understanding MLOps

Objective: Define MLOps and explain its importance.

Duration: 1 hour

Content:

- What is MLOps?
- Differences between MLOps and DevOps
- Real-world examples and case studies
- Activities:
  - Group discussion: "Why do ML models fail in production?"
  - Case study analysis: Netflix's model deployment pipeline
- Materials:
  - Slides (with visuals and diagrams)
  - Short video: "The Role of MLOps in Modern AI"
  - Reading: Blog post on MLOps practices
  - Assignment: Write a short reflection on the challenges of deploying ML models.

# LESSON 2:

## SETTING UP YOUR ENVIRONMENT

**Objective:** Set up the basic tools needed for MLOps.

**Duration:** 2 hours

Content:

- Installing Python and package managers (pip, conda)
- Setting up Git and version control
- Configuring Jupyter Notebook or VS Code
- Hands-On Activity:
  - Clone a GitHub repo and set up a virtual environment
- Materials:
  - Step-by-step setup guide (PDF)
  - Video tutorial for setting up the environment
- Assignment: Submit a screenshot of your configured environment.



# MODULE 2:

## MACHINE LEARNING AND MODEL BUILDING (WEEKS 2-3)

### LESSON 3: REFRESHING ML CONCEPTS

**Objective:** Reinforce core ML concepts.

**Duration:** 1.5 hours

Content:

- Supervised vs. unsupervised learning
- Key algorithms (linear regression, decision trees, clustering)
- Hands-On Activity:
- Implement a simple regression model in Python
- Materials:
- Jupyter Notebook template
- Slides with algorithm explanations
- Assignment: Train a regression model on a public dataset (like Boston Housing).



# LESSON 4:

## MODEL EVALUATION AND HYPERPARAMETER TUNING

**Objective:** Understand how to evaluate models properly.

**Duration:** 2 hours

Content:

- Evaluation metrics (accuracy, F1-score, ROC-AUC)
- Hyperparameter tuning techniques (GridSearchCV, RandomizedSearchCV)
- Hands-On Activity:
- Tune hyperparameters for a classification model
- Materials:
- Code templates for hyperparameter tuning
- Reading: “Best Practices for Model Evaluation”
- Assignment: Perform hyperparameter tuning on a random forest classifier.





# Module 3: MODEL PACKAGING AND SERVING (WEEKS 4-5)

## LESSON 5: CREATING APIs FOR ML MODELS

**Objective:** Serve ML models through REST APIs.

**Duration:** 2 hours

Content:

- Building APIs with Flask and FastAPI
- Model serialization with Pickle and joblib
- Hands-On Activity:
- Create an API that serves a pre-trained model
- Materials:
- Flask and FastAPI code snippets
- Video demo: “Building and Testing an ML API”
- Assignment: Deploy a simple prediction API using FastAPI.



# Lesson 6:

## CONTAINERIZING ML MODELS WITH DOCKER

**Objective:** Package models in containers for portability.

**Duration:** 2 hours

Content:

- Docker basics and creating Dockerfiles
- Best practices for containerizing ML models
- Hands-On Activity:
- Containerize the API from Lesson 5
- Materials:
- Dockerfile examples
- Command cheat sheet
- Assignment: Push your Docker image to Docker Hub.

# Module 4:

## CI/CD PIPELINES FOR ML (WEEKS 6-7)

### LESSON 7: INTRODUCTION TO CI/CD FOR ML

**Objective:** Automate model deployment with CI/CD pipelines.

**Duration:** 2 hours

Content:

- CI/CD concepts and benefits
- Setting up Jenkins for ML projects
- Hands-On Activity:
- Create a simple pipeline that tests and deploys an ML model
- Materials:
- Jenkins pipeline scripts
- Video tutorial: “CI/CD for Machine Learning”
- Assignment: Automate training and deployment using Jenkins.



# MODULE 5:

## MODEL MONITORING AND MAINTENANCE (WEEKS 8-9)

### LESSON 8: MONITORING MODELS IN PRODUCTION

**Objective:** Track model performance and detect drift.

**Duration:** 2 hours

Content:

- Key metrics to monitor (accuracy, latency, drift)
- Using Grafana and Prometheus for real-time monitoring
- Hands-On Activity:
- Set up a Grafana dashboard for monitoring an API
- Materials:
- Grafana configuration files
- Monitoring scripts
- Assignment: Create an alert system for performance drops.



# MODULE 6:

## EXPERIMENT TRACKING AND VERSIONING (WEEK 10)

### LESSON 9: EXPERIMENT TRACKING WITH MLFLOW

**Objective:** Track and version ML experiments.

**Duration:** 2 hours

**Content:**

- Setting up MLflow to log experiments
- Comparing model versions and metrics
- Hands-On Activity:
- Track multiple training runs with MLflow
- Materials:
- MLflow configuration guide
- Sample experiment script
- Assignment: Track hyperparameter tuning experime



# MODULE 7:

## SCALING AND INFRASTRUCTURE MANAGEMENT (WEEKS 11-12)

### LESSON 10: SCALING ML MODELS WITH KUBERNETES

**Objective:** Deploy models on a Kubernetes cluster.

**Duration:** 2 hours

**Content:**

- Kubernetes basics and pods
- Using Helm for deployment
- Hands-On Activity:
- Deploy a containerized model on a Kubernetes cluster
- Materials:
- Kubernetes deployment YAML files
- Helm chart examples
- Assignment: Deploy and scale a model using Kubernetes.



# CAPSTONE PROJECT (FINAL WEEK)

**Objective:** Apply all skills to an end-to-end MLOps project.

Project: Deploy a real-world ML model from training to production, including:

- Data preprocessing and model training
- API development and containerization
- CI/CD pipeline setup
- Real-time monitoring and maintenance
- Presentation: Demonstrate the end-to-end solution and discuss challenges.
- Evaluation: Code quality, pipeline robustness, monitoring setup, and presentation.



## BONUS RESOURCES:

- **Live Q&A Sessions:** Weekly interactive sessions to discuss progress and challenges.
- **Guest Lectures:** Industry experts sharing real-world experiences.
- **Peer Reviews:** Code review sessions to enhance collaboration skills.



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