Training Course on MLOps Fundamentals

Professional Development Training Course Outline

Category	Data Science	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In today's **data-driven landscape**, the rapid deployment and reliable operation of **machine learning models** are paramount for business success. MLOps, or Machine Learning Operations, bridges the gap between **data science** and **DevOps**, establishing a collaborative and automated framework for the entire **ML lifecycle**. Training Course on MLOps Fundamentals: From Experimentation to Production: Core principles of Machine Learning Operations. delves into the core principles, best practices, and cutting-edge tools that enable organizations to transition **ML models** from experimental prototypes to robust, scalable, and continuously monitored production systems.

Mastering MLOps empowers teams to accelerate **model delivery**, enhance **model quality**, ensure **reproducibility**, and achieve **continuous integration and continuous deployment (CI/CD)** for machine learning. By streamlining workflows, automating critical tasks, and fostering seamless collaboration, MLOps transforms the way enterprises leverage **artificial intelligence** to drive innovation, optimize operations, and gain a significant **competitive advantage**. This comprehensive training provides hands-on experience and practical insights, preparing participants to implement effective MLOps strategies within their organizations.

Programme Curriculum

Training Course on MLOps Fundamentals: From Experimentation to Production: Core principles of Machine Learning Operations.

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Course Objectives

Upon completion of this training, participants will be able to:

1. Architect robust and automated machine learning pipelines for efficient data ingestion, model training, and deployment.
2. Utilize tools like MLflow and Weights & Biases for systematic experiment tracking, version control, and ensuring reproducible ML workflows.
3. Manage data lineage and build efficient feature stores (e.g., Feast, Featureform) for consistent model development and deployment.
4. Develop comprehensive strategies for automated model testing, data validation, and performance validation in pre-production environments.
5. Leverage Docker and Kubernetes for efficient model containerization and scalable model serving in diverse environments.
6. Design and implement CI/CD pipelines (e.g., GitHub Actions, Azure DevOps) tailored for ML model deployment and continuous integration.
7. Set up robust monitoring tools (e.g., Prometheus, Grafana, Evidently AI) for real-time model performance monitoring, data drift detection, and concept drift.
8. Ensure model transparency, address AI ethics, and apply explainable AI techniques for regulatory compliance and trustworthiness.
9. Deploy and manage MLOps workflows on cloud platforms (e.g., AWS SageMaker, Google Cloud Vertex AI, Azure Machine Learning).
10. Utilize model registries for efficient model lifecycle management, versioning, and discoverability.
11. Understand the nuances of LLMOps for deploying and managing Large Language Models and Generative AI applications.
12. Identify and resolve common issues in production ML environments, including performance bottlenecks and stability challenges.
13. Enable seamless collaboration between data scientists, ML engineers, and DevOps teams through shared MLOps practices and tools.

Organizational Benefits

- Rapidly deploy and iterate on machine learning models, bringing AI-powered solutions to market faster.
- Ensure consistent and optimal model performance in production through continuous monitoring and automated retraining.

- Maintain complete traceability of models, data, and code, crucial for debugging, compliance, and future development.
- Automate manual processes, optimize resource utilization, and minimize errors, leading to significant cost savings.
- Foster a seamless workflow between data science, engineering, and operations teams, breaking down silos and improving productivity.
- Implement robust governance, security, and ethical AI practices, mitigating risks and ensuring regulatory adherence.
- Effortlessly scale ML initiatives, manage a growing portfolio of models, and adapt quickly to changing business requirements.
- Gain real-time insights from deployed models, enabling more informed and impactful business decisions.

8 Target Audience

1. Data Scientists.
2. Machine Learning Engineers.
3. DevOps Engineers.
4. Software Engineers.
5. Data Engineers machine learning models.
6. AI/ML Leads & Architects.
7. Product Managers (AI/ML Focus)
8. IT Professionals

Course Outline

Module 1: Introduction to MLOps

- Defining MLOps: Bridging Data Science, DevOps, and ML Engineering.
- Challenges in Traditional ML Development & Deployment.
- The MLOps Lifecycle: From Business Understanding to Monitoring.
- Key Principles: Automation, Reproducibility, Collaboration, Monitoring.
- Benefits of MLOps for Organizations.
- *Case Study: How Netflix utilizes MLOps to personalize user recommendations and manage thousands of models in production, ensuring high availability and continuous improvement.*

Module 2: ML Project Setup & Version Control

- Structuring ML Projects for Production Readiness.
- Code Versioning with Git for ML Repositories.
- Data Version Control (DVC) for Datasets and Models.
- Environment Management with Conda/Virtualenv and Docker.
- Dependency Management for ML Projects.
- *Case Study: A pharmaceutical company using DVC to track drug discovery experiment data and models, ensuring auditability for regulatory compliance.*

Module 3: Data Management for MLOps

- Data Ingestion and ETL Pipelines.
- Data Validation and Quality Checks.
- Introduction to Feature Stores: Centralizing Feature Engineering.
- Data Drift Detection and Handling.
- Data Governance and Compliance in ML.

- *Case Study: Airbnb's robust data infrastructure and their use of Metis (a custom platform similar to a feature store) to ensure data quality and provide consistent features for various ML models.*

Module 4: Experiment Tracking & Model Management

- Tracking ML Experiments with MLflow and Weights & Biases.
- Logging Metrics, Parameters, and Artifacts.
- Comparing and Analyzing Experiment Runs.
- Model Registry for Versioning and Lifecycle Management.
- Artifact Management and Storage.
- *Case Study: A financial institution leveraging MLflow to track hundreds of fraud detection models, enabling data scientists to compare model performance and collaborate effectively.*

Module 5: Model Training & Tuning in Production

- Automated Training Workflows.
- Hyperparameter Tuning Strategies (Grid Search, Random Search, Bayesian Optimization).
- Distributed Training Frameworks (e.g., Horovod, Ray).
- Early Stopping and Checkpointing.
- Managing Compute Resources for Training.
- *Case Study: Uber's Michelangelo platform for distributed model training, enabling them to train large-scale models for ETA prediction and fraud detection efficiently.*

Module 6: Model Evaluation & Testing

- Metrics for Regression, Classification, and Other ML Tasks.
- Offline Model Evaluation and Baselines.
- Automated Unit and Integration Tests for ML Code.
- Data Validation Tests for Input Data.
- Model Validation Tests for Performance and Robustness.
- *Case Study: A retail company using automated model testing suites to ensure new recommendation models don't negatively impact conversion rates before deployment.*

Module 7: Model Containerization with Docker

- Introduction to Docker and Containerization Concepts.
- Building Docker Images for ML Models.
- Containerizing Dependencies and Runtime Environments.
- Best Practices for Dockerizing ML Applications.
- Publishing Docker Images to Registries.
- *Case Study: Spotify deploying their recommendation engine models as Docker containers, ensuring consistent execution across different environments.*

Module 8: Model Serving & Deployment Strategies

- RESTful APIs for Model Inference.
- Batch vs. Real-time Inference.
- Deployment Patterns: Blue/Green, Canary, A/B Testing.
- Model Serving Frameworks (e.g., Flask, FastAPI, BentoML, TensorFlow Serving, TorchServe).
- Scalable Model Serving Architectures.
- *Case Study: Google Cloud's Vertex AI Endpoints for serving millions of predictions per second for various Google services, demonstrating scalable and managed model deployment.*

Module 9: Orchestration with Kubernetes

- Introduction to Kubernetes for Container Orchestration.
- Deploying ML Models on Kubernetes.
- Managing Resources and Scaling Deployments.
- Kubeflow: The Machine Learning Toolkit for Kubernetes.
- Serverless Deployment Options for ML (e.g., AWS Lambda, Google Cloud Functions).
- *Case Study: Philips leveraging Kubernetes and Kubeflow to streamline the deployment of AI-powered medical imaging models, improving diagnostic accuracy.*

Module 10: CI/CD for Machine Learning

- Continuous Integration (CI) for ML Code and Data.
- Continuous Delivery (CD) of ML Models.
- Automated Testing in CI/CD Pipelines.
- Triggering Retraining Pipelines.
- Tools: GitHub Actions, GitLab CI/CD, Jenkins, Azure DevOps.
- *Case Study: Uber's in-house Michelangelo platform implementing CI/CD practices for ML, enabling one-click model testing and deployment for their vast ML ecosystem.*

Module 11: Monitoring & Alerting for ML Models

- Why Monitor ML Models in Production?
- Performance Monitoring: Latency, Throughput, Error Rates.
- Data Drift and Concept Drift Monitoring.
- Bias Detection and Mitigation in Production.
- Setting Up Alerts and Dashboards (Prometheus, Grafana, Evidently AI).
- *Case Study: A major e-commerce platform using real-time monitoring to detect changes in customer behavior (concept drift) and automatically trigger retraining of their fraud detection models.*

Module 12: MLOps Security & Governance

- Data Privacy and Security in ML Pipelines.
- Model Access Control and Permissions.
- Regulatory Compliance (GDPR, HIPAA) in MLOps.
- Audit Trails and Explainability for Compliance.
- Ethical AI Considerations in Production.
- *Case Study: Revolut's "Sherlock" system for fraud detection, emphasizing strong security and governance practices to protect customer data and ensure model integrity.*

Module 13: Advanced MLOps Topics

- MLOps for Large Language Models (LLMOps) and Generative AI.
- Federated Learning and Edge AI in Production.
- Model Compression and Optimization for Edge Devices.
- Reinforcement Learning in Production.
- Human-in-the-Loop MLOps.
- *Case Study: How major tech companies are implementing LLMOps to continuously improve and deploy their large language models, managing massive datasets and complex evaluation metrics.*

Module 14: Cloud-Specific MLOps Platforms

- AWS SageMaker: End-to-End MLOps Service.
- Google Cloud Vertex AI: Unified ML Platform.
- Azure Machine Learning: MLOps Capabilities.
- Choosing the Right Cloud Platform for Your MLOps Needs.
- Hands-on Labs with a Chosen Cloud Platform.
- *Case Study: Walmart leveraging Azure Machine Learning to enhance the efficiency and scalability of their ML models for supply chain optimization and customer insights.*

Module 15: Building an MLOps Culture & Future Trends

- Fostering Collaboration Between Teams.
- MLOps Team Structures and Roles.
- Developing an MLOps Roadmap for Your Organization.
- Future Trends in MLOps: AIOps, MLOps for Responsible AI.
- Workshop: Designing an MLOps Strategy for a Fictional Company.
- *Case Study: How leading AI-first companies like Google and Meta integrate MLOps as a core part of their organizational culture, enabling rapid innovation and reliable AI product delivery.*

Training Methodology

This training will employ a highly interactive and practical methodology, combining:

- **Instructor-led Sessions:** Engaging lectures and discussions covering core MLOps concepts and principles.
- **Hands-on Labs:** Practical exercises and coding sessions using industry-standard MLOps tools (e.g., MLflow, Docker, Kubernetes, DVC, cloud platforms).
- **Real-world Case Studies:** In-depth analysis of successful MLOps implementations across various industries.
- **Group Discussions & Problem Solving:** Collaborative sessions to discuss challenges and brainstorm solutions for MLOps adoption.
- **Live Demos:** Demonstrations of MLOps tools and workflows in action.
- **Project-Based Learning:** Participants will work on a capstone project to apply learned concepts and build a functional MLOps pipeline.
- **Q&A and Expert Insights:** Opportunities to interact with instructors and gain insights from their extensive MLOps experience.

Register as a group from 3 participants for a Discount

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Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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