MLOps for Beginners — A Practical, End-to-End Guide

1. Executive Summary

This document introduces the fundamentals of MLOps (Machine Learning Operations), explains how models are optimized and deployed, and covers best practices for monitoring and updating ML systems. It ends with a hands-on project using open-source tools and Google Colab.

2. What is MLOps?

MLOps = DevOps + Machine Learning. It manages the full ML lifecycle to ensure models are reliable, scalable, and continuously improving.

3. The ML Lifecycle

8 Steps: Data Collection, Versioning, Training, Evaluation, Packaging, Deployment, Monitoring, Updating.

4. MLOps Fundamentals

Data Versioning (DVC), Experiment Tracking (MLflow), Model Packaging (Docker), Deployment (FastAPI, Gradio), Monitoring (Evidently), Continuous Training.

5. Model Optimization & Deployment

Hyperparameter tuning (GridSearchCV, Optuna), quantization, pruning, ONNX, blue-green & canary deployments.

6. Monitoring & Updating

Monitor drift, performance metrics, system metrics. Use Evidently or Prometheus. Retrain periodically or automate continuous training.

7. Practical Project

Hydraulic system sensor failure prediction using MLflow, Gradio, and Evidently.

8. Conclusion

MLOps transforms ML models into scalable, production-ready systems with consistent monitoring and improvement.