

MLOps Course Outline

Lesson 1 - MLOps Introduction

- 1.1 What is MLOps & MLOps Motivation
- 1.2 Solutions and Future Trends
- 1.3 MLOps Components
- 1.4 Different Roles involved in MLOps (ML Engineering + Operations)
- 1.5 Machine Learning Life Cycle
- 1.6 MLOps Vs DevOps
- 1.7 Major Phases — what it takes to master MLOps
- 1.8 Different tools for MLOps
- 1.9 MLOps Maturity Model Levels
- 1.10 MLOps - Stages of CI / CD

Lesson 2 - Linux Basics Foundation

- 2.1 Why Linux? Linux types? How to access Linux env in different system
- 2.2 Free tier Amazon EC2 ubuntu instance
- 2.3 SSH and SSH tools & Putty
- 2.4 File zilla & WinSCP
- 2.5 Introduction to Shell, Bash Shell & Basic Linux Commands
- 2.6 Help for Command Line
- 2.7 Linux Core Concepts & Kernel and types
- 2.8 Linux file system, Boot Sequence, Run levels, File Types & Filesystem Hierarchy
- 2.9 Package Management Introduction and Configuration
- 2.10 Linux Type Based Package Manager
- 2.11 RPM and YUM
- 2.12 DPKG and APT
- 2.13 File Compression and Archival, Searching for Files and Patterns using grep/wildcards etc
- 2.14 VI, Nano Editor
- 2.15 Security and File Permissions, The Security Incident (story)
- 2.16 Linux Accounts, User Management, Access Control Files, Account Management
- 2.17 File Permissions and Ownership , Cron jobs
- 2.18 Service management with systemd, Working overtime (story)
- 2.19 Creating a Systemd Service, Systemd Tools
- 2.20 Lab - systemd services
- 2.21 Assignment | Assignment Solution

Lesson 3 - GIT Foundation – Github

- 3.1 What? Why? When? Type? Vendor? Pricing? Industry wise uses of GIT
- 3.2 Creation of Github / Gitlab / bitbucket account
- 3.3 Local GitHub UI installation, setup with VSCode and Pycharm
- 3.4 Local and Remote Repositories installation and configuration
- 3.5 GIT Repository initialisation
- 3.6 Commands: git log

- 3.7 Git Branches - What is branching in Git and why we need it?
- 3.8 Master/main branch and user-defined branch
- 3.9 Checkout and pushing to a branch, Merging of branches
- 3.10 Project control and management
- 3.11 In Remote Repositories, Initialisation of Remote Repositories
- 3.12 Pushing code to the remote repositories
- 3.13 Cloning of the remote repositories to local
- 3.14 PR (Pull Requests), Fetch and Pull
- 3.15 Handling conflict on merging branch, Forking of repository
- 3.16 Rebasing, Resetting and Reverting, Stashing
- 3.17 Assignment | Assignment Solution

Lesson 4 - Data version control DVC

- 4.1 What is DVC, DVC Uses, Installation in Mac OS, Windows & Linux
- 4.2 Data Versioning, Model Versioning
- 4.3 Data Access, Model Access & Data Pipelines, Metrics, Parameters, Plots
- 4.4 Run, Queue, Compare, Persisting, and Sharing Experiments
- 4.5 Clean up, Versioning Data and Models, Sharing Data and Model Files
- 4.6 Data Registries, Shared Development Server & Project Structure
- 4.7 Setup Google Drive Remote, Large Dataset Optimisation
- 4.8 External Dependencies, Managing External Data
- 4.9 Automate Pipelines with DVC, Pipelines & Experiment Automation, Build automated pipelines
- 4.10 Experiments Management, Experimenting with reproducible pipelines, Common issues with ML experiments
- 4.11 Tracking metrics and plots & Compare experiment results, Build, Test & Deploy
- 4.12 Introduction to CI/CD in Machine Learning & Build CI/CD pipeline
- 4.13 Install GitLab Runner and Trigger CI/CD pipeline
- 4.14 Build Machine Learning pipeline, Build CI/CD pipeline, Trigger CI/CD pipeline
- 4.15 Making Continuous Integration work with ML, DVC Integration with Project
- 4.16 Build a model Prototype, Build a prototype with Jupyter Notebook
- 4.17 Start to version your code with Git, Version your code with Git
- 4.18 Create pipelines, Automate pipelines and data versioning with DVC
- 4.19 Create CI pipeline to build, test, experiment, Experimenting with DVC and CML & Deploy your model
- 4.20 Assignment | Assignment Solution

Lesson 5 - DevOps - Docker Foundation

- 5.1 What is DevOps, Why DevOps
- 5.2 Dev-Test-Deploy ,DevOps Principles,DevOps Toolchain
- 5.3 Overview of DevOps Tools
- 5.4 Co-relation between Agile and DevOps,Categories of DevOps Tools
- 5.5 Containers Concepts , Container Vs Virtual Machine
- 5.6 Installing docker on CentOS, Debian and Windows
- 5.7 Managing Container with Docker Commands
- 5.8 Building your own docker images & Docker Compose

- 5.9 Docker registry - Docker Hub , Networking inside single docker container
- 5.10 Lab - Running Python Web App in docker container
- 5.11 Lab - Create a docker image from git repo
- 5.12 Lab - Deploying flask app using docker-compose
- 5.13 Lab - Complex deployment using docker-compose
- 5.14 Lab - Creating your own docker registry
- 5.15 Assignment | Assignment Solution

Lesson 6 - DevOps - Kubernetes Foundation

- 6.1 Introduction to Kubernetes
- 6.2 Architecture and Kubernetes cluster installation
- 6.3 Raft Consensus Algorithm and Networking in Kubernetes
- 6.4 Raft Consensus Algorithm and Networking in Kubernetes
- 6.5 Installing Minikube and Objects in Kubernetes - Pod, Deployment
- 6.6 Services - Service Discovery, Service Object, Headless Services, Service Type
- 6.7 Role based Access
- 6.8 Volumes - Persistent Volumes, Persistent Volume Claim, Storage Class
- 6.9 Config Map and Secrets
- 6.10 Ingress - Virtual Host, Types, Fanout, Virtual Host, Fanout Ingress configuration,
- 6.11 Virtual Host Ingress configuration
- 6.12 Lab - Installing Minikube on EC2
- 6.13 Lab - Enable and access Dashboard Addon
- 6.14 Lab - Deploy flask web app on Minikube
- 6.15 Lab - Deploy Nginx app on Minikube
- 6.16 Lab - Deploy application with host type volumes
- 6.17 Assignment | Assignment Solution

Lesson 7 - DevOps - Continuous Monitoring with Prometheus and Grafana

- 7.1 Introduction to Prometheus
- 7.2 Prometheus installation
- 7.3 Introduction to Grafana
- 7.4 Grafana Installation
- 7.5 Integration of Prometheus and Grafana
- 7.6 Adding customised dashboard in Grafana
- 7.7 Introduction to node exporter
- 7.8 Integrating node exporter for monitoring
- 7.9 Lab - Scrape metric from Grafana
- 7.10 Lab - View Node exporter metric in Grafana
- 7.11 Lab - View Docker metric in Grafana
- 7.12 Lab - Import AWS EC2 dashboard in Grafana
- 7.13 Assignment | Assignment Solution

Lesson 8 - DevOps - Continuous Integration using Jenkins

- 8.1 Introduction to Jenkins

- 8.2 Continuous Integration & Continuous Integration with Jenkins
- 8.3 Jenkins Architecture
- 8.4 Installing Jenkins on EC2
- 8.5 User management
- 8.6 Set up Jenkins Master & Slave
- 8.7 Setup CI-CD pipeline for sample project
- 8.8 Lab - Setup Role based access
- 8.9 Lab - Master/Slave Setup
- 8.10 Lab - Configure SCM in Jenkins
- 8.11 Assignment | Assignment Solution

Lesson 9 - MLFlow (Manage your Machine Learning Lifecycle)

- 9.1 What is MLFlow & Installation
- 9.2 MLFlow Tracking, Where Runs Are Recorded, How Runs and Arti-facts are Recorded
- 9.3 Scenario 1: MLFlow on localhost
- 9.4 Scenario 2: MLFlow on localhost with SQLite
- 9.5 Scenario 3: MLFlow on localhost with Tracking Server
- 9.6 Scenario 4: MLFlow with remote Tracking Server, backend and arti-fact stores
- 9.7 Logging Data to Runs, Logging Functions, Launching Multiple Runs in One Program, Performance Tracking with Metrics
- 9.8 Visualising Metrics, Automatic Logging
- 9.9 Scikit-learn, TensorFlow and Keras, Gluon, XGBoost, Pytorch
- 9.10 MLFlow Tracker, Organising Runs in Experiments, Managing Experiments and Runs with the Tracking Service API, Tracking UI
- 9.11 Querying Runs Programmatically, MLFlow Tracking Servers, Storage,Networking
- 9.12 Logging to a Tracking Server, MLFlow Projects, Specifying Projects, Running Projects, Iterating Quickly, Building Multi Step Workflows
- 9.13 MLFlow Models, Storage Format, Model Signature And Input Example
- 9.14 Model API, Built-In Model Flavours, Model Customisation, Built-In Deployment Tools, Deployment to Custom Targets
- 9.15 Model Registry, Model Registry Workflows, UI Workflow, Registering a Model, Using the Model Registry, API Workflow
- 9.16 Adding an MLFlow Model to the Model Registry, Fetching an MLFlow Model from the Model Registry
- 9.17 Serving an MLFlow Model from Model Registry, Adding or Updating an MLFlow Model Descriptions, Renaming an MLFlow Model
- 9.18 Transitioning an MLFlow Model's Stage, Listing and Searching MLFlow Models, Archiving an MLFlow Model, Deleting MLFlow Models
- 9.19 Assignment | Assignment Solution

Lesson 10 - Tensor Flow Extend (TFX)

- 10.1 Introduction to TFX
- 10.2 Data Ingestion using TFX & Data Validation using TFDV
- 10.3 Data Preprocessing using TFT
- 10.4 Model Training, Model Analysis & Model Evaluation using TFX
- 10.5 Model Deployment using TF Serving

10.6 Assignment Assignment Solution

Lesson 11 - KubeFlow (Model Version Control & ML Pipeline)

- 11.1 What is Kubeflow?
- 11.2 Core Kubeflow components
- 11.3 How to set up Kubeflow on Kubernetes
- 11.4 How to develop basic ML models in Kubeflow Notebooks
- 11.5 How to train and deploy models in Kubeflow
- 11.6 How to use Kubeflow Pipelines
- 11.7 How to use KFServing to deploy models
- 11.8 How to manage logs with Kubeflow Metadata component
- 11.9 Katib Hyper Parameter Tuning
- 11.10 Kubeflow Pipelines to KFServing
- 11.11 Assignment | Assignment Solution

Lesson 12 - GitLab Foundation

- 12.1 GitLab Triggers
- 12.2 AWS S3 storage
- 12.3 GitLab CI/CD Pipelines
- 12.4 Pipelines definition
- 12.5 MongoDB cloud Atlas
- 12.6 Heroku | Logdata | Coral for Monitoring
- 12.7 Assignment | Assignment Solution

Lesson 13 - AWS MLOps - MLOps in Cloud

- 13.1 Amazon Sagemaker | Amazon S3 | AWS Codebuild | AWS Codecommit
- 13.2 Sagemaker Training Job | Sage Maker Endpoint | Amazon Api Gateway
- 13.3 Sagemake Model Monitoring | Cloudwatch Synthetics | Cloudwatch Alarm
- 13.4 Assignment | Assignment Solution

Lesson 14 - Azure MLOps - MLOps in Cloud

- 14.1 Create an Azure Machine Learning workspace
- 14.2 Setup a new project in Azure DevOps
- 14.3 Import existing YAML pipeline to Azure DevOps
- 14.4 Declare variables for CI/CD pipeline
- 14.5 Create training compute
- 14.6 Train ML model | Register model
- 14.7 Deploy model in AKS
- 14.8 Assignment | Assignment Solution

Lesson 15 - Projects

- 15.1 Deploy a Personalized Product Recommendation using MLOps

15.2 Deploy a Classification Model using MLOps on AWS

15.3 Deploy a Multiple Linear Regression Model using MLOps

15.4 Deploy a Gaussian Model in Time Series using MLOps on AWS

15.5 Deploy a Customer Churn Prediction using MLOps on Azure