MLOps Applications

Program Syllabus

About FourthBrain
FourthBrain trains aspiring Machine Learning practitioners in the technical and practical skills necessary to contribute immediately to an AI team. This program prepares students with the tools and skills to deploy, test, and monitor ML models and pipelines for timely inferencing in production environments. We infuse values of collaboration and communication throughout the program.

Program Outcomes
At the end of the program, you will be able to:

- Build and validate ML/DL model prototypes on a variety of ML use cases including Recommendation Engines, Natural Language Processing (NLP) and Computer Vision (CV)
- Rapidly prototype ML/DL applications using cloud-based solutions
- Understand the impact of data drift and concept drift in ML production systems
- Dockerize ML web-apps and deploy to cloud solutions (GCP and AWS)
- Apply ML stack orchestrations using Kubeflow and MLFlow
- Build and maintain CI/CD pipelines for cloud-based ML-Model Deployments
- Perform production testing using shadow, blue-green and Canary deployments
- Deploy CI/CD pipelines using Helm, Jenkins, Spinnaker
- Apply production-grade ML monitoring using Prometheus, Grafana, EFK stack
- Integrate yourself into an industrial ML software team as a key contributor

Our program emphasizes more than just technical skills. In addition to the outcomes listed above, you will also be able to:

- Communicate effectively to technical and non-technical audiences
- Approach your career goals with knowledge of how to apply MLOps skills in your field

Weekly Schedule

November 2021 Cohort

The MLOps program is a 12-week program that includes both individual and team projects.

Week	Topics	Project
Week 1 11/6	Introduction to the MLOps program ● Review syllabus, weekly assignments, and expectations for Capstone Project	- Hands-on deployment of a web-app performing currency-note classification data set using Flask. - ***Capstone*** *ideation & planning*
Week 2 11/13	MLOps I: Basic ML and data concepts ● ML algorithms & data visualization ● Intro to MLOps ● Data pipelines for MLOps	- Machine learning (classification and clustering) on Sagemaker (AWS) - ***Capstone*** *project scoping*
Week 3 11/20	MLOps II: Advanced ML & data concepts ● Deep Learning & model selection ● Data augmentation ● ML/DL monitoring	- Facial Detection using Pytorch - Model upgrading to accommodate masked face detection - ***Capstone*** *commitments*
Break	*Thanksgiving*	
Week 4 12/4	Deployment I: Docker ● Webapp deployment deep dive ● Dockerizing ML applications ● CI/CD Pipelines and Model Serving	- Dockerizing CV and NLP webapps. - ***Capstone*** *dataset curated*
Week 5 12/11	Deployment II: Distributed ML ● Recommendation Engines: DataBricks, AutoML, PySpark ● TF Extended and AI Explainability ● AutoML Vision and Vertex AI on GCP ● Big Data Analytics on AWS	- Recommendation Engine Use Case on AWS EMR - ***Capstone*** *ML model development completed*
Week 6 12/18	● Midterm Assignment: Deployment Test	- *Midterm* ***capstone*** *project presentations due*
Break	*Christmas*	

Break	*New Years*	
Week 7 1/8	Orchestration I: Basic Kubernetes ● Docker to Kubernetes ● Kubernetes architecture, components and deployment ● Kubernetes on cloud platforms	- cluster creation, app deployment, methods for app updates *- Containerization of **capstone** project data and models*
Week 8 1/15	Orchestration II: Advanced Kubernetes ● MiniKube for Kubernetes Simulation ● Deploying fair ML applications ● Observability and Logging	- Distributed Tensorflow deployment on Kubernetes cluster *- Container orchestration of **capstone** projects*
Week 9 1/22	ML Stack I: Kubernetes-based MLOps Pipelines and Services ● Kubeflow and MLFlow on AWS ● MiniKF and Pipelines ● Deployment to Kubermetes on AWS	- Kubeflow pipelines on AWS for CV use case (classification) *- Iterate on components of full ML-stack **capstone** projects, analyze potential business value*
Week 10 1/29	ML Stack II: Deployment of End-to-End Pipelines and Production Testing ● Full ML-stack pipelines in the cloud ● Data pipeline tools ● Production application testing	- Canary Deployments on Kubernetes Cluster for CV models *- **Capstone** practice presentations and videos; peer reviews*
Week 11 2/5	Scalable Serving Systems, ML Monitoring, and Special Topics: ● Scalable serving systems, CI/CD pipelines, and dashboard monitoring ● Special Topics	- Monitoring Kubernetes webapp deployment *- **Capstone** presentation practice, final improvements, bug fixes, and iterations; define future work*
Week 12 2/12	Final Demo Day	***Capstone** Project Demo!*

Capstone Project

Your projects will be developed individually or in partnership with one other student. Groups of 3 will be considered on a case-by-case basis.

Your project will be designed to demonstrate your understanding of full-stack MLOps pipelines and their implications. This includes a focus on the potential business-value of your application and its extensibility, as well as a deep understanding of the infrastructure and tools required to deploy, scale, and monitor ML models in production software development environments.

Sample Team Project 1: There is a pre-existing application that is used for online shopping. The Search engine searches based on text entries. Your goal is to create a new function “Find similar” for a product using its image, and to implement the updated ML model pipeline.

Sample Team Project 2: There is an existing application that detects faces in camera images. Your goal is to extend the application to face detection/identification for faces with masks, and to implement the updated ML model pipeline.

Communication

Communication with technical and non-technical colleagues is a crucial skill for all engineers. We emphasize the importance of regular verbal and written communication throughout the program. You’ll regularly collaborate with your peers in breakout sessions to reinforce engineering team settings. For your capstone project, you’ll collaborate with your project team over a period of several weeks. Your team will regularly update the cohort on your status in both verbal and written form. The final project deliverable will also include a presentation and technical report.

Career Growth

The MLOps and Systems program is designed for you to acquire the skills and knowledge required to work on an MLOps team. Whatever your reason for taking the program - to get a new role at a new company, to gain skills for your current job, or just for fun - we will support your career growth by helping you connect to professionals and employers, via guest speaking events and inviting employers to the final project presentation day.

The skills you gain in this program are useful for a variety of roles, including titles like:

- MLOps Engineer
- ML Tech Manager
- Junior ML Engineer
- QA Engineer / Test Engineer
- ML Systems Integration
- ML Solutions Engineer / Architect
- DevOps for ML/AI Teams

Career services assistance is available after graduation to help ensure that all candidates achieve their career goals.