MLOps and Systems

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, communication, empathy, and equity throughout the program.

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

- Build and validate well known ML/DL model prototypes on a variety of ML use cases such as Data Streams (eCommerce), Natural Language Processing and Computer Vision
- Apply transfer learning for ML Model deployment on cloud platforms
- Understand the impact of data drift and concept drift in ML pipelines
- Apply AutoML and collaborative frameworks such as MLflow
- Build and maintain CI/CD pipelines for cloud-based ML-Model Deployments
- Create rapid prototypes from state-of-the-art pre-trained models
- Perform pre-production testing using A/B patterns, shadow patterns and Canary patterns
- Apply Apache Spark for big data workflows
- Deploy ML models using optimized Kuberenetes workflows
- Apply production-specific software services using Prometheus, grafana cloud, elk stack (AWS), fluentD and cloudwatch (AWS)
- Integrate themselves into industrial teams as key contributors for production-ready environments

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

- Communicate effectively to technical and non-technical audiences
- Approach their career goals with the skills and knowledge of how to apply their newly gained skills in their chosen field

Weekly Schedule

June 2021 Chort

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

Week	Topics	Project
Orientation 6/19	Introduction to the program • Review syllabus, weekly assignments, and expectations for individual and team projects	
Week 1 6/26	Statistical ML Models for Data Streams • Classification, Regression, Unsupervised learning, • AutoML: autosklearn, TPOT, • Linear and non-Linear Models: linear regression, Random Forest, SVM, kNN, k-means, logistic regression • Visualization using D3, Tableau.	E-commerce use-case for data wrangling, compression, meta-data tagging, metrics and visualization
Break	*Independence Day*	
Week 2 7/10	Deep Learning Models for Computer Vision use cases • Classification • Object Detection • Semantic segmentation • Metrics and Transfer Learning • RAPIDS GPU	Computer vision use case for data pre-processing, transfer learning, metrics and reporting.
Week 3 7/17	ML API Development and Deployment on GCP and AWS • Flask • FastApi • Tensorflow serving • Tensorflow lite for optimization latency	Rapid Prototyping for NLP use case

Week 4 7/24	Big Data Processing • Intro to Apache Spark • Intro to Hadoop • Pyspark (MLlib) • Collaborative filtering • Introduction to Databases (relational vs no-SQL) • Databricks	Recommendation engine use case: Collaborative filtering use case for product rating Capstone Project Finalized
Week 5 7/31	Cloud-based APIs • Intro to Kubeflow • Collaborative platforms: MLflow • AutoML in GCP, Azure, AWS • Hyper parameter optimization	Computer Vision use case: Hyper-parameterization using MLflow
Week 6 8/7	Midterm Project Capstone Project Proposal	
Week 7 8/14	ML Deployment • Docker Containers • Kubernetes • FluentD • Elk Stack	Deployment use case
Week 8 8/21	MLOps Pipelines • CI/CD Pipelines • Gitlab, Jenkins • YAML/XML • Profiler	Deployment use Case
Week 9 8/28	Application Production Testing on Google Optimize • Canary pattern • A/B Pattern • Shadow Pattern	Deployment use Case
Break	*Labor Day*	
Week 10 9/11	Production Software Build and Analytics • Prometheus • Grafana Cloud • Cloudwatch Special Topics	Deployment use case

	• Building models from scratch • Hyper-parameterization • optimization • quantization	
Week 11 9/18	Final Demo Day	Capstone Project Demo

Capstone Project

You'll develop a capstone project with one or two other classmates. Your project will be designed to demonstrate your understanding of ML Pipeline and infrastructure requirements; data collection and preprocessing; deployment and testing; system design; outcomes; and extendability.

> **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 following is a list of sample roles that candidates who successfully complete the MLOps and Systems program are expected to qualify for:

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

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