SCHOOL OF ARTIFICIAL INTELLIGENCE

Machine Learning Engineer with Microsoft Azure

This goal of this Nanodegree Program is to enhance your skills by building and deploying sophisticated Machine Learning (ML) Solutions using popular open source tools and frameworks such as scikit-learn. You will also gain experience in understanding ML models, protecting people and their data, and controlling the end-to-end ML lifecycle at scale.

A graduate of this program will be able to:

- Analyze how to manage data

- Run complex machine learning tasks using Azure labs

- Identify use cases for Automated Machine Learning

- Use the Azure ML SDK to design, create and manage machine learning pipelines in Azure

- Analyze model interpretations

This program is comprised of 2 courses and 3 projects. Each project you build will be an opportunity to demonstrate what you've learned in the lessons. Your completed projects will become part of a career portfolio that will demonstrate your acquired skills in Machine Learning Engineering with Microsoft Azure.

Program Information

ESTIMATED TIME TO COMPLETE
3 months; study 10 hrs/week

LEVEL
Practitioner

PREREQUISITES
- Basic Python programming
- Basic familiarity with fundamental machine learning concepts
- An understanding of the basics of Azure and Docker/ Container experience
- A background in beginning level statistics, is helpful
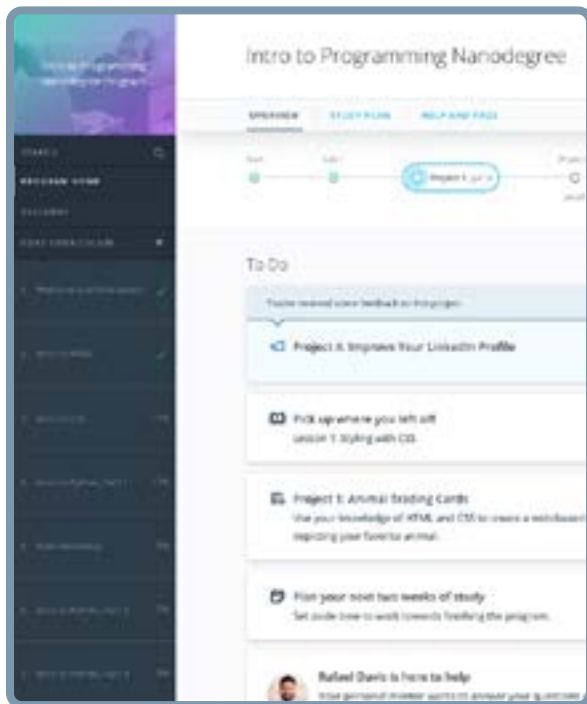
HARDWARE/SOFTWARE REQUIRED
None

LEARN MORE ABOUT THIS NANODEGREE
Contact us at enterpriseNDs@udacity.com.

Our Classroom Experience

REAL-WORLD PROJECTS
Learners build new skills through industry-relevant projects and receive personalized feedback from our network of 900+ project reviewers. Our simple user interface makes it easy to submit projects as often as needed and receive unlimited feedback.

KNOWLEDGE
Answers to most questions can be found with Knowledge, our proprietary wiki. Learners can search questions asked by others and discover in real-time how to solve challenges.

LEARNER HUB
Learners leverage the power of community through a simple, yet powerful chat interface built within the classroom. Learner Hub connects learners with their technical mentor and fellow learners.

WORKSPACES
Learners can check the output and quality of their code by testing it on interactive workspaces that are integrated into the classroom.

QUIZZES
Understanding concepts learned during lessons is made simple with auto-graded quizzes. Learners can easily go back and brush up on concepts at anytime during the course.
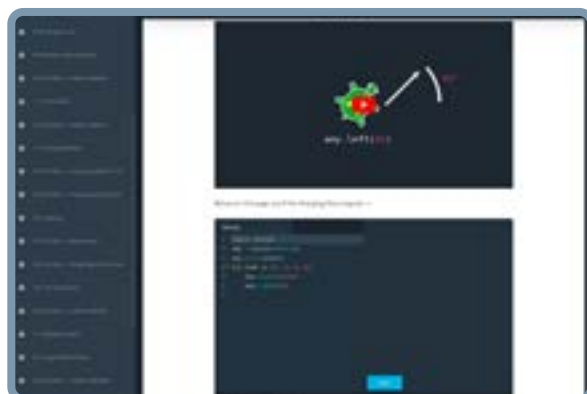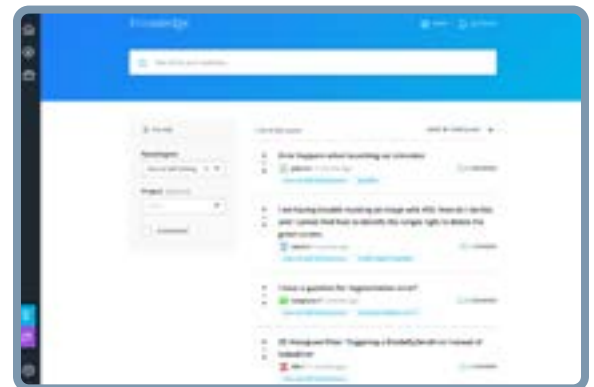
CUSTOM STUDY PLANS
Mentors create a custom study plan tailored to learners' needs. This plan keeps track of progress toward learner goals.

PROGRESS TRACKER
Personalized milestone reminders help learners stay on track and focused as they work to complete their Nanodegree program.

Learn with the Best

Noah Gift
INSTRUCTOR

Noah Gift teaches and consults at top universities and companies globally, including Duke and Northwestern. His areas of expertise are machine learning, MLOps, A.I., Data Science, Machine Learning, and Cloud Architecture. Noah has authored several bestselling books, including Python for DevOps.

Alfredo Deza
INSTRUCTOR

Alfredo Deza is a passionate software engineer, avid open source developer, Vim plugin author, photographer, and former Olympic athlete. He has rebuilt company infrastructure, designed shared storage, and replaced complex build systems, always in search of efficient and resilient environments.

Erick Galinkin
INSTRUCTOR

Erick Galinkin is a hacker and scientist specializing in Applying Artificial Intelligence to Cybersecurity. He also conducts academic research on machine learning theory and the interplay between algorithmic game theory and information security.

Soham Chatterjee
INSTRUCTOR

Soham is an Intel® Software Innovator and a former Deep Learning Researcher at Saama Technologies. He is currently a Masters by Research student at NTU, Singapore. His research is on Edge Computing, IoT and Neuromorphic Hardware.

Course 1: Using Azure Machine Learning

Machine learning is a critical business operation for many organizations. Learn how to configure machine learning pipelines in Azure. Identify use cases for Automated Machine Learning. Use the Azure ML SDK to design, create, and manage machine learning pipelines in Azure.

Project 1	Optimizing an ML Pipeline in Azure

Throughout the course, we cover many different ways to work with data and machine learning. It can be quite challenging to decide what method to use - building your own machine learning pipeline, leveraging AutoML, hyperparameter tuning, and so on. In this project, students use scikit-learn, Hyperdrive, and AutoML to understand the costs and benefits of each methodology. First, students will construct a pipeline from scikit-learn, using the Azure ML SDK to import data from a URL. Then, students will configure a Hyperdrive run for their scikit-learn pipeline to find the optimal hyperparameters. Students will then use the same dataset for an AutoML run to find an optimal model and set of hyperparameters. Finally, students write a README documenting their findings and comparing the differences, costs, and benefits of the different methods they've used.

LESSON TITLE	LEARNING OUTCOME
INTRODUCTION TO AZURE ML	• Understand why you should do ML in the cloud • Understand when you should do ML in the cloud • Analyze the customers of ML
WORKSPACES AND THE AZURE ML STUDIO	• Interpret the Azure ML Platform • Explain how to manage and choose compute resources • Summarize the key components of Workspaces and Notebooks
DATASTORES AND DATASETS	• Analyze how to manage data • Construct datasets • Compose solutions to manage data drift and deal with sensitive data
TRAINING MODELS IN AZURE ML	• Experiment with the Designer • Develop and manage pipelines • Organize and run hyperparameter experiments

LESSON TITLE	LEARNING OUTCOME
THE AZUREML SDK	• Utilize data with the SDK • Create pipelines • Organize experiments
AUTOML AND HYPERPARAMETER	• Design solutions with AutoML and the SDK • Analyze model interpretation experiments • Create portable ML models with ONNX

Course 2: Machine Learning Operations

Operationalizing Machine Learning is a set of best practices that are mostly inherited by the DevOps movement. In the past few years, it has become clear that shipping models into production in a reliable, reproducible, and automated way with a constant feedback loop is crucial. This is where all the DevOps principles come into play and is exactly what this course covers in detail.

Project 2	Operationalizing Machine Learning

MLOps and its core features have been covered in this course in detail. This project will apply all the principles from the lessons to get a model trained with AutoML and deployed into a production environment.

This project covers a lot of the key concepts of operationalizing Machine Learning, from selecting the appropriate targets for deploying models, to enabling Application Insights, identifying problems in logs, and harnessing the power of Azure's Pipelines. All these concepts are part of core DevOps pillars that will allow you to demonstrate solid skills for shipping machine learning models into production.

LESSON TITLE	LEARNING OUTCOME
ENABLING SECURITY	• Create a Service Principal account for different types of roles • Determine what the differences are in various forms of authentication • Use a specific type of authentication when selecting deployment settings

LESSON TITLE	LEARNING OUTCOME
DEPLOY A ML MODEL	• Use a production environment for deployment • Enable authentication in the deployment cluster • Discover the differences between container-based deployment and kubernetes.
ML ENDPOINTS	• Use a proven tool to find what a baseline for performance is • Gather information about an endpoint input to interact with it • Find what potential issues can happen with incorrect input
PIPELINE AUTOMATION	• Create a pipeline to further automation when training models • Enable a REST API for the pipeline, so other services can interact with it • Use the Python SDK to publish a pipeline and enable the endpoint

Capstone Project

The program capstone gives you the opportunity to use the knowledge you have obtained from this Nanodegree program to solve an interesting problem. You will have to use Azure's Automated ML and HyperDrive to solve a task. Finally, you will have to deploy the model as a webservice and test the model endpoint.

Capstone Project	Training and Deploying a Machine Learning Model in Azure

You will be using both the hyperdrive and automl API from azureml to build this project. You can choose the model you want to train, and the data you want to use. However, the data you use needs to be external and not available in Azure's ecosystem. After you have chosen a dataset, you will have to import the dataset into your workspace. Subsequently, you will train a model on that dataset using automated ML and then train a custom model whose hyperparameters you have tuned using HyperDrive. The type of model you use is not important. You can use ML models through Scikit-learn or Deep Learning models like ANNs and CNNs through Keras, TensorFlow, or PyTorch for this part of the project.

After you have trained both the models, compare their performance, deploy the best model as a webservice and test the model endpoint.

This project will demonstrate your ability to use an external dataset in your workspace, train a model using the different tools available in the AzureML framework as well as your ability to deploy the model as a web service.

Our Nanodegree Programs Include:
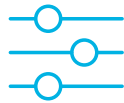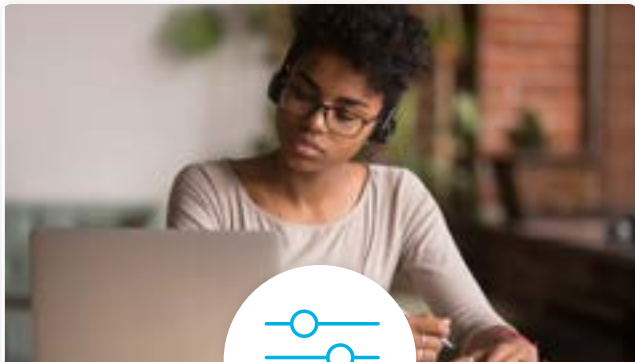
Pre-Assessments

Our in-depth workforce assessments identify your team's current level of knowledge in key areas. Results are used to generate custom learning paths designed to equip your workforce with the most applicable skill sets.

Dashboard & Progress Reports

Our interactive dashboard (enterprise management console) allows administrators to manage employee onboarding, track course progress, perform bulk enrollments and more.

Industry Validation & Reviews

Learners' progress and subject knowledge is tested and validated by industry experts and leaders from our advisory board. These in-depth reviews ensure your teams have achieved competency.

Real World Hands-on Projects

Through a series of rigorous, real-world projects, your employees learn and apply new techniques, analyze results, and produce actionable insights. Project portfolios demonstrate learners' growing proficiency and subject mastery.

Our Review Process

Real-life Reviewers for Real-life Projects

Real-world projects are at the core of our Nanodegree programs because hands-on learning is the best way to master a new skill. Receiving relevant feedback from an industry expert is a critical part of that learning process, and infinitely more useful than that from peers or automated grading systems. Udacity has a network of over 900 experienced project reviewers who provide personalized and timely feedback to help all learners succeed.

Vaibhav
UDACITY LEARNER

"I never felt overwhelmed while pursuing the Nanodegree program due to the valuable support of the reviewers, and now I am more confident in converting my ideas to reality."

now at
CODING VISIONS INFOTECH

All Learners Benefit From:

Line-by-line feedback for coding projects	Industry tips and best practices	Advice on additional resources to research	Unlimited submissions and feedback loops

How it Works

Real-world projects are integrated within the classroom experience, making for a seamless review process flow.

- Go through the lessons and work on the projects that follow
- Get help from your technical mentor, if needed
- Submit your project work
- Receive personalized feedback from the reviewer
- If the submission is not satisfactory, resubmit your project
- Continue submitting and receiving feedback from the reviewer until you successfully complete your project

About our Project Reviewers

Our expert project reviewers are evaluated against the highest standards and graded based on learners' progress. Here's how they measure up to ensure your success.

900+	1.8M	3	4.85 /5
Expert Project Reviewers	**Projects Reviewed**	**Hours Average Turnaround**	**Average Reviewer Rating**
Are hand-picked to provide detailed feedback on your project submissions.	Our reviewers have extensive experience in guiding learners through their course projects.	You can resubmit your project on the same day for additional feedback.	Our learners love the quality of the feedback they receive from our experienced reviewers.

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For more information visit: **www.udacity.com/enterprise**