THE OHIO STATE UNIVERSITY

College of Engineering

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Memo

To: Randy Smith Vice Provost for Academic Programs

From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment

Date: July 6, 2023

Re: Informational Item

The College of Engineering would like to present the following informational item which was approved by Associate Dean Dave Tomasko on June 26, 2023.

- Non-credit, 24-week Online Program *Artificial Intelligence (AI) Bootcamp.*

Per College Committee on Academic Affairs (CCAA) rules, the Associate Dean serves as proxy for curriculum reviews and approvals during periods that CCAA does not meet.

Yours sincerely,

Rosie Quinzon-Bonello

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College of Engineering

Proposal for a Non-credit, 24-week Online Program

"Artificial Intelligence (AI) Bootcamp"

June 26, 2023

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OAA Certificate Program Category: (4) Workforce Development Certificate of Completion Programs

Description

The Artificial Intelligence (AI) Boot Camp is a unique, forward-thinking product, where learners will develop the skills needed to step into the new and exciting world of AI. Throughout the program, students will get practical, hands-on learning to empower them to develop the skills and processes needed to enhance their AI job prospects, including 3 projects where students will build and develop new skills while building a portfolio of example work. The program is rigorous, fast-paced, and focused on the practical, technical skills needed to solve data, machine learning, and artificial intelligence problems. Throughout the course, students will gain proficiency in numerous marketable technologies, including Python, Unsupervised and Supervised Machine Learning, Natural Language Processing, Transformers, Artificial Intelligence, and more. Students will leave with an impressive professional portfolio and the confidence to succeed in today's data-driven economy.

The AI Boot Camp is a 24-week, part-time online program that gives students the knowledge and skills to conduct robust analytics on a host of real-world problems. Whether they are employed or are a full-time student, the boot camp is designed to fit into their lives, with convenient evening sessions.

The program includes live online, instructor lead class sessions, three days per week, (Mon, Wed, Thur) from 6:30pm-9:30pm. Live office hours for additional support are provided 45 minutes before each class and for 30 minutes afterwards. Personalized support is also provided through a dedicated student success manager, 24/7 learning assistant support, tech support, tutoring, personalized grading and feedback, and Career Services and engagement network resources.

Participants must complete the 24-week program to obtain the certificate of completion. The bootcamp will be delivered 100% online. The bootcamp is a partnership with the College of Engineering, edX, a 2U brand, and the Computer Science and Engineering department and administered through the Professional and Distance Education Programs Office.

This bootcamp is very similar to the Coding, Cybersecurity, Data Analytics, and UX/UI bootcamps already approved and offered through a partnership with edX/2U and the Computer Science and Engineering and Electrical and Computer Engineering departments.

Outcomes-based

During this bootcamp students will learn how to:

1. Employ statistical models to predict and forecast trends.
2. Create Python-based scripts to automate the cleanup, restructuring, and rendering of large, heterogeneous datasets.
3. Interact with APIs using Python Requests and JSON parsing techniques.

4. Create in-depth graphs, charts, and tables utilizing a wide-variety of data-driven programming languages and libraries.
5. Apply machine learning techniques to gain knowledge and solve problems.
6. Use unsupervised machine learning models to categorize unlabeled data.
7. Use supervised machine learning models trained on labeled data to make predictions about data.
8. Evaluate and improve the performance of machine learning models by using test data, metrics, and optimization techniques.
9. Use neural networks and deep learning models to make predictions about data.
10. Determine the sentiment of vector-encoded text using NLP and transformers.
11. Describe recent innovations in AI and their impact on the field of AI Curriculum

The bootcamp curriculum will include these modules and topics:

Module 1 Introduction to Artificial Intelligence

Key Topics:

- What is AI
- Narrow vs. General AI
- Impact of Machine Learning

Module Description:

In the first week, students will be introduced to Artificial Intelligence. Students will round out the week with a deeper dive into narrow vs. general AI, and the impact of Machine Learning.

Module 2 Programming for Artificial Intelligence - Part 1

Key Topics:

- Fundamental Python Syntax
- Python Coding Logic & Reasoning
- Python Script & Dictionary Creation
- Reading & Writing Datasets
- Fundamental Git/Version Control

Module Description:

Students will gain hands-on experience working with a leading programming language in the industry, creating scripts and using the command line to run them against external datasets. Students will expand on their understanding of programming and logical reasoning while diving into a robust language that will be expanded upon in future units.

Module 3 Programming for Artificial Intelligence - Part 2

Key Topics:

- Data Structures
- Functions
- File IO

Module Description:

Students will gain hands-on experience learning about and working with data structures, functions, and reading and writing files.

Module 4 Preparing Data with Pandas - Part 1

Key Topics:

- Jupyter Notebook
- Pandas DataFrame Creation
- Functions on Pandas DataFrames

Module Description:

Students are introduced to Jupyter Notebook and Pandas, a Python library with robust tools for data analysis and manipulation.

Module 5 Preparing Data with Pandas - Part 2

Key Topics:

- DataFrame Navigation and Manipulation
- Data Cleaning
- Data Engineering

Module Description:

As students dive deeper into the world of dataframes and data manipulation, they will solidify concepts from earlier weeks by testing their skills in solving complex data engineering problems.

Module 6 Sourcing Data for AI Projects Key Topics:

- External APIs
- Parsing Documentation
- Error Handling

Module Description:

Students will learn how to use third party APIs with Python. They will dive deep into documentation to obtain data from sources such as the US Census, The New York Times, The World Bank, and Google Maps.

Module 7 Exploring Data Through Visualizations

Key Topics:

- Fundamental Statistics & Calculations with Python
- Matplotlib
- Chart Types and Manipulation
- Analyzation & Visualizations of Complex Datasets
- Calculation & Plotting of a Linear Regression

Module Description:

This week continues with an introduction into the basics of Matplotlib, one of the most popular Python plotting libraries in today's industry. We round out the week with fundamental statistics practices, giving the students hands-on experience in calculations involving various sample sizes, populations, standard error, the Pearson correlation coefficient, and linear regression.

Module 8 Making Predictions with Data Key Topics:

- Data Modeling
- Data Forecasting
- Time Series Data

Module Description:

Students will learn how to make predictive models to use for forecasting time series data.

Modules 9 & 10 Project 1 (2 weeks)

Students will work on group projects to prepare data and forecast predictions. They will leverage skills from previous modules such as programming, data preparation, visualization, and forecasting.

Module 11 Unsupervised Learning

Key Topics:

- Unsupervised Machine Learning
- Clustering
- K-means Algorithm
- PCA and reducing dimensionality in data

Module Description:

In this module, learners will learn how to identify hidden patterns, relationships, and structure within data that reveal interesting insights used to make predictions. Learners will learn how unsupervised learning is used to find hidden patterns and similarities in data.

Module 12 Supervised Learning – Linear Regression

Key Topics:

- Supervised Learning Models
- Regression
- Linear Regression

Module Description:

In this module, learners will build on the knowledge of the previous module and learn how supervised learning differs from unsupervised learning. Learners will further refine and improve the results of algorithms using balanced data to train AI models more accurately.

Module 13 Supervised Learning - Classification

Key Topics:

- Classification
- Logistic Regression
- Model-Fit-Predict Process
- Linear vs Nonlinear Models
- Ensemble Learning

Module Description:

Learners will continue with supervised learning but now focus on classification, logistic regression, and then go further into applying other models with complex data. Learners will then be introduced to linear vs. nonlinear data and ensemble learning with random forests.

Module 14 Machine Learning Optimization

Key Topics:

- Evaluating Model Performance
- Imbalanced Data
- Model Selection for Success Metrics
- Limitations of Traditional Models

Module Description:

In this module, learners will learn how to manipulate data in preprocessing, test multiple models, and fine tune hyperparameters to achieve better results with machine learning. Learners will build upon the previous two modules and take their knowledge a step further by learning techniques that optimize performance in models.

Module 15 AI Ethics

Key Topics:

- Legal and Ethical Considerations
- Data Reproducibility
- Algorithmic Bias
- Data Privacy Regulations

Module Description:

In this module, learners review the legal and ethical considerations of AI Ethics. In a world where new uses are unfolding and use cases become more complex by the day, we'll review ethical considerations, data reproducibility, Algorithmic Bias, and discuss Data Privacy.

Modules 16 & 17 Project 2 (2 weeks)

Students will work in groups to train machine learning models, optimize the models, and evaluate model performance in order to choose the best model for their application.

Module 18 Neural Networks

Key Topics:

- Neural network models
- TensorFlow
- Keras

Module Description:

Students will implement neural network and deep neural network models using TensorFlow. Students will learn how different neural network structures change algorithm performance. Using their judgment as AI professionals, students will discern between machine learning concepts to design, create, and deploy an appropriate machine learning pipeline.

Module 19 Deep Learning

Key Topics:

- Deep Learning vs. Neural Networks
- Deep Learning on TensorFlow and Keras

Module Description:

In this module, learners will be introduced to neural networks, a type of machine learning model that was designed to work like the human brain. Then they will learn about deep learning models, which are more advanced types of neural networks. Learners will use both types of models to make predictions about data, and they will learn optimization techniques for these models.

Module 20 Natural Language Processing

Key Topics:

- Natural Language Processing
- Tokenization
- Word Models

Module Description:

In this module, learners will learn how natural language processing (NLP) and transformers help computers understand, interpret, and predict human language.

Module 21 Transformers

Key Topics:

- Pre-trained Transformer models
- Encoders and Decoders
- Text Summarization and Generation
- Applied Use of Transformers

Module Description:

Students will learn pre-trained transformer models, and move on to encoders and decoders. From there, they'll move on to text summarization and generation, and understand the applied use of transformers.

Module 22 Emerging Topics

Key Topics:

- Generative AI
- AI Applications Outside the Computer
- Active Research Areas
- Ethics and Regulation

Module Description:

In this module, learners will be introduced to several topics related to cutting edge AI research areas and technologies. They will learn about these topics at a high-level, with a focus on key concepts rather than technical applications.

Modules 23 & 24 Final Project

Students will work in groups to leverage deep learning and advanced AI language models to solve a problem in artificial intelligence related to natural language processing.

Prerequisites
No previous experience in data or programming is required, however, it is recommended that applicants hold a Bachelor's degree and/or two years of work experience in business, finance, statistics, management, or a related field. Pre-work will include an optional "Math for Machine Learning" edX course.

Stand-alone Program and Maximum Credit Overlap between Academic Certificate and Other Academic Programs
This is a non-credit, online course and will be a stand-alone program.

Maximum Credit Overlap with Degree Program
N/A

Minimum Acceptable Grade to Apply
N/A

Transfer Credit
N/A

EM Credit
N/A

Arranged/Individual Study Courses
None.

Minimum Grades and GPA to Complete Program
Students must obtain a passing grade on all quizzes, assessments and projects to receive the certificate of completion.

Recorded in the Student Information System (SIS)
No

Regular OSU Tuition and Fee Assessment
No, this is a non-credit program. Fee will be $11,745 per person.

Eligibility for Federal Pell Grant and Direct Student Loans
No

Diploma Issued

No.

Type of Completion Document Issued

A certificate of completion is awarded after a participant successfully completes the 24-week program.

Proposal Contact Information

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