MACHINE LEARNING AND AI ESSENTIALS

COURSE OVERVIEW

The "Machine Learning & AI Essentials" course is designed to introduce post-secondary students to the foundational concepts, algorithms, and tools used in machine learning (ML) and artificial intelligence (AI). This course covers the spectrum from understanding data and its importance in AI, through various machine learning models, to deploying AI solutions in real-world applications. Through a blend of theoretical knowledge and hands-on practice, students will learn to design, implement, and assess ML models to solve diverse problems.

CURRICULUM OBJECTIVES

After completing this curriculum, you will be able to:

UNDERSTAND THE CORE PRINCIPLES OF AI AND ML:

- Grasp the history, evolution, and fundamental concepts underlying artificial intelligence and machine learning.

IDENTIFY AND PREPARE DATA:

- Recognize the importance of data in ML, learn to collect, clean, and preprocess data for model training.

IMPLEMENT ML ALGORITHMS:

- Gain proficiency in a variety of machine learning algorithms, including supervised and unsupervised learning models, and understand their real-world applications.

EVALUATE MODEL PERFORMANCE:

- Use validation techniques to assess the performance of machine learning models and understand overfitting, underfitting, and model tuning.

DEPLOY AI SOLUTIONS:

- Learn the essentials of deploying machine learning models into production, including the use of ML frameworks and cloud services.

ETHICS AND BIAS IN AI:

- Understand ethical considerations, the impact of bias in machine learning models, and approaches to mitigate these issues.

COURSE REQUIREMENTS

To successfully engage and complete this course, students should possess some basic computer literacy and possess a 9th grade reading/comprehension level. A basic understanding of computer frameworks is preferred.

A COMPUTER WITH THE MINIMUM REQUIREMENTS TO USE OF CENGAGE

Operating System	Apple® macOS™ Big Sur, Catalina, Mojave
CPU Type	1.8+ GHz / multi-core
Memory	2+ GB
Graphics Card	DirectX, 64+ MB
Disk Space	3 GB of storage
Display Resolution	1366 × 768, color
Pointing Device	HID-compliant mouse or trackpad.
Internet	5 Mbps or faster download
Audio	Sound (for some content)

COURSE SCHEDULE AND LEARNING OBJECTIVES

WEEK 1: INTRODUCTION TO AI AND MACHINE LEARNING

- **Topics Covered**: History of AI, Difference between AI and ML, Overview of ML applications.

- **Activities**: Introduction lecture, multimedia presentation on AI milestones, icebreaker AI trivia.

WEEK 2: PYTHON FOR MACHINE LEARNING

- **Topics Covered**: Python programming basics, introduction to NumPy, Pandas, and Matplotlib.

- **Activities**: Python programming lab, hands-on exercises with NumPy and Pandas.

WEEK 3: FUNDAMENTALS OF DATA IN ML

- **Topics Covered**: Importance of data, types of data, data collection methods.

- **Activities**: Lecture on data needs for AI, group discussion on data sources, hands-on data collection lab.

WEEK 4: DATA PREPROCESSING

- **Topics Covered**: Data cleaning, handling missing data, data normalization and transformation.

- **Activities**: Data cleaning workshop, practical exercises on preprocessing techniques.

WEEK 5: EXPLORATORY DATA ANALYSIS (EDA)

- **Topics Covered**: Visualization techniques, statistical analysis for data understanding.

- **Activities**: EDA lab using Matplotlib and Seaborn, case study analysis.

WEEK 6: SUPERVISED LEARNING - PART 1

- **Topics Covered**: Introduction to supervised learning, linear regression, logistic regression.

- **Activities**: Lecture and lab on implementing regression models, assignment on regression analysis.

WEEK 7: SUPERVISED LEARNING - PART 2

- **Topics Covered**: Decision trees, support vector machines (SVM), ensemble methods.

- **Activities**: Workshop on decision trees and SVMs, group project on ensemble learning methods.

WEEK 8: UNSUPERVISED LEARNING

- **Topics Covered**: K-means clustering, hierarchical clustering, principal component analysis (PCA).

- **Activities**: Lecture on clustering algorithms, lab session on implementing PCA and k-means.

WEEK 9: INTRODUCTION TO NEURAL NETWORKS

- **Topics Covered**: Basics of neural networks, activation functions, loss functions.

- **Activities**: Neural network lab with TensorFlow/Keras, assignment on designing simple neural networks.

WEEK 10: DEEP LEARNING FUNDAMENTALS

- **Topics Covered**: Convolutional neural networks (CNNs), recurrent neural networks (RNNs).

- **Activities**: Workshop on CNNs and RNNs, project kickoff for deep learning application.

WEEK 11: MIDTERM REVIEW AND EXAMINATION

- **Activities**: Comprehensive review session covering weeks 1-10, **midterm examination.**

WEEK 12: MODEL EVALUATION AND SELECTION

- **Topics Covered**: Overfitting, underfitting, cross-validation, model performance metrics.

- **Activities**: Lecture on model evaluation, hands-on lab on cross-validation techniques.

WEEK 13: MODEL OPTIMIZATION AND TUNING

- **Topics Covered**: Hyperparameter tuning, regularization techniques.

- **Activities**: Workshop on hyperparameter tuning using GridSearchCV, project work on model improvement.

WEEK 14: ML DEPLOYMENT AND MLOPS

- **Topics Covered**: Deployment strategies, introduction to MLOps, ML model lifecycle management.

- **Activities**: Lecture on ML deployment, group discussion on MLOps practices.

WEEK 15: ETHICS AND BIAS IN AI

- **Topics Covered**: Ethical considerations in AI, bias detection and mitigation.

- **Activities**: Ethics roundtable discussion, bias detection workshop, case study on ethical AI.

WEEK 16: EMERGING TRENDS IN AI AND ML

- **Topics Covered**: AI in healthcare, autonomous vehicles, generative adversarial networks (GANs).

- **Activities**: Guest lecture on AI advancements, group project presentations.

WEEK 17: FINAL EXAM AND PROJECT PRESENTATION

- **Activities**: Comprehensive final exam covering all course topics, presentation of final projects to demonstrate applied skills and knowledge in machine learning and AI.

GETTING HELP

If you have questions or need to have something explained there are lots of ways to get help. If I am contacted through email, canvas, or phone I will respond within 24 hours. Methods of contact include:

- Message the instructor through the Canvas platform.
- Contact the course instructor VIA phone call.
- Send your question via email to the course instructor.

PARTICIPATION & ATTENDANCE

It is expected each student to participate in class discussion and to engage your fellow students along with the instructor in the activity of learning.

Among other things this means that each student will have completed any reading, assignments, labs, etc. that are due. Additional means of measurement is the component of taking attendance at the start of class.

Assignments will be turned in at the start of class on the day they are due. Any assignment (exercise or project) will be accepted for partial credit for up to one week after the due date. They will be marked down according to how late they are. One week or more after the due date for any assignment it will not be accepted any longer for credit.

COURSE POLICIES

- Disruptive Behavior – Disruptive behavior of any type is NOT permitted and may result in dismissal from the program. Muting and leaving during a virtual class, tardiness to class, excessive talking during class, and disrespectful behavior are examples of disruptive behavior.

- Plagiarism – Submitting plagiarized work for an academic requirement is considered academic misconduct. Plagiarism is the representation of another's work or ideas as one's own; it includes the unacknowledged word-for-word use and/or paraphrasing of another person's work, and/or inappropriate unacknowledged use of another person's ideas.
- Diversity - It is the responsibility of the instructor and the students to foster and maintain a harmonious, non-threatening and non- discriminating environment in the classroom. Therefore, all individuals are to be respected as equal and contributing partners of our society.
- Attendance: Must maintain at least a 90% rate of attendance. You are required to attend all classes. However, you may miss up to 2 classes and still pass the course. Any other absences must be approved by the instructor.

GRADING

Evaluation of student performance is based upon pupil performance objectives relating to course competencies study. The number of competencies mastered, and the degree of mastery is translated into appropriate grades consistent with the DSDT SAP policy on grading guidelines, practices, and procedures.

In the process of evaluation, instructors obtain several grades for each student within the time frame of the course. These grades may include, but are not limited to, performance on tests, quizzes, assignments, classroom participation, lab competency mastery and/or improvement and the demonstration of positive employability traits.

DELIVERY METHODS

This course will be taught using the Canvas LMS system. Curriculum will be accessed through the Cengage Unlimited Portal within the Canvas LMS. The course will be delivered through lecture in-person. For students who are not required to attend class in person due to program funding source, the lectures will be delivered via Microsoft Teams meetings platform. Students will log on to Canvas through their school provided Office 365 Account.

STUDENTS ARE EXPECTED TO PARTICIPATE.

All students will have the same expectations to participate in this course regardless of course delivery. All will be treated as though you are present at the school. It is important that all students pay attention during class and limit the amount of outside distraction present. DSDT expects all students to speak up if they are falling behind or not able to

complete a lesson due to technology issues. Just as in person, the class will not mind pausing to ensure no student is left behind.

SPECIAL ACCOMMODATIONS

Accommodations for Disabilities: If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive, and you need some accommodations or alternatives to lectures, assignments, or exams, please feel free to contact me to discuss reasonable accommodations for your access needs.

Signature_____ Date_____