Artificial Intelligence and Machine Learning with Cloud Computing & Gen AI

Course Objectives	Course Outcomes
- Develop a Comprehensive understanding of AI concepts, machine learning algorithms, and deep learning techniques. - Analyze the structures and algorithms of a selection of techniques related to machine learning and Artificial Intelligence. - Able to design and implement various machine learning algorithms in a range of real-world applications. - Exploring the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning. - Knowledge of basic concepts in computer vision, including image formation, feature extraction, image filtering, and image trans-formation. Understanding the use of cloud computing in AI applications. - Explore generative AI concepts. - Familiarity with foundational ethical principles such as fairness, transparency, accountability, privacy, and safety in AI development and deployment. - Develop critical thinking skills and the ability to approach problems systematically.	- Hands-on experience through exercises, and real-world scenarios/case studies. - Build a strong portfolio showcasing your ideas to solve the case studies and to demonstrate your skills to potential employers. - Exhibit Artificial Intelligence and Gen AI principles. - Create functional applications, and possess the necessary skills to pursue entry-level roles or further education in the field. - Launching software development for career guidance on job search strategies and interview preparation.

Course Duration: 45 Hours

Course Content:

Unit 1 -Introduction to AI and Python Basics

Getting familiar with AI and ML concepts: Understanding terms like Artificial Intelligence and Machine Learning with MS demos - Types of Machine Learning and its applications.

GitHub Programming: Getting started with GitHub for project development and repository creation - Git development and git commands - Introduction to GitHub Co-pilot

Python Fundamentals for ML: Fundamentals of open-source python programming Tools: Installation of Anaconda - Set up the Python Environment - Use Command Line and IDE to create and execute a Python program - Writing and interpreting the first program in Python - Understanding and Implementing data Structures in Python - Understanding and implementing Control Flow - Understanding and Implementing Python Functions - To use Microsoft Co-Pilot within a Python development environment to assist with code completion tasks.

Unit 2 - Data Analytics and Database Programming with Python

Fundamental of Databases and Database programming with Python: Introduction to Databases - Install of MySQL and Basics of SQL - Creating and Managing Databases and Tables - Installing MySQL Connector for Python - Connecting to a MySQL Database using Python - Executing SQL Queries from Python - Fetching and Manipulating Data with Python

Python packages for EDA applications: Introduction of Exploratory Data Analysis and Types of EDA - Python packages for EDA applications: Practicing with NumPy. - Python packages for EDA applications: Practicing with Pandas. - Practicing with Data Visualization Python packages (matplotlib) - A Data Analysis case study using techniques of EDA.

Unit 3 - Implementation of Machine Learning Algorithms

Supervised and Unsupervised ML Algorithms: Supervised ML Algorithms

Linear Regression: Use linear regression to predict housing prices based on features such as square footage, number of bedrooms, bathrooms, etc.

Decision Tree: Use decision trees to predict whether customers are likely to churn (cancel their subscription or leave the service).

Support Vector Machine: Use support vector machines to classify emails as spam or non-spam based on their content and features.

Unsupervised ML Algorithm: K-Means Clustering for Customer Segmentation -Use k-means clustering to segment custom-ers based on their purchasing behavior, demographics, and other relevant features.

Unit 4 - Gain Fundamental Skills and knowledge in Deep Learning

Neural Networks and Deep Learning: Introduction to Neural Networks - Feedforward Neural Networks - Convolutional Neural Networks (CNNs) - Introduction to TensorFlow/Keras

Interpret and understand visual information using Computer vision: Computer vision with Python and OpenCV - Introduction to computer vision. - Image

representation, Basics of digital images (pixels, resolution, colour channels) - Image formats (RGB, grayscale, etc.) - Practical Exercise: Basic image manipulation and visualization. - Image processing techniques (Image Filtering, Thresholding and Morphological Operations)

Feature extraction techniques: Corner detection (Harris corner detector), Edge detection (So-bel, Canny), Scale-invariant feature transform (SIFT) - Practical Exercise: Implementing corner detection and edge detection algorithms. - Basics of CNNs - Practical Exercise: Build an image classifier using convolutional neural networks (CNNs) to distinguish between images of cats and dogs. - Transfer learning with pre-trained models (VGG)

Unit 5 - Understanding of Generative AI and role of cloud Computing in AI

Introduction & Generative AI Application Discussion - Tools and Examples of GenAI - Prompt Engineering (Hands-on Activity) - Bringing GenAI in our daily life (Hands-on Activity): Improving student experience with ChatGPT

Understanding the role of Cloud Computing in AI applications: Fundamentals of Cloud Computing and its applications

Deployment of AI Application using Streamlit and Ethical Consideration in AI Applications: Overview of Streamlit. - Different Stages of Deployment - Setting up of Heroku account - Testing and Deployment of AI Application

Test Projects:

Use Cases

1. **Agricultural Raw Material Analysis** - You are tasked to analyze agricultural-raw-material-prices dataset over the years (EDA)

- Find the high range and low range raw materials according to their prices.
- high and low %Change materials
- Identify the range of prices changed over the years.
- Map a correlation between them using a heatmap.

2. **E-commerce Sales Analysis** - You are tasked to perform an E-commerce Sales Analysis that includes the components below.

- Analyze sales data from an e-commerce website.
- Calculate key metrics like total sales, best-selling products, and customer purchase patterns.
- Generate reports and visualizations to present insights for decision-making.

3. **Stock Market Forecast** - You are tasked to perform Stock Market Forecasting using linear regression.

- Load historical pricing data into Pandas Data Frame.
- Add technical indicators to use as features in our Linear Regression model.
- Train a simple linear regression model using a 10-day exponential moving average as a predictor for the closing price.
- Analyze the accuracy of the model, plot the results, and consider the magnitude of our errors

4. Spotify Music Recommendation System - You are tasked to perform Spotify Music Recommendation System.

- Use the Spotify songs dataset available on Kaggle.
- The recommender system will group relevant data points using K-Means clustering.
- After developing the recommender system, you may deploy it as a standard Python application.
- Users can enter their favorite songs on Spotify, and your model will immediately display the most like their preferred songs as recommendations on the user's screen.

5. Employee Churn Prediction - You are tasked to perform Employee Churn prediction in Python. Employee churn can be defined as a leak or departure of an intellectual asset from a company or organization. or in simple words, you can say, when employees leave the organization is known as churn. The following points help you to understand, employee and customer churn in a better way:

- The business chooses the employee to hire someone while in marketing you don't get to choose your customers.
- Employees will be the face of your company, and collectively, the employees produce everything your company does.
- Losing a customer affects revenues and brand image. acquiring new customers is difficult and costly compared to retaining existing customers. Employee churn is also painful for companies in organizations. It requires time and effort to find and train a replacement.

You are going to cover the following steps -

- Exploratory Analysis
- Data Visualization
- Cluster Analysis
- Building Prediction Model
- Evaluating Model Performance

6. Automatic Music Generation – You are tasked to develop an end-to-end model for Automatic Music Generation.

- Understand the WaveNet architecture and implement it from scratch using Keras.

- Compare the performance of WaveNet versus Long Short-Term Memory for building an Automatic Music Generation model.
- Collect as much training data as you can since the deep learning model generalizes well on the larger datasets.

7. AI Chatbot using ChatGPT – You are tasked to build your own AI chatbot using the ChatGPT API. From setting up tools to installing libraries, and finally, creating the AI chatbot from scratch, we have included all the small details for general users here.

- You can build a ChatGPT chatbot on any platform, whether Windows, macOS, Linux, or ChromeOS.
- To create an AI chatbot, you don't need a powerful computer with a beefy CPU or GPU.
- The heavy lifting is done by OpenAI's API on the cloud. you will need Python, Pip, OpenAI, and Gradio libraries, an OpenAI API key, and a code editor like Notepad++.

8. Sentiment analysis AI system – You are tasked to create a Sentiment analysis AI system using ChatGPT. Here are the key steps:

- Describes the dataset to be used. Choose anyone you prefer to work with or create your new dataset.
- Introducing the OpenAI API.
- Installation of required libraries in Jupyter and start using ChatGPT OpenAI API for Sentiment Analysis.
- ChatGPT's powerful AI capabilities can be harnessed for comprehensive sentiment analysis, summarization, and actionable insights from customer reviews.

9. Mental Health Assessment: Facial expression recognition can be used to assess patients' emotional states and monitor their mental health conditions, enabling early detection of mood disorders such as depression and anxiety.

10. Personalized Treatment Recommendations: Build AI systems for analyzing patient data (e.g., medical records, genetic information) to provide personalized treatment, and recommendations and improve patient outcomes.

11. Medical Imaging Analysis: Develop AI models for automated diagnosis and analysis of medical images (e.g., X-rays, MRIs) to detect abnormalities and assist radiologists in interpretation.

12. Algorithmic Trading: Implement AI-based trading algorithms to analyze market data, identify trends, and make automated trading decisions to optimize investment strategies.

13. Traffic Management: Implement AI-based traffic management systems to optimize traffic flow, reduce congestion, and improve trans-portation efficiency by analyzing traffic patterns and coordinating traffic signals.

14. Customer Segmentation and Personalization: Utilize AI techniques to segment customers based on their preferences, behavior, and purchase history, and deliver personalized recommendations and targeted marketing campaigns.

15. Personalized Learning: Develop AI-powered personalized learning platforms that adapt to students' learning styles, preferences, and progress, providing tailored educational content and recommendations.

16. AI Integrated Smart water management System: The AI-Integrated Smart Water Management System is a real-world application that combines advanced technologies to monitor and manage water resources efficiently, with a specific focus on disaster preparedness. This system utilizes HTML, CSS, and JavaScript for the frontend, Python with Flask for the backend, MySQL for data storage, and incorporates machine learning (ML) and artificial intelligence (AI) for predictive analytics and decision support.

17. Group Data Sharing In Cloud Computing On Identity Based Encryption: The problem statement revolves around enhancing secure data sharing in cloud computing environments through Identity-Based Encryp-tion (IBE) while focusing on group-based access control. Traditional access control mechanisms in the cloud often lack scalability and effi-cient key management for group data sharing. This research aims to address these challenges by leveraging IBE, which simplifies key distribution and access control by using user identities as public keys. The objective is to design and implement a system that enables secure group data sharing in the cloud, ensuring that only authorized users or groups can access encrypted data while maintaining scala-bility, efficiency, and robust security against unauthorized access and key compromise.

18. Intelligent Garbage Classification using Deep Learning: The problem statement involves developing a garbage classification system using a CNN architecture and deploying it as a web application with Flask. The system aims to classify garbage images into seven categories, employing data preparation techniques such as data aug-mentation. The CNN model is constructed with Conv2D, MaxPooling2D, Flatten, and Dense layers, compiled with Adam optimizer and categorical cross-entropy loss. Flask is used for deployment, implementing routes for home page and prediction functionality, with up-loaded images processed for prediction and displayed with predicted class. The trained model is saved for persistence, ensuring accurate predictions through an intuitive web interface.

19. AI Notes Generator: The emergence of Artificial Intelligence (AI) has revolutionized note-taking through systems like the AI Note Generator, which employs advanced Natural Language Processing (NLP) algorithms. But, AI note generators include the risk of generating inaccurate or misleading content, the potential for plagiarism or lack of proper attribution, and the ethical implications of using AI to create notes without human oversight. These concerns stem from the limitations of AI algorithms in understanding context, ensuring accuracy, and

maintaining ethical standards in content generation. Additionally, there is a risk of AI-generated notes containing offensive or harmful material, especially if the algorithms are not adequately trained or monitored to prevent such outputs.

20. EduBot- Revolutionizing Education: The educational landscape often grapples with challenges related to personalized learning experiences and classroom dynamics. RP offers a solution by blending AI and machine learning to create an intelligent tutor that caters to individual learning needs. By leveraging tech-nology inspired by Iron Man's Jarvis, RP reshapes traditional educational paradigms, offering real-time insights and adaptability. Through its integration with physical robots, RP enhances classroom interactions, fostering a dynamic and engaging learning environment. This innovative approach not only addresses the shortcomings of traditional education but also propels the field towards a smarter future, where technology and teaching artistry converge to unlock unparalleled educational excellence.