

Introduction to Machine Learning and AI

Prof. Douglas Kunda, PhD

Vice Chancellor – ZCAS University

vc@zcasu.edu.zm



Training Programme

09:15hrs Introduction to AI and Machine Learning

09:30hrs Supervised Learning

10:30hrs Tea Break (30 minutes)

11:00hrs Unsupervised Learning

12:00hrs Robotics and AI

13:00hrs Lunch break (60 minutes)

14:00hrs Deep and Reinforcement Learning

14:45hrs NLP and LLM

15:30hrs Self service tea break (0 minutes)

15:30hrs Speech recognition and computer vision

16:15hrs Benefits and Challenges of AI and ML

17:00hrs End of Programme

Exercise 1

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - Install python on your laptop or use online compiler. Write a python program Suppose that the data for analysis includes the attribute age . The age values for the data tuples are (in increasing order) 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. Using Python solve the following problems (a) What is the mean, median and mode of the data? (b) What is the midrange of the data? (c) what is first and third quartile of the data? (d) Give the five-number summary of the data.(e) Show a boxplot of the data.
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - List 3 possible application of ML and AI in your organization that you can implement after this training
4. Use of existing ML and AI software to solve new or existing problems,
 - List 3 software in your organization that uses or implements ML and AI

Exercise 2

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Import the diabetes data and use at least 5 ML classifier algorithms to evaluate the performance of the models. Ensure that you print the precision, recall, AUC score and f1-scores as well as plot ROC curve and plot the Confusion Matrix calculate
4. Use of existing ML and AI software to solve new or existing problems,
 - List 3 AI software that uses classifiers. You can Google or use ChatGPT or BARD

Exercise 3

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Develop python program that uses sample Boston Housing dataset and use linear regression to predict house prices and indicate the performance of the model
 - Develop python program that uses sample Iris dataset to predict species (setosa or non-setosa) based on petal length using logistic regression and indicate the performance of the model
 - Develop python program that uses multiple linear regression to predict some variable and indicate the performance of the model
4. Use of existing ML and AI software to solve new or existing problems,
 - List 3 AI software that uses regression that you can adopt in your organization. You can Google or use ChatGPT or BARD

Exercise 4

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Using any data write a python code that uses at least 3 clustering algorithms and calculate the performance for each algorithm and indicate which is the best
 - Using swiss banknote data to detect counterfeit notes, give me a python code based on the following outlier methods: a) Elliptic Envelope Algorithm, b) Isolation Forest Algorithm, c) One-class SVM Algorithm, d) Local Outlier Factor (LOF) Algorithm, e) Minimum Covariance Determinant. It should first show the dataset, plot boxplot, plot the scatterplot of the data and then calculate their performance
4. Use of existing ML and AI software to solve new or existing problems,
 - List 3 AI software that uses clustering, association and outlier analysis that you can adopt in your organization. You can Google or use ChatGPT or BARD

Exercise 5

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - N/A
4. Use of existing ML and AI software to solve new or existing problems,
 - Provide 10 areas where robotics and AI can be used in Zambia. Think of innovative applications, for example drones can be used for monitoring cattle grazing.

Exercise 6

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Develop a python program that implements deep learning using tensorflow keras mnis datasets. Include printing of data and performance of the algorithm
4. Use of existing ML and AI software to solve new or existing problems,
 - Identify 5 software that use deep learning that you can adopt in your organization.

Exercise 7

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Write a python program with a simple example using the Q-learning algorithm to solve a basic environment, either use "FrozenLake" or "Taxi-v3" environment from OpenAI Gym
4. Use of existing ML and AI software to solve new or existing problems,
 - Identify 5 AI application that use reinforcement learning that you can adopt in your organization.

Exercise 8

1. Develop new ML and AI algorithms? N/A
2. Develop new and efficient ML packages and implementation? N/A
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Use OpenAI's GPT-3 API to generate creative and coherent text. Write a Python script that sends prompts to the API and receives text completions. You can experiment with different prompts, generate stories, dialogues, or even code snippets. Make sure you have access to an API key from OpenAI.
 - Build a question-answering system using GPT-3. Write a Python program that takes a passage of text and a question as input and uses the GPT-3 API to generate an answer. Experiment with various question formats and see how well the model can understand and answer different types of questions.
 - Create an interactive chatbot using GPT-3. Develop a Python script that simulates a conversation between a user and the chatbot. The chatbot should be able to provide informative responses, engage in small talk, and handle a dynamic conversation flow. This exercise will involve sending a series of messages to the GPT-3 API and processing the responses.
4. Use of existing ML and AI software to solve new or existing problems,
 - Has your institution adopted ChatGPT and how are you using these AI technology for the good of your institutions

Exercise 9

1. Develop new ML and AI algorithms,
 - N/A
2. Develop new and efficient ML packages and implementation,
 - List 3 ML algorithms for speech recognition and 3 ML algorithms for computer vision
3. Application of existing ML and AI algorithms to solve new or existing problems,
 - Write a python program that implements one of the traditional ASR namely: Hidden Markov models (HMM) and dynamic time warping (DTW).
 - Write a python program that implements one of the most popular state-of-the-art speech recognition acoustic models namely: Quartznet, Citrinet, and Conformer.
 - Write a python program that implements computer vision feature detection
4. Use of existing ML and AI software to solve new or existing problems,
 - Identify 3 AI application for speech recognition and computer vision that you can adopt in your organization.

Discussion questions

- Do you support use of ChatGPT in University and for doing home work?
- What some of the areas that Zambia can leverage on the applications of AI and ML
- Why is there little innovation in ML and AI related to algorithms or robotics in Zambia and what can we do to reverse this challenge