Course Title: No-Code AI (or similar)

Course Outline:

This course introduces students to AI and Machine Learning (ML) through no-code platforms requiring no prior programming experience. Students will learn how to work with structured, unstructured, temporal, and visual data using simple, yet powerful AI tools. The course will introduce key AI concepts, such as data exploration, decision systems, classification, predictive modelling, neural networks, and generative AI, without requiring programming skills, emphasizing real-world use cases and practical problem-solving. The course uses a hands-on learning approach; students will develop their own AI models, critically evaluate them, and examine the potential for using AI methods to create innovative solutions for challenging problems in business and society. Along with the limitations of AI/ML solutions, ethical and privacy issues will be examined to highlight the positive and negative implications of AI on business and society.

Course Learning Outcomes:

- CL01: Explore and analyse structured, unstructured, and temporal data using no-code tools.
- CL02: Build and evaluate models for predictive analytics, classification, recommendation systems, time series analysis, and data clustering, using no-code tools.
- CL03: Discover how to use AI models to solve real-world problems in business and society, in a wide range of areas.
- CL04: Understand and mitigate ethical concerns in AI applications.
- CL05: Use generative AI for efficient problem solving, while acknowledging its limitations.

Course Schedule:

Lectures (2 lectures, 2 hours each, total 4 hours per week over nine weeks)

Week-01:

Lecture-A: **Overview** of data science, Machine Learning and AI. Overview of ML modelling life cycle. Understanding the data – visualisation, descriptive statistics concepts, etc.

Lecture-B: *Structured **Data Analysis***: data processing techniques for structured data, using no-code platform. Exploring dimensionality reduction techniques (PCA). Generating clusters (K-means and DBSCAN) and evaluating the quality of clusters.

Week-2:

Lecture-A and B

Regression *Models and Predictive Analytics*: Gain an understanding of regression tasks in machine learning. Use a no-code platform to build regression models and evaluate their performance using key metrics such as R-squared and root mean squared error (RMSE). Solve/introduce two real-world problems (e.g. house prices, sales forecasting) using regression model.

Week-03

Lecture-A and B

Classification *Models*: Gain an understanding of classification tasks in machine learning (binary and multi-class classifications). Build classification models using a no-code platform and evaluate them using key metrics such as accuracy, precision, recall, and confusion matrix analysis. Solve/introduce two real-world problems using classification model.

Week-04

Lecture-A and B

Predictive Models Using **Neural Networks**: An overview of Neural Networks, using a simple video example to demonstrate basic architecture and how forward and backward propagation function. Discuss how the cost function and gradient descent are employed to minimize error over multiple cycles (epochs). Highlight why Neural Networks are generally more effective at learning complex functions compared to models like regression and decision trees. Explore how to fine-tune the architecture of a Neural Network by adjusting relevant parameters to improve performance.

Week-05

Lecture-A: Temporal Data and **Time Series** Predications: Introduce the key distinctions between time series data and tabular data, particularly focusing on stationary versus non-stationary data. Explore preprocessing techniques used to transform non-stationary data into stationary form for more accurate time series forecasting. Solve/introduce one real-world problem for time series prediction.

Lecture-B: Computer **Vision** Models: Explain why images represent a spatial form of unstructured data. Using a simple example, explain how features are extracted from an image and how CNNs learn from images. Solve/introduce one real-world problem to demonstrate how to build models to classify images or recognise objects in an image.

Week-06

Break Week.

Week-07

Lecture-A and B:

Unstructured Data Exploration and intro to LLMs: Compare structured and unstructured data, highlighting why natural language is considered unstructured. Explore key techniques in Natural Language Processing (NLP) for feature extraction from unstructured data and their application in predictive models, such as sentiment

analysis. Review various business applications of NLP. Introduce the history and evolution of Large Language Models (LLMs) and discuss their growing popularity. Provide an intuitive explanation of how LLMs generate tokens (text, images, etc.), emphasizing their need for extensive data and human-in-the-loop processes.

Week-08

Lecture-A and B: **Generative AI**: Introduce the concepts of generative AI and prompt engineering, highlighting their potential in accelerating problem-solving. Explore how generative AI can be used as a creative assistant for idea exploration through effective prompt engineering. Discuss generative AI's limitations, such as hallucinations, bias, and incomplete knowledge, using real-world examples. Contrast generative models with traditional machine learning models, emphasizing key differences. Finally, explain techniques like Retrieval Augmented Generation (RAG) and others to enhance the performance of large language models (LLMs).

Week-09

Lecture- A and B:

Recommendation Systems (consult Wayne).

Week-10

Lecture-A and B

Ethical *and* ***Responsible*** *Use of AI*: explore key ethical challenges in AI, including issues of bias, privacy, and fairness in AI systems. Discuss importance of transparency and accountability in AI systems. Explore regulatory frameworks and responsible AI guidelines. Examine case studies that relate to ethical issues and AI biases.

Review of the course.

Labs (2 hours each, nine labs):

Lab-Week-01:

Setting up accounts, and exploring the no-code interface
Data exploration – visualisation, descriptive stats, distributions, etc.

Lab-Week-02:

Data exploration – Dimensionality reduction techniques (PCA), clustering using K-means and DBSCAN. Evaluating the quality of clusters.

Lab-Week-03

Given a dataset, build a **regression** model, evaluate it using a relevant metrics. Use the model for prediction.

Lab-Week-04

Given a dataset, build a **classification** model, evaluate it using a relevant metrics. Use the model for prediction.

Lab-Week-05

Given a dataset, build a **NN model**, evaluate it using a relevant metrics. Use the model for prediction.

Lab-Week-07

Given a dataset, build a model for **time series** predictions, evaluate it using a relevant metrics. Use the model for prediction.

Lab-Week-08

Given a dataset of images, build a model for **image classifications**, evaluate it using a relevant metrics. Use the model for prediction.

Lab-Week-09

Introduction to **generative AI** and prompt engineering. Examples of types of problems where generative AI can speed up problem solving. How to use generative AI (prompt engineering) as an assistant to explore new ideas. Understand limitations of generative AI, using examples.

Lab-Week-10

Given a dataset, build a **recommendation** system, evaluate it using a relevant metrics. Use the model for prediction.

Resources

- ***RapidMiner*** software (used in the MIT no-code AI course). The student edition is free, no coding is required.
- ***Custom Jupiter notebooks.*** They will be available on the cloud for labs and other lecture materials. Students only use an interface; no coding is required. Only open-source software libraries (like scikit-learn) will be used.
- Students will also be introduced to some of the latest no-code AI platforms, such as SageMaker Canvas (from AWS), AutoML (from Google), etc., using demos.

Assessments

- **Labs (LABS) worth 20 marks**. For example, each lab worth 2.5 marks, marks are capped at 20, so they can miss one lab without penalty, if required. We don't need to specify marks for each lab now.
- **One assignment (ASS) worth 30 marks**. The assignment will have multiple parts, for example:
    - Part-1: data exploration
    - Part-2: building and evaluating models using decision trees and NNs

    - Part-3: comparing results and write a report
    - Part-4: (advanced) Time series prediction, or another topic to be selected later.
- **Final Exam (EXAM) worth 50 marks**. The hurdle to passing the course is to get a minimum of 40% on the final exam.

Mapping

- **CL01**: Explore and analyse structured, unstructured, and temporal data using no-code tools. – LABS, ASS and EXAM
- **CL02**: Build and evaluate models for predictive analytics, classification, recommendation systems, time series analysis, and data clustering, using no-code tools. – LABS, ASS and EXAM
- **CL03**: Discover how to use AI models to solve real-world problems in business and society, in a wide range of areas. - LABS and ASS
- **CL04**: Understand and mitigate ethical concerns in AI applications. – LABS and ASS
- **CL05**: Use generative AI for efficient problem solving, while acknowledging its limitations. – LABS

Why No-code AI course?

If required, I can provide this section.
