Part 1: Theoretical Understanding (40%)

1. Short Answer Questions

Q1: Explain the primary differences between TensorFlow and PyTorch. When would you choose one over the other?

TensorFlow is a developer friendly library or framework that focuses on production and scalability while PyTorch is a framework that researchers who experiment new ideas use due to its flexibility.

TensorFlow for deployment (mobile, web) and large-scale stable applications. PyTorch for research in academia, prototyping and for complex dynamic models.

Q2: Describe two use cases for Jupyter Notebooks in AI development.

Exploratory Data Analysis -Visualizing and cleaning data instantly

Rapid Model Prototyping- Building, training, checking and tweaking models quickly without re-running long scripts.

Q3: How does spaCy enhance NLP tasks compared to basic Python string operations?

Basic Python string operations treat text as characters, while spaCy treats text as language. For example, A string operation sees "A-p-p-l-e," but spaCy sees "Company Name or an organization."

2. Comparative Analysis

Compare Scikit-learn and TensorFlow in terms of:

- Target applications (e.g., classical ML vs. deep learning).

  Scikit-learn -Classical Machine Learning (Classification, Regression, Clustering) on structured/tabular data for example spam filters and credit scoring.

  TensorFlow- Used for Deep Learning (Neural Networks) for unstructured data for example image recognition, NLP and reinforcement learning

- Ease of use for beginners.

  Scikit-learn – Very simple to use as it provides a clean, consistent API and is great for quickly testing standard algorithms due to its non-deep-learning focus.

  TensorFlow- Was initially more complex, but it’s integration of the Keras API makes building and training complex deep learning models very user-friendly and accessible for beginners.

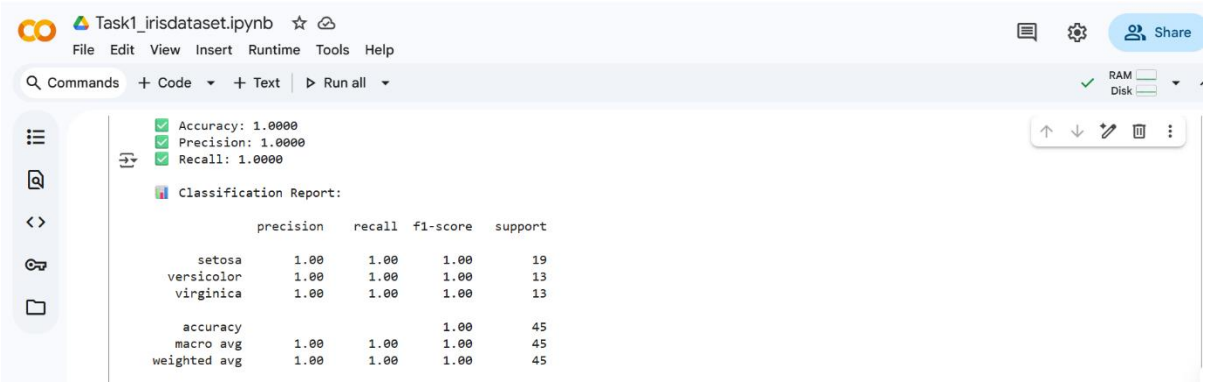
- Community support.

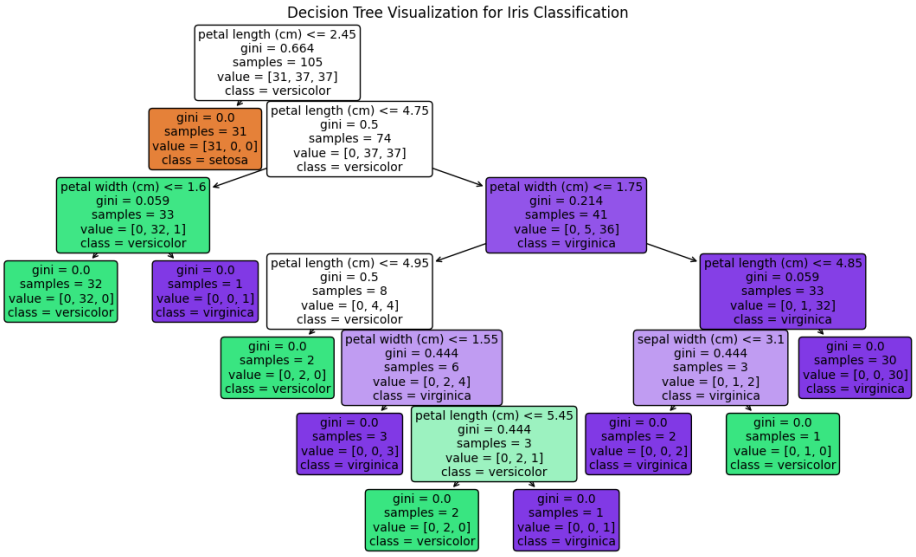
Scikit-learn – Widely used in academia and traditional Machine Learning and it's known for reliable, well-documented algorithms.
TensorFlow- It powers google, YouTube. Widely used by industries, backed by Google. It focuses on deep learning and getting complex models into real-world products.

Screenshots of model outputs (e.g., accuracy graphs, NER results)

Task 1: Iris Classification (Scikit-learn)

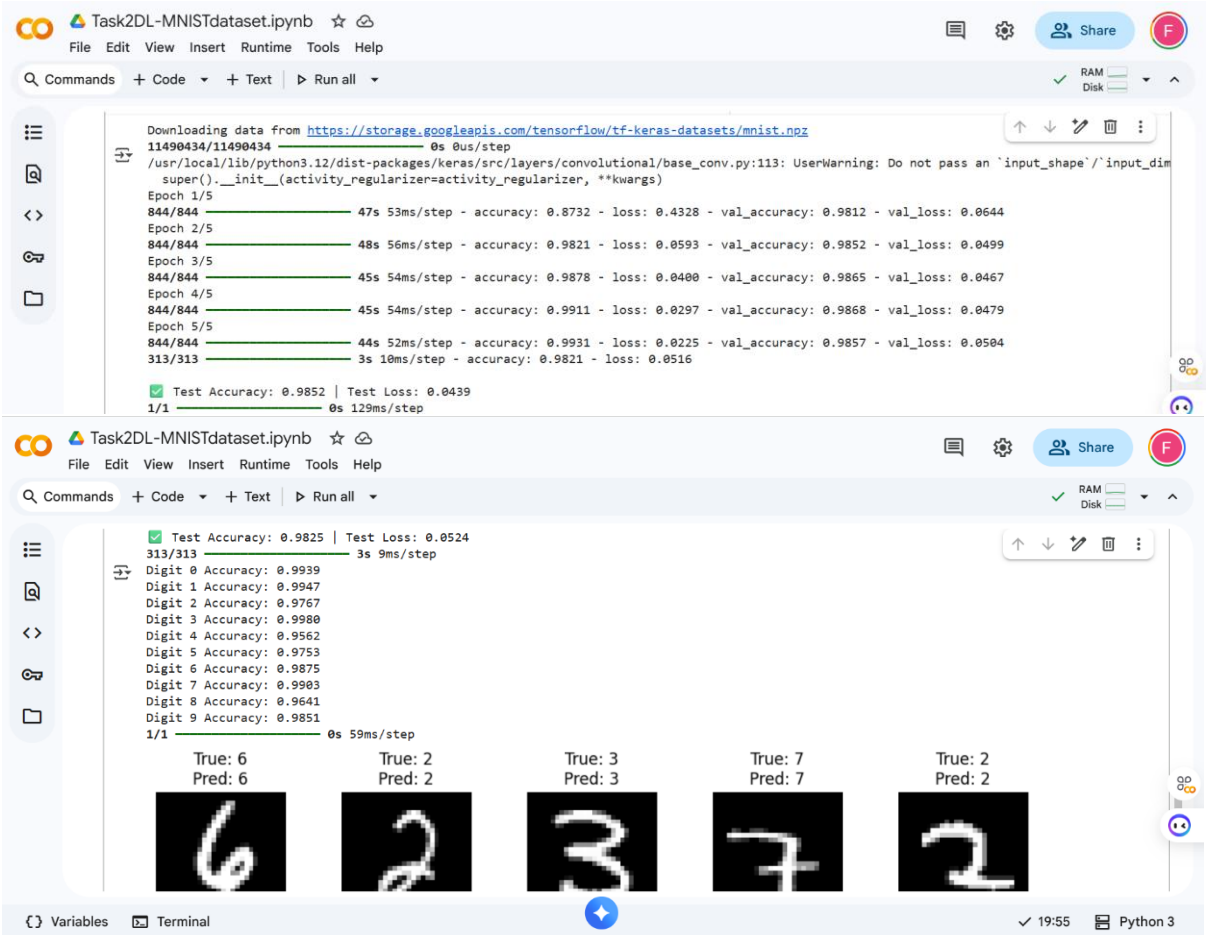
- Model evaluation output: The printed accuracy, precision, recall, and classification report.
- Decision tree plot: The visual tree generated using plot_tree().





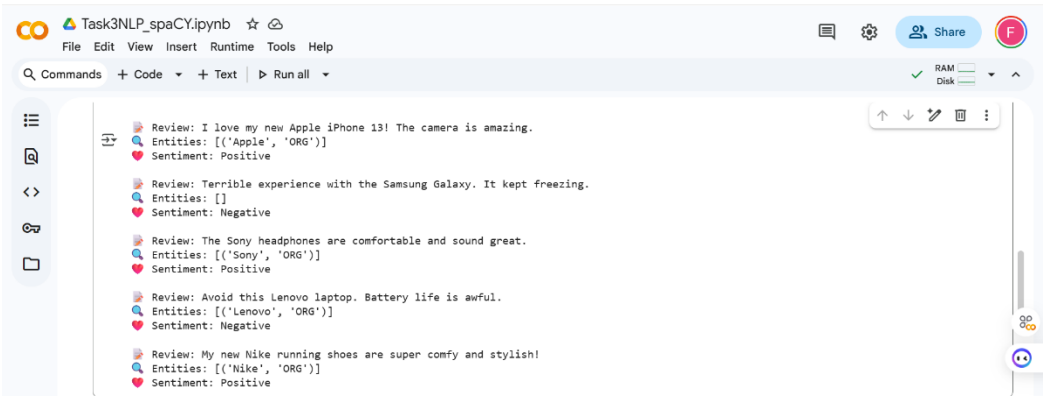
Task 2: MNIST CNN (TensorFlow)

- Test accuracy printout-The final model.evaluate() result.
- Prediction visualization- plot showing 5 sample digits with true vs predicted labels.



Task 3: NLP with spaCy

- NER output: Printed named entities like ('Apple iPhone 13', 'PRODUCT') and sentiment result: Printed sentiment label for each review (e.g., "Positive", "Negative").



Ethic Considerations Fairness Check: Accuracy MNIST dataset