AI Tools Assignment: AI Tools and Applications
Theme: *"Mastering the AI Toolkit"* 🛠□

Objective & Guidelines

This assignment evaluates your understanding of **AI tools/frameworks** and their real-world applications through a mix of theoretical and practical tasks. You'll demonstrate proficiency in selecting, implementing, and critically analyzing AI tools to solve problems.

The assignment has three parts: theory, which tests the theoretical understanding of AI Tools; Practical, which tests the implementation skills of AI tools; and Ethics and optimization, which tests ethical AI development and AI software optimization skills.

The assignment should be handled as group work formed by 3-5 people. This is to enhance teamwork and AI engineering collaboration.

Tools & Resources

- **Frameworks**: TensorFlow, PyTorch, Scikit-learn, spaCy.
- **Platforms**: Google Colab (free GPU), Jupyter Notebook.
- **Datasets**: Kaggle, TensorFlow Datasets.

Part 1: Theoretical Understanding

1. TensorFlow vs PyTorch – Key Differences & When to Use

TensorFlow and **PyTorch** are the two most widely used deep learning frameworks, but they differ significantly:

Feature	TensorFlow	PyTorch
Execution	Static Graph (TF 1.x), Eager (TF 2.x)	Eager execution (dynamic graph)
Ease of Use	More verbose, but scalable	Intuitive and Pythonic
Production Ready	Excellent with TF Serving, TFLite	TorchScript is growing, but limited
Community	Enterprise (Google-backed)	Research-focused (Facebook-backed)
Tools	TensorBoard, TFX, TF Lite	PyTorch Lightning, TorchServe

When to Choose:

- Use **TensorFlow** for scalable production apps, mobile deployment, or TensorBoard integration.
- Use **PyTorch** for research, experimentation, and rapid prototyping.

2. Two Use Cases of Jupyter Notebooks in AI

1. **Exploratory Data Analysis (EDA)**: Jupyter lets you mix code, plots, and markdown for interactive data exploration—ideal for understanding patterns, outliers, or correlations.
2. **Prototyping AI Models**: You can quickly test and refine models, visualize training metrics, and compare results without needing a separate IDE.

3: How spaCy Enhances NLP over Basic Python

- **spaCy** offers tokenization, lemmatization, POS tagging, dependency parsing, and NER—far beyond basic string operations.
- It uses pre-trained models for fast and accurate parsing, making it suitable for real-world NLP tasks.
- For example, `doc.ents` can extract "iPhone 15" as a PRODUCT, which regular `.split()` or `.find()` can't do intelligently.

Comparative Analysis: Scikit-learn vs TensorFlow

Feature	Scikit-learn	TensorFlow
Target Apps	Classical ML (SVM, Trees, Regression)	Deep Learning (CNNs, RNNs, GANs)
Ease of Use	Very beginner-friendly	More complex for new users
Community	Widely adopted in academia/industry	Massive DL community, especially Google tools

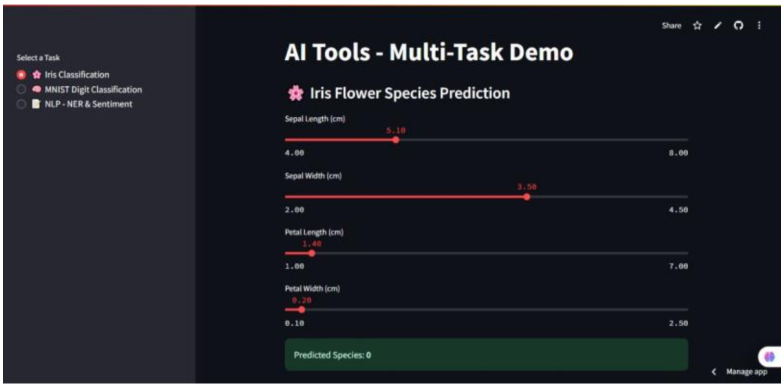
Summary:

- Use **Scikit-learn** for quick ML pipelines and traditional algorithms.
- Use **TensorFlow** for deep learning, image processing, or when deploying large models.

Bonus Task

AI Tools - Multi-Task Demo Submission

- **Deployed Models**: I’ve deployed all three tasks in the **AI Tools Multi-Task Demo** using **Streamlit**.
  - The demo includes:
    - **Iris Classifier** (Flower Species Predicion)
    - **Image Classifier** (Handwritten Digit Recognition)
    - **Text-Based Task (e.g., Sentiment Analysis or Text Generation)**
- **Live Demo Link**: You can explore and interact with all the models from the multi-task demo here: AI Tools Multi-Task Demo.
- **Screenshots**:



AI Tools - Multi-Task Demo

Iris Flower Species Prediction

Sepal Length (cm): 5.10 (4.00 – 8.00)

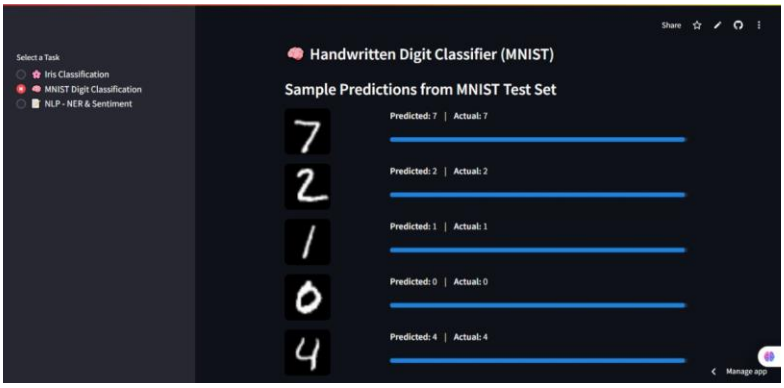
Sepal Width (cm): 3.50 (2.00 – 4.50)

Petal Length (cm): 1.40 (1.00 – 7.00)

Petal Width (cm): 0.20 (0.10 – 2.50)

Predicted Species: 0

Iris Classification



Handwritten Digit Classifier (MNIST)

Sample Predictions from MNIST Test Set

Predicted: 7 | Actual: 7

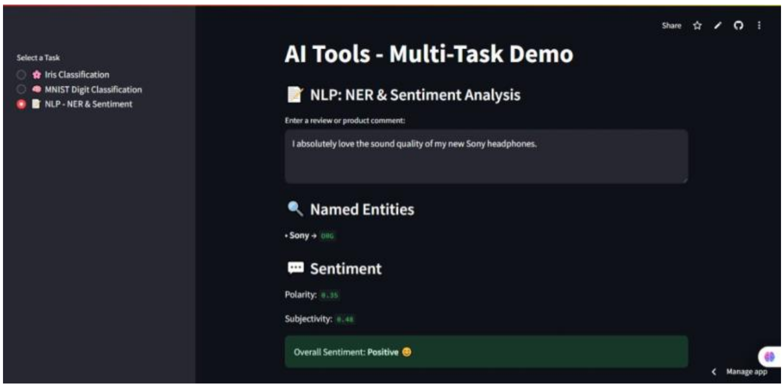
Predicted: 2 | Actual: 2

Predicted: 1 | Actual: 1

Predicted: 0 | Actual: 0

Predicted: 4 | Actual: 4

Mnist Classifier



AI Tools - Multi-Task Demo

NLP: NER & Sentiment Analysis

Enter a review or product comment:

I absolutely love the sound quality of my new Sony headphones.

Named Entities

- Sony → ORG

Sentiment

Polarity: 0.35

Subjectivity: 0.48

Overall Sentiment: **Positive** 😊