AI Tools Assignment: Project Report

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GitHub Repo Link: https://github.com/muchoki769/week_3_AI_Assignment
Community Article Link: https://academy.powerlearnprojectafrica.org/community

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Part 1: Theoretical Understanding

1. Short Answer Questions

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

TensorFlow is an open-source machine learning framework developed by Google. It is widely used for building and training deep learning models.

PyTorch is an open-source machine learning library developed by Facebook. It is known for its dynamic computation graph and ease.

Choose TensorFlow when:

Working on large-scale distributed training tasks.

I need a powerful, integrated tool like Tensor Board for visualization and experiment tracking from outset.

Choose PyTorch when:

Rapid prototyping and research are the priorities.The dynamic graph makesit ideal for models with variable-length inputs

I am working in fields where the latest academic research is often published in PyTorch

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

1.Interactive Data Exploration and Prototyping:

Jupyter Notebooks are ideal for the initial stages of an AI project. Developers, Data Scientists can load a dataset, run statistical summaries, and create visualization in individual cells.This interactive feedback loop is crucial for understanding data distributions, identifying outliers, and forming hypothesis before committing to a full model architecture.

2. Creating Reproducible Tutorials and Reports:

Notebooks seamlessly combine code, rich text, equations, and results (table, graph, images) into a single, linear document. This makes them perfect for creating educational materials, documenting an experimental process, or building a final report for stakeholders.

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

Basic Python string operations (split(), find(), regex) work on a superficial, character-level basis.

spaCy provides a linguistically-informed, statistical model that understands the structure and meaning of text.

2. Comparative Analysis

Feature	Scikit-learn	TensorFlow
Target Application	Classical Machine Learning. Excels at traditional algorithms like Linear Regression, Random Forests. Ideal for tabular data, small to medium-sized datasets, and tasks where feature engineering is key.	Deep Learning. Designed for building and training large-scale neural networks (CNNs, RNNs, Transformers).Essential for unstructured data like images, text, audio and for tasks requiring high representational power.
Ease of use for Beginners	High. It features a remarkably consistent and simple API (e.g. the universal. fitdicts(), . score() methods).Its documentation is excellent, making it the best starting point for understanding core ML concepts.	Moderate (improved with keras). The core TensorFlow API was historically more complex. However, the integration of tf.keras as its high-level API has made it significantly easier for beginners to start building neural networks with minimal code.
Community Support	Strong in classical ML. Its one of the most well established and trusted libraries in the data science community. You will find a vast number of tutorials, and courses covering almost every algorithm it implements.	Rapidly growing in deep learning. Backend by Google and widely adopted in both industry and research. It has one of the largest and most active communities for deep learning, with extensive official documentation, forums, and pre-trained models

Results Summary

Task 1: Iris Classification

- **Model**: Decision Tree Classifier
- **Accuracy**: 100%
- **Key Features**: Petal length and width

Task 2: MNIST Digit Recognition

- **Model**: CNN Architecture
- **Accuracy**: >98%
- **Architecture**: 3 Conv layers + 2 Dense layers

Task 3: Amazon Reviews Analysis

- **Entities Extracted**: Brands, Products, Organizations
- **Sentiment Analysis**: Rule-based approach
- **Visualization**: Interactive NER displays