

1. Short Answer Questions

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

TensorFlow is developed by Google and offers a more production-oriented framework with strong deployment tools like TensorFlow Serving, TensorFlow Lite, and TensorFlow.js. It uses a static computation graph (though TensorFlow 2.x introduced eager execution).

PyTorch, developed by Meta (Facebook), is research-friendly, featuring dynamic computation graphs that make debugging and experimentation easier.

Choice:

- Choose PyTorch for research, rapid prototyping, and when you need flexibility.
- Choose TensorFlow for large-scale deployment, mobile integration, or production environments.

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

1. Data Exploration and Visualization: Jupyter Notebooks allow interactive analysis of datasets with tools like pandas, matplotlib, and seaborn, helping developers understand data distributions and correlations.

2. Model Prototyping and Experiment Tracking: AI developers can iteratively write, test, and visualize machine learning or deep learning models, documenting code and results in a single interactive document.

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

spaCy provides pre-trained language models and advanced NLP features like tokenization, part-of-speech tagging, named entity recognition, and dependency parsing — tasks that go far beyond what basic string operations can do.

It's optimized for performance and handles context-aware language processing, unlike simple text manipulation with Python's built-in string methods.

2. Comparative Analysis

Aspect: Target Applications

- Scikit-learn: Best for classical machine learning tasks such as regression, classification, and clustering (e.g., logistic regression, decision trees, SVMs).
- TensorFlow: Designed for deep learning and neural networks, handling large-scale computation with GPUs/TPUs.

Aspect: Ease of Use for Beginners

- Scikit-learn: Very beginner-friendly, with a simple and consistent API that integrates easily with pandas and NumPy.
- TensorFlow: More complex, though high-level APIs like Keras have simplified usage.

Aspect: Community Support

- Scikit-learn: Strong community for traditional ML; abundant tutorials and documentation.
- TensorFlow: Very large global community focused on AI and deep learning; widely supported by Google and major enterprises.