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### 1. Short Answer Questions

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

TensorFlow and PyTorch are both open-source deep learning frameworks, but they differ in how they execute operations and their ease of use.

Execution Model: TensorFlow uses a static computation graph (defined and then run), while PyTorch uses dynamic computation graphs (define-by-run), which are more intuitive for debugging and experimentation.

Syntax & Usability: PyTorch is considered more Pythonic and easier to use, especially for research and prototyping. TensorFlow, especially with Keras, is often preferred for production-level deployment and scalability.

Choose PyTorch when you need flexibility for research or experimenting with novel architectures. Choose TensorFlow for deploying large-scale models in production environments, especially when using tools like TensorFlow Serving or TensorFlow Lite.

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

Data Exploration and Visualization: Jupyter Notebooks allow interactive exploration of datasets using Python libraries like Pandas, Matplotlib, and Seaborn. This is useful for understanding patterns, correlations, and outliers in the data before training models.

Model Prototyping and Documentation: Developers can write, test, and tweak machine learning models in small, manageable code blocks while documenting each step. This improves reproducibility and collaboration, especially in research and education.

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

Answer: spaCy is an advanced NLP library that offers pre-trained models and efficient algorithms for linguistic processing tasks like tokenization, part-of-speech tagging, named entity recognition, and dependency parsing.

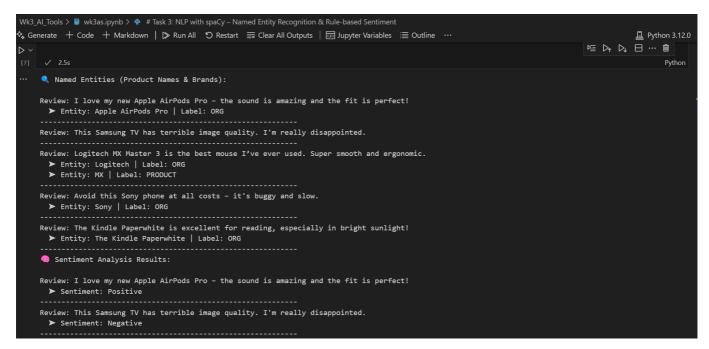
Unlike basic Python string operations (e.g., .split(), .replace()), spaCy understands the grammatical structure and meaning of text, enabling more accurate and context-aware text processing. It handles complex language rules, supports multiple languages, and is optimized for performance and scalability.

2. Comparative Analysis: Scikit-learn vs TensorFlow

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Feature	Scikit-learn	TensorFlow
Target Applications	Classical ML (e.g., regression, classification, clustering)	Deep learning (e.g., neural networks, NLP, computer vision)
Ease of Use	Very beginner-friendly with a simple and intuitive API	More complex, but easier with Keras and good documentation
Community Support	Mature and well-established community with many tutorials and examples	Large and active community, widely used in industry and research





#### 3. Ethical Considerations

- MNIST Bias: Dataset limited to one demographic
- Amazon Review Bias: Rule-based methods may ignore sarcasm, culture

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### Mitigation:

- Use TensorFlow Fairness Indicators
- Customize spaCy rule sets for better neutrality