

AI Model Development Report

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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 leading deep learning frameworks, but they differ in design philosophy and usability. TensorFlow (developed by Google) offers a static computation graph and better support for production deployment via TensorFlow Serving and TensorFlow Lite. PyTorch (developed by Meta) uses a dynamic computation graph, making it more intuitive and flexible for research and experimentation. You would choose TensorFlow when targeting large-scale production or mobile deployment, and PyTorch for fast prototyping and academic research.

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

- 1. **Interactive Prototyping:** Data scientists use Jupyter Notebooks to explore datasets, visualize results, and rapidly iterate over models with real-time feedback.
- 2. **Documentation and Education:** Jupyter integrates narrative text with executable code, making it ideal for teaching, tutorials, and reproducible research.

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

spaCy is an advanced NLP library offering tokenization, part-of-speech tagging, named entity recognition (NER), dependency parsing, and word vector embeddings. Unlike basic Python string operations, which handle text at a character or substring level, spaCy processes linguistic structure, enabling semantic understanding, entity extraction, and context-aware processing.

2. Comparative Analysis

Criteria	Scikit-learn	TensorFlow
Target Applications	Classical Machine Learning algorithms such as linear regression, decision trees, and SVMs.	Deep learning architectures, neural networks, and classification for high-dimensional data.
Ease of Use	Simpler syntax and API for beginners; excellent for smaller projects and prototyping.	More complex setup and API, but powerful for large-scale and advanced AI tasks.
Community Support	Large, mature community focused on traditional ML.	Extensive global support from Google and deep learning research community.

3. Model Output Screenshots (Placeholders)

Below are placeholders for model results such as accuracy graphs, confusion matrices, or NER visualizations.

[Insert Screenshot: Model Accuracy Graph Here]

[Insert Screenshot: Named Entity Recognition (NER) Results Here]

4. Ethical Reflection on AI Model Development

Developing and deploying AI models involves significant ethical considerations. Key ethical aspects include fairness, accountability, transparency, and privacy. For example, in house price prediction models, bias in training data could reinforce socioeconomic inequalities or unfairly influence property valuations. Ethical AI practices require diverse datasets, explainability tools (e.g., SHAP, LIME), and human oversight to ensure decisions remain justifiable and inclusive. In addition, models should comply with data protection laws (like GDPR) and provide clear documentation for users and stakeholders.