NLP Engineer Interview Challenge

Background

A global financial services company receives thousands of customer support inquiries daily across multiple channels (email, chat, phone transcripts) in several languages. The company wants to implement an advanced NLP system to automatically classify, prioritize, and route these inquiries to the appropriate departments while extracting key information to help customer support representatives respond more efficiently.

Current manual classification is time-consuming, inconsistent, and causes delays in customer response times. The challenge is complicated by the technical nature of financial inquiries, the mix of languages, and the need to identify potentially urgent or high-risk issues quickly.

Objective

Design and implement an NLP system that can process customer support inquiries to:

1. Classify messages into appropriate categories and subcategories
2. Extract key entities and intents
3. Assess urgency and sentiment
4. Identify potential compliance or security issues
5. Generate structured summaries for support staff

Dataset Overview

- **Customer Inquiries**: 100,000 anonymized support messages (email, chat, call transcripts)
- **Taxonomies**: Hierarchical classification categories with definitions
- **Annotated Samples**: 10,000 messages with human-labeled categories, entities, and urgency levels
- **Language Distribution**: 70% English, 15% Spanish, 10% French, 5% German
- **Historical Routing**: Records of how previous inquiries were routed and resolved

Scope of Work

1. Text Processing Pipeline

- Implement multilingual text normalization and preprocessing
- Develop language identification and routing
- Handle financial jargon, abbreviations, and domain-specific terminology
- Address code-switching and mixed-language messages

2. Classification System

- Build a hierarchical classification model for inquiry categorization
- Implement intent recognition for common customer needs
- Develop named entity recognition for financial instruments, account details, and transaction information
- Create urgency detection based on message content and context

3. Information Extraction

- Extract key facts and parameters from unstructured text
- Identify action items and requested information
- Recognize temporal elements (dates, deadlines, timeframes)
- Link related inquiries from the same customer

4. Performance Optimization

- Address class imbalance in rare but critical categories
- Implement confidence scoring for routing decisions
- Develop strategies for handling previously unseen categories
- Create active learning workflows for continuous improvement

5. Integration Design

- Design APIs for integration with existing support systems
- Implement explanation mechanisms for classification decisions
- Create fallback processes for low-confidence predictions
- Develop visualization tools for support staff

Technical Requirements

- Well-documented NLP pipeline with clear component separation
- Thoughtful approach to multilingual support
- Attention to both precision and recall, with emphasis on not missing critical issues
- Consideration of explainability for automated decisions
- Privacy-conscious design that protects sensitive customer information

Evaluation Criteria

Your solution will be evaluated based on:

- Classification accuracy across different categories and languages
- Quality of information extraction and summarization

- System performance and latency considerations
- Handling of edge cases and ambiguous inquiries
- Code quality, documentation, and reproducibility

Discussion Questions

- How would your system handle entirely new categories of inquiries?
- What approaches did you take to balance precision and recall for critical issues?
- How would you address potential biases in the training data?
- What strategies would you implement for continuous model improvement?
- How would you measure the business impact of your NLP system?

Deliverables

- Complete code repository with setup instructions
- Technical documentation explaining your approach and algorithms
- Performance analysis across different languages and categories
- Integration guide for deployment in production environments
- Brief presentation summarizing your solution and design decisions

Final Notes

This challenge assesses your ability to build practical NLP systems that handle the complexities of real-world language data in a business context. Focus on creating a solution that not only performs well technically but also addresses the specific needs of a financial services environment where accuracy, compliance, and customer experience are paramount.