AI LLM Engineer Screening Task: Advanced Infrastructure Projects Data Analysis with Entity Relationship Mapping

Objective: Leverage advanced techniques in Large Language Models (LLMs), ensemble models, and knowledge graphs to interpret infrastructure projects data. The goal is to infer relationships between governments and companies, identifying which entities collaborate more frequently and gaining insights into their project networks.

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1. Data Sources:

- World Bank Projects
- SAM.gov tenders
- Multi-modal data (images, videos, and textual descriptions)

2. Required Tools/Technologies:

- langchain
- Llama2
- GPT API
- BERT, RoBERTa, or similar LLMs
- TensorFlow, PyTorch
- Ensemble Learning Libraries
- Knowledge Graph frameworks (e.g., Neo4j, Grakn)

Instructions:

A. Advanced Architecture Diagram and Workflow:

- Construct an architecture diagram highlighting data flows, multi-modal integration, LLM and ensemble model usage, and the creation/updating of a knowledge graph.
- Clearly document the workflow, emphasizing how knowledge graph technologies will be used to track and represent relationships between entities.

B. Implementation of LLMs, Ensemble Models, and Knowledge Graphs:

- Apply LLMs like BERT or RoBERTa to extract entities (governments, companies) and relationships (collaborations, projects) from textual data.
- Incorporate ensemble models to bolster the reliability and accuracy of entity extraction and relationship mapping.
- For multi-modal data (e.g., images containing logos or videos with mentions), use appropriate models to identify entities. Combine these results with textual data interpretations.
- Populate a knowledge graph with extracted entities and relationships. This graph should be dynamic and capable of evolving with new data.

C. Creative Use Case:

- Develop a feature where stakeholders can query the knowledge graph to understand the extent and nature of collaborations between specific governments and companies. This can be showcased using a graphical interface, where entity nodes can be explored to reveal deeper insights. The system should also be able to offer recommendations or insights on potential future collaborations, leveraging the GPT API and knowledge graph analytics.

Critical Thinking Milestones:

Data Integration and Analysis:
- How well are multi-modal data sources and knowledge graphs integrated for a thorough understanding?
- Is entity extraction from various data sources accurate and consistent?

Model Selection and Implementation:
- How well do the chosen LLMs and ensemble methods extract and infer relationships?
- Are there feedback loops in place to correct or refine knowledge graph entries?

Knowledge Graph Utilization:
- Is the graph effectively used to infer deeper relationships between entities?
- How is the knowledge graph kept up-to-date and how does it evolve with new data?

Scalability and Evolution:
- Can the system accommodate an influx of new projects and collaborations?
- Are mechanisms in place to ensure the knowledge graph remains coherent and accurate as it grows?

Output and Evaluation Criteria Table:

Criteria	Poor (1-2)	Average (3-4)	Good (5-6)	Excellent (7-8)	Outstanding (9-10)
Architecture & Workflow Clarity	Lacks clarity & structure	Basic structure	Detailed with minor flaws	Comprehensive & clear	Exceptionally well-structured
Data & Entity Handling	Inconsistent extraction	Basic entity mapping	Good entity-relationship	Efficient mapping & relations	Seamless integration & mapping
Model & Knowledge Graph Implementation	One-dimensional approach	Uses some AI & graph techniques	Balanced use of techniques	Optimized models & graph usage	Mastery in implementation
Creative Use Case Effectiveness	Doesn't address real needs	Satisfies basic requirements	Addresses stakeholder needs	Predictive & insightful	Transformative & highly useful

System Validation & Testing	Inconsistent results	Some accuracy in inferences	Reliable entity relations	High accuracy & validation	Near-perfect entity mapping
Scalability	Not scalable	Limited scalability	Moderate scalability	Highly scalable	Future-proof & scalable

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Submission Details:

- Submit all source code, datasets, architecture diagrams, and relevant documentation.
- Provide a demo, preferably web-based, showcasing the querying and insights extraction capabilities from the knowledge graph.
- Include a detailed report outlining the methodologies used, challenges encountered, and how they were addressed.

Best of luck, and we eagerly await your innovative solutions!

Kindly find the survey form for the task submission: Behavioral Form