Job Recommendations System Report

1. Key Features

1.1 Intelligent Job Title Extraction

Our system utilizes Gemini Pro AI to process job descriptions and extract standardized job titles, this ensures that there is consistent mapping between the job descriptions entered by the user and entries in the Neo4j database.

1.2 Personalized Module Recommendations

The user is able to optionally input their matriculation number and the system would analyze the user's academic history to consider the modules that they have completed as well as the preclusions to these modules. The system will then filter out the modules that cannot be taken. Additionally, the user is able to filter for 5000/6000-coded modules if they would like to consider graduate-level coursework. This flexibility helps students focus on modules that match their current academic level.

1.3 Advanced Relevance Scoring

We implemented semantic similarity using SentenceTransformer (all-MiniLM-L6-v2) which is a lightweight model specifically trained for semantic similarity tasks and is optimized for efficiency. This is crucial as we require faster response times for real-time recommendations. While larger models might offer slightly better accuracy, it would not justify their additional computational overhead and slower response times as 'all-MiniLM-L6-v2' provides good enough accuracy for comparing module descriptions with skills. The model calculates normalized relevancy scores (0-100%) between skills and module descriptions and with these scores, it would return the top 5 most relevant modules for each skill.

1.4 Career Exploration Support

The system shows related job opportunities based on the job description they have keyed in. This helps students to understand potential career paths for their field of interest. Additionally, we have provided comprehensive knowledge graph visualizations for modules, staff, and student data to help students make more informed decisions on which modules to take.

1.5 Enterprise Features

- Interactive dashboard with student distribution visualizations
- Knowledge graph consistency checking
- Graph visualization of graph database
- Query interface for easy data access
- Data management capabilities (CSV upload, add/modify/delete)
- Job-Modules Recommendation System

2. Addressing Traditional Limitations

2.1 Beyond Keyword Matching

Traditional systems often fall short due to their reliance on exact keyword matches, which can miss valuable connections between skills and academic content. Our system overcomes this limitation by using semantic similarity to understand the relationship between skills and modules. This approach captures nuanced relationships that might have been missed by conventional matching methods, ensuring more meaningful recommendations for students.

2.2 Dynamic Data Integration

Furthermore, our system's dynamic data integration capabilities ensure that our related job recommendations remain relevant. By adapting to changes in the industry needs, our system would be able to provide consistent up-to-date related job recommendations for the student's consideration when viewing the job pathway.

3. Benefits for Enterprise Knowledge Workers

3.1 Educational Institution Staff

Our system provides valuable insights into the potential skill gaps in the curriculum, aiding in academic planning. This data-driven approach enables more informed decisions about course development and program improvements. The knowledge graph consistency monitoring ensures data integrity by flagging out any potential issues or errors in the Neo4j database, generating a user-friendly detailed report for administrators to address these issues. The querying feature provides quick access information in the database, streamlining administrative decision-making processes.

The enhanced ability to match students with relevant career paths could enable career counselors to provide more targeted and effective career guidance. These data-backed recommendations strengthen the connection between academic choices and career outcomes.

4. Implementation Challenges and Solutions

4.1 Data Integration

Challenge: Integrating diverse data sources (academic records, job requirements, module information)
Solution:

- Develop and implement a comprehensive ontology and configuration schema for the graph database
- Entity and Relationship extraction to identify entity types
- Implemented Neo4j graph database for flexible data relationships
- Created standardized data import processes
- Developed consistency checking mechanisms

4.2 Relevance Scoring

Challenge: Accurate matching between job skills and module content
Solution:

- Implemented semantic similarity using SentenceTransformer
- Added caching mechanism for improved performance
- Normalized scores for consistent comparison

4.3 System Performance

Challenge: Managing large-scale data processing and real-time recommendations
Solution:

- Implemented efficient caching strategies
- Optimized database queries
- Used lightweight but effective NLP models

5. Ethical Considerations and Privacy

5.1 Data Privacy

Data privacy is a fundamental consideration in our system's design. We implemented several measures to protect sensitive information:

- Student identification: We use matriculation numbers as unique identifiers instead of more sensitive personal information
- Sensitive data masking: For confidential information such as NRIC numbers, we implement masking protocols that hide the first six digits/letters
- Role-Based Access: Staff information is handled differently based on intended use. For example, while professor names are visible to facilitate module selection, their personal information is either masked or excluded from the database.

These measures ensure compliance with data protection requirements while maintaining system functionality.

5.2 Recommendation Transparency

Transparency is a key focus of our recommendation system. We provide clear visibility into how recommendations are generated. Hence, our system displays relevance scores for users to understand why a certain module was recommended for a particular skill. This transparency helped users make informed decisions about their academic choices while understanding the reasoning behind each recommendation.

Conclusion

The Job Recommendations System represents a significant advancement in academic and career planning tools. By combining advanced NLP techniques with comprehensive academic data management, it provides valuable insights for both students and educational institutions while maintaining the privacy of the user and ethical considerations.