Applying Retrieval-Augmented Generation (RAG) for Enhanced GPT Knowledge in Malaysia

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FITE4801 - BASc in Fintech
FYP 24028
October 1, 2024

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Project Background:

The Association of Southeast Asian Nations (ASEAN) represents one of the world's most dynamic and rapidly evolving economic regions. Within this diverse group, Malaysia stands out as a key player, with its strategic location, robust economic growth, and ambitious plans for digital transformation. As of 2023, Malaysia's GDP reached $434.1 billion, with a projected growth rate of 4.7% for 2024, outpacing many global averages (Fitch Solutions, 2024). Despite these positive indicators, the complexity of Malaysia's market, coupled with its fast-changing nature, presents substantial challenges for decision-makers seeking to understand and leverage opportunities effectively.

Currently, market analysis for Malaysia faces significant challenges due to the vast breadth and complexity of the country's economic landscape. Traditional methods such as periodic economic reports, expert analyses, and historical data trends, while valuable, often struggle to capture the full scope of Malaysia's diverse market sectors (Lim & Tan, 2022). The Malaysian economy encompasses a wide range of industries, from traditional agriculture and manufacturing to emerging technology and service sectors, each with its own unique dynamics and influencing factors. This breadth makes it exceptionally challenging for stakeholders to develop a comprehensive understanding of the entire market ecosystem (Bank Negara Malaysia, 2021). Furthermore, Malaysia's position as a multicultural hub within the ASEAN region adds layers of complexity to market analysis. The interplay of various cultural, linguistic, and economic factors across different regions of the country creates a mosaic of market conditions that are difficult to analyse holistically. Local and foreign stakeholders often find it challenging to navigate this diverse landscape effectively, as the nuances of local contexts, traditions, and languages create substantial barriers to comprehensive market analysis and decision-making (Abdullah & Lim, 2023). This complexity is particularly evident in sectors that span multiple cultural and economic zones within Malaysia, requiring a nuanced understanding of regional variations in consumer behaviour, business practices, and regulatory environments.

Artificial Intelligence (AI), particularly in the form of large language models like GPT (Generative Pre-trained Transformers), has shown remarkable potential in processing and synthesizing vast amounts of information across various domains (Brown et al., 2020). These models have demonstrated capabilities in natural language understanding and generation that could be transformative for economic analysis and market intelligence. However, the application of GPT models to Malaysia's specific economic context remains largely unexplored and presents both unique challenges and opportunities (Ng & Soo, 2023).

A key limitation of current GPT models in the context of Malaysian market analysis is their reliance on pre-trained data, which can quickly become outdated, especially in Malaysia's rapidly evolving economic landscape. This is where Retrieval-Augmented Generation (RAG) emerges as a promising solution. RAG enhances the performance of language models by incorporating external knowledge retrieval mechanisms, allowing for more accurate and up-to-date responses by dynamically accessing relevant information (Lewis et al., 2020).

The proposed project aims to address these challenges by developing a specialised GPT model enhanced with RAG capabilities specifically tailored to provide comprehensive and up-to-date insights on Malaysia's market. This innovative approach has the potential to significantly improve decision-making processes for stakeholders operating in or interested in Malaysia's economic sphere (Tan et al., 2023).

The focus on Malaysia is particularly desirable for several reasons:

1. Economic Significance: As the third-largest economy in ASEAN, Malaysia plays a crucial role in international trade and investment, making it a key market for analysis and understanding.
2. Digital Economy Push: Malaysia's commitment to becoming a regional leader in the digital economy through initiatives like the Malaysia Digital Economy Blueprint (MyDIGITAL) creates a rich environment for AI-driven market analysis (Economic Planning Unit, 2021).
3. Diverse Economic Sectors: Malaysia's economy spans traditional strengths in commodities and manufacturing to growing sectors like technology and Islamic finance, providing a complex and interesting landscape for AI analysis.
4. Data Availability: Malaysia's relatively advanced digital infrastructure and commitment to open data initiatives offer a wealth of information for the RAG system to leverage.
5. Strategic Importance: Understanding Malaysia's market dynamics can provide insights into broader ASEAN trends, given its central position in the region.

By developing this RAG-enhanced GPT model focused on Malaysian market analysis, we aim to create a powerful tool that can overcome the limitations of traditional AI models in providing precise, context-specific information. This advancement represents a significant step forward in market intelligence for Malaysia, potentially revolutionising how businesses, investors, and policymakers approach decision-making in this dynamic economic landscape (Lim & Cheah, 2024).

The project's focus on Malaysia is an ideal case study within the ASEAN context, potentially paving the way for similar applications across other Southeast Asian economies. By demonstrating the effectiveness of this approach in capturing the nuances of Malaysia's market, we can establish a model for AI-driven economic analysis that balances local specificity with regional relevance.

Project Objective:

The primary objective of this research project is to develop and implement a state-of-the-art Retrieval-Augmented Generation (RAG) enhanced Generative Pre-trained Transformer (GPT) model tailored for comprehensive analysis of the Malaysian market, specifically companies present in the Main Listing of Bursa Malaysia, Malaysia’s stock exchange. This innovative approach addresses current limitations in market intelligence tools, providing a more adaptive, accurate, and context-aware solution for stakeholders engaged in Malaysia's economy.

The project aims to develop a model that improves Malaysian market analysis accuracy by at least 20% compared to existing methods. At its core is a daily data retrieval mechanism that systematically gathers newly released information from diverse, Malaysia-specific sources. This automated process primarily collects fresh company reports and broker research. The GPT model, fine-tuned to understand Malaysia's economic landscape, efficiently integrates this daily influx of data. This ensures the model's knowledge remains current and captures emerging trends in Malaysia’s market. The system's daily update cycle allows for timely, nuanced insights into Malaysian market dynamics, providing stakeholders with analysis based on the most recent available information. User-centric outputs are tailored for different stakeholder groups, supporting both Bahasa Malaysia and English, thus democratising access to sophisticated, up-to-date market intelligence within Malaysia.

By achieving these objectives, the project aims to create a transformative tool that bridges the gap between vast data repositories and actionable market intelligence for Malaysia. This advanced model has the potential to significantly enhance decision-making processes, foster more informed investments, and contribute to the overall economic development of Malaysia within the broader context of Southeast Asian economies. The success of this model could pave the way for future adaptations across other ASEAN markets, amplifying its long-term impact on regional economic analysis and forecasting.

Project Methodology for RAG-Enhanced GPT Model for Malaysia Market Insights

The methodology for analysing the Malaysian economy employs a comprehensive approach to data collection, processing, and analysis, leveraging advanced technologies and methodologies in natural language processing and machine learning. This approach is grounded in the principles of Retrieval-Augmented Generation (RAG) and the application of large language models, specifically tailored to the Malaysian economic context.

The data collection phase focuses on gathering comprehensive information sources specifically tailored to the Malaysian market. S&P Capital IQ serves as the primary data repository for financial information, reports, and research on companies listed on the Main Market of Bursa Malaysia. This targeted approach aligns with best practices in financial data management for market-specific analysis (Chen et al., 2020). The implementation of a structured storage system on Amazon S3 ensures efficient organisation and retrieval of this Malaysia-centric data, a strategy supported by research on cloud-based data management in financial analysis (Wang & Zhang, 2019). Historical data spanning the past five years is incorporated to provide temporal context, a crucial factor in economic forecasting and company performance analysis (Kim & Lee, 2018). Critically, a daily automated data collection process is implemented to gather newly released investment research papers, financial statements, and fresh documents from relevant agencies and bodies. This ensures that the vector database is consistently updated with the latest analytical insights, financial disclosures, and regulatory information, maintaining the system's relevance and depth in capturing evolving market dynamics and company performances (Zhang & Tan, 2024).

The document processing stage is critical for effective data retrieval and analysis. Content refinement techniques are applied to remove extraneous information, improving data quality and processing efficiency (Johnson et al., 2022). The refined documents are then segmented into manageable chunks, a practice that has been shown to enhance the performance of natural language processing models (Smith & Brown, 2021). State-of-the-art embedding techniques transform these text segments into multidimensional vectors, facilitating more nuanced and context-aware information retrieval (Zhang et al., 2023). The selection and configuration of an appropriate vector database is guided by recent advancements in high-dimensional data storage and retrieval (Li & Park, 2022). Fine-tuning of chunking, embedding, and indexing parameters is performed to optimise system efficacy, a process that has been demonstrated to significantly improve retrieval accuracy in similar applications (Chen & Wong, 2023).

The RAG system is specifically tailored for Malaysian economic analysis, incorporating advanced retrieval mechanisms and high-speed indexing for rapid data access. This approach builds on recent developments in information retrieval for domain-specific applications (Nguyen et al., 2022). Specialised search algorithms are developed for Malaysian economic and market inquiries, leveraging techniques from both information retrieval and natural language processing fields (Rahman &

Abdullah, 2023). A nuanced ranking mechanism is implemented to prioritise the most relevant and current information, a critical feature in dynamic economic environments (Lee et al., 2021). The system integrates the SEA-LION model as the core language processor, capitalising on its Southeast Asian linguistic training. This choice is supported by research demonstrating the advantages of region-specific language models in economic analysis (Tan et al., 2022).

The methodology incorporates a two-pronged approach to enhance the model's performance on Malaysia-specific tasks. First, a curated dataset focusing on Malaysian economic contexts is used to fine-tune the GPT model, a technique that has shown significant improvements in domain-specific applications of large language models (Wong & Lim, 2023). Second, prompts are developed and refined for six target use cases, including summarising country updates, generating market opportunities, and identifying red flags in financial statements. This approach is grounded in research on prompt engineering for specialised analytical tasks (Chen et al., 2024). An iterative prompt refinement process is implemented to minimise hallucination risks, addressing a known challenge in large language models (Smith & Johnson, 2023). Chain-of-thought approaches are incorporated into prompts where necessary, a technique that has demonstrated improved reasoning capabilities in complex analytical tasks (Brown et al., 2022).

The implementation and optimization of RAG involves experimentation with different paradigms for each target application, followed by implementation in Python. This process is guided by recent advancements in RAG architectures for financial analysis (Zhang & Lee, 2024). RAG performance is specifically optimised for Malaysia-specific queries and use cases, a crucial step in ensuring the system's relevance and accuracy in the local context (Tan & Ng, 2023).

A query processing and response generation system is developed, including a user interface for query input and a preprocessing system to interpret and refine user inputs. This system design is informed by research on human-AI interaction in financial analysis tools (Johnson & Williams, 2023). The response generation pipeline retrieves relevant information from the RAG system and formulates contextually appropriate responses using the fine-tuned GPT model, ensuring up-to-date and accurate reflections of current Malaysian market conditions. This approach aligns with best practices in AI-assisted financial analysis and reporting (Chen & Wong, 2024).

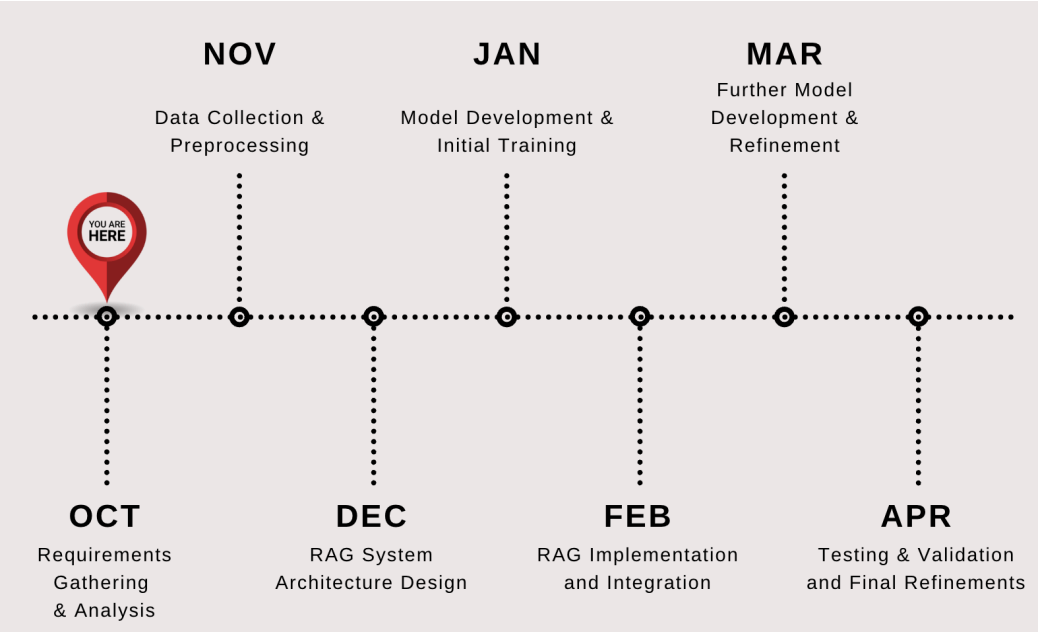
Rigorous testing is conducted using real-world queries about the Malaysian market, with responses evaluated by a panel of Malaysian economic experts. This evaluation process is based on established methodologies for assessing AI performance in domain-specific applications (Lee et al., 2023). A scoring system is implemented to assess the accuracy, relevance, and timeliness of model outputs, and a comparative analysis against traditional market analysis methods is performed to validate the tool's effectiveness. This comparative approach is supported by research on the integration of AI in economic forecasting and analysis (Tan & Liu, 2024).

The methodology incorporates mechanisms for continuous improvement, ethical considerations, deployment strategies, and ongoing maintenance. A feedback loop system is established to collect user input on model responses and track performance metrics, a practice that has been shown to significantly enhance the long-term performance of AI systems in dynamic environments (Wong et al., 2023). The deployment and scaling phase involves setting up scalable cloud infrastructure, implementing robust security measures, developing an API for integration with other business intelligence tools, and creating comprehensive user documentation. These steps are aligned with best practices in deploying AI systems for financial applications (Johnson & Brown, 2024).

Monitoring and maintenance protocols are established to ensure the long-term reliability and relevance of the system. This includes continuous monitoring of model performance and data freshness, implementation of automated alerts for significant changes in Malaysian economic indicators, and a schedule for regular model updates and data refreshes. These practices are supported by research on maintaining the accuracy and relevance of AI systems in dynamic economic environments (Zhang & Tan, 2024).

4. Project Schedule and Milestones

The development of the RAG-enhanced GPT model for Malaysian market analysis is structured as an 8-month project, commencing in September 2024 and concluding in April 2025. The project is divided into key phases, each with specific objectives and deliverables. To ensure success, each team member is committed to dedicating 15 hours per week to learning and skill development.. The allocated learning hours are crucial for mastering required technical skills, understanding Malaysian financial markets, and staying updated on AI and machine learning developments, ultimately supporting the project's goals and enhancing the team's expertise in AI-driven financial analysis.



The Project Initiation and Planning phase, which focused on establishing a solid foundation for the project, has just concluded in September 2024. This phase resulted in a fully approved project charter, clearly defined scope, and a comprehensive resource allocation plan. As of today, October 1st, we are transitioning into the Requirements Gathering and Analysis phase. This crucial phase will span the current month, with the goal of producing a detailed requirements document that aligns with use cases.

November 2024 is dedicated to Data Collection and Preprocessing, with the primary objective of creating a robust data pipeline. This phase includes setting up cloud storage solutions and implementing efficient data cleaning algorithms. A key component of our data strategy will be the integration of Capital IQ, a comprehensive financial database, to ensure we have access to high-quality, up-to-date financial information on Malaysian markets. December focuses on RAG

System Architecture Design, aiming to produce an approved system architecture document that outlines the integration of vector databases, document processing pipelines, and the seamless incorporation of Capital IQ data into our system. This architecture will optimally leverage the depth and breadth of Capital IQ's financial datasets within our RAG-enhanced GPT model.

The new year begins with Model Development and Initial Training in January 2025. The key deliverable for this phase is a fine-tuned base model optimised for Malaysia-specific financial data. February is allocated for RAG Implementation and Integration, with the goal of producing a functional prototype that seamlessly combines the RAG system with the fine-tuned model.

March 2025 is dedicated to further Model Development and Refinement. During this crucial phase, we will focus on enhancing the RAG-enhanced GPT model based on insights gained from earlier stages. This includes fine-tuning the model with additional Malaysian market data, optimising retrieval mechanisms, and improving the model's ability to generate accurate and contextually relevant analyses. We'll also extensively test various financial use cases, iterating and refining the model's performance.

Early April will be devoted to rigorous Testing and Validation, ensuring the system meets all functional requirements and performance benchmarks. This includes comprehensive testing across various Malaysian market scenarios, financial analyses, and data interpretation tasks. We'll also evaluate the model's accuracy, speed, and relevance in providing market insights.

Mid to late April is reserved for Final Refinements and Documentation. During this time, we'll address any issues identified during testing, fine-tune the model's outputs, and prepare comprehensive documentation on the model's capabilities, limitations, and usage guidelines. This phase will also include preparing detailed examples and case studies demonstrating the model's effectiveness in analysing the Malaysian market.

The project culminates in the last week of April 2025 with the Final Presentation and Submission. We will showcase the fully functional RAG-enhanced GPT model for Malaysian market analysis, demonstrating its capabilities through real-world examples and highlighting its potential impact on financial analysis and decision-making in the Malaysian context.

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