**A Homogeneous LLM Network with Dynamic Attention for Hierarchical Task Decomposition**

*A Project proposal submitted towards the fulfillment of the requirement.*

**Bachelor of Technology** *In* **Computer Engineering**

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## Introduction

The real estate industry generates and maintains an enormous amount of data, particularly legal documents, contracts, and agreements that are critical to its operations. The complexity and volume of these documents often make information retrieval challenging and inefficient. To address this issue, the proposed project aims to design and implement a customizable chatbot powered by Large Language Models (LLMs) to facilitate efficient and accurate information retrieval from real estate-related documents.

## Objectives of the Project

The primary objectives are as follows:

1. Design and develop a customizable chatbot interface for interacting with real estate documents

1. Implement advanced techniques like semantic embedding, vector indexing, and retrieval augmented generation (RAG) using state-of-the-art LLMs (Google Gemini Pro).

1. Enhance information retrieval efficiency by combining semantic search (Sentence Transformers

and FAISS) and traditional keyword-based retrieval (TF-IDF).

1. Evaluate the chatbot's effectiveness and accuracy in responding to domain-specific queries, ensuring it only answers within the scope of provided documents.

1. Highlight ethical considerations and outline limitations associated with deploying such chatbots in

legal contexts.

## Feasibility Study

A preliminary study has been conducted considering the required data sources, computational resources, and software tools. Necessary resources include:

* Access to representative real estate documents.
* Computational resources for embeddings and vector indexing.
* Appropriate software such as Streamlit for user interface development, PyMuPDF for document processing, and FAISS for efficient semantic searching.
* Domain-specific knowledge for evaluating chatbot accuracy and effectiveness.

The project is feasible considering existing computational resources, software tools availability, and the team’s expertise in Natural Language Processing and Machine Learning.

## Methodology

The project methodology includes the following phases:

1. Data Collection & Preprocessing:
   1. Collection of relevant real estate legal documents.
   2. Text extraction from documents using PyMuPDF.
   3. Data cleaning, normalization, and chunking for embedding preparation.

1. Semantic Embedding & Indexing:
   1. Utilize Sentence Transformer models to generate embeddings.
   2. Use FAISS (Facebook AI Similarity Search) for indexing and efficient retrieval of embeddings.

1. Retrieval-Augmented Generation (RAG):
   1. Implement semantic search using cosine similarity.
   2. Execute keyword-based retrieval using TF-IDF.
   3. Combine retrieval methods for accurate contextual information selection.

1. LLM Integration & Chatbot Interface:
   1. Integrate Google Gemini Pro for answer generation within a structured prompt-based approach.
   2. Develop a user-friendly Streamlit-based web interface for chatbot interactions.

1. Testing & Evaluation:
   1. Perform tests using real-world legal queries to validate chatbot accuracy.
   2. Evaluate chatbot’s capability to refuse out-of-scope questions, minimizing hallucination risks.

**Facilities Required:**

* High-capacity computational resources (GPU or cloud services).
* Access to necessary software and programming libraries (Python, Streamlit, PyMuPDF, FAISS).
* Adequate storage and processing capabilities for large document sets.
* Domain expertise in real estate laws and chatbot systems.

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