**Fact-Checking Health Claims Using Transformers and RAG Techniques**

**Abstract:**

The proliferation of medical misinformation on digital platforms, particularly social media, has emerged as a significant public health concern. The ability to accurately verify information presented on such platforms is critical to preventing the spread of false or misleading health-related content. This project aims to develop an advanced system that leverages state-of-the-art natural language processing (NLP) techniques, specifically the BioBERT model, to verify medical claims through evidence-based fact-checking. The system begins by accepting user-provided textual input, which may contain medical terms or health-related claims. Using BioBERT, the system performs Named Entity Recognition (NER) to extract relevant medical entities, such as diseases, symptoms, treatments, and pharmaceutical products, from the input text.

Once the entities are identified, the system employs Retrieval-Augmented Generation (RAG) techniques to query multiple authoritative medical databases, including PubMed, the World Health Organization (WHO), and the Unified Medical Language System (UMLS). These databases provide reliable, up-to-date, and peer-reviewed medical information, allowing the system to cross-check the claims made in the input data. The RAG model retrieves evidence from these sources and assesses the factual accuracy of the extracted entities by comparing the retrieved data against the original claims.

For claims where insufficient evidence is available, the system integrates a Large Language Model (LLM) to generate context-aware suggestions or alternative perspectives. For instance, the LLM may provide insights into ongoing medical research, alternative treatments, or potential explanations for the lack of corroborative evidence. This additional capability ensures that users receive constructive feedback even when claims cannot be definitively validated.

The system’s output is presented in a clear and user-friendly manner, categorizing the content into three possible outcomes: "Factual," indicating that the claim is supported by reliable evidence; "False," when the claim contradicts authoritative sources; and "Insufficient Evidence," when the claim lacks sufficient corroborative data or is not addressed in the databases. By integrating the BioBERT model for accurate medical entity extraction, RAG for querying multiple sources, and LLMs for generating informed suggestions, this system offers a robust solution for fact-checking health content.

This project addresses a growing need for reliable tools to combat medical misinformation, ensuring that users can make informed decisions based on evidence-backed information. It not only enhances the credibility of online health content but also contributes to broader efforts to improve public health literacy and reduce the impact of false medical claims in digital media.