**AI-Powered Clinical Decision Support System Using Retrieval-Augmented Generation (RAG)**

# Project Overview

**AI-powered clinical Decision Support System Using Retrieval-Augmented Generation (CDSSRAG)** can serve as an intermediary for patient queries to create a healthcare chatbot that can answer questions or suggest a diagnosis, offering accessible information on symptoms, medications, and treatment options sourced from a database of medical knowledge. This can improve patient engagement and enhance the decisions made by the health professionals.

**Specific Goal of the Project**

This project aims to develop an AI-powered Clinical Decision Support System (CDSS) using Retrieval- Augmented Generation (RAG) to assist doctors and healthcare professionals in making accurate, evidence-based medical decisions. The system will:

* + Retrieve relevant responses that answer clinical queries from the annotated medical Textbooks,
  + Generate reliable, context-aware clinical recommendations based on up-to-date medical knowledge.
  + Reduce misdiagnoses and improve patient outcomes by providing real-time, evidence-based answers tailored to clinical decision support.

# Relevance to Sustainable Development Goals (SDGs):

This project aligns with the United Nations Sustainable Development Goals (SDGs), particularly **SDG 3 (Good Health and Well-being),** also contributes to **SDG 4 (Quality Education):** By providing AI-driven medical insights for continuous learning and **SDG 1 (No Poverty):** By optimizing healthcare efficiency and reducing costs associated with incorrect treatments.

# Literature Examples:

**MedRAG** enhances clinical decision support by integrating a hierarchical diagnostic knowledge graph with retrieval-augmented generation, improving diagnostic accuracy by dynamically incorporating relevant electronic health records (EHRs) and reducing misdiagnosis rates (arxiv.org). Similarly, **ClinicalRAG** addresses hallucinations in large language models (LLMs) by retrieving heterogeneous medical knowledge, ensuring more reliable and contextually accurate clinical recommendations. By extracting key medical entities and incorporating relevant knowledge during text generation, ClinicalRAG outperforms traditional models in providing trustworthy decision support for healthcare professionals (aclanthology.org). Both projects highlight the transformative potential of RAG-based models in improving diagnostic precision and mitigating misinformation in healthcare applications.

# Describe Your Data:

The primary data for the project will be derived from 17 annotated medical textbooks. Each textbook provides foundational knowledge across various medical disciplines. These data will ensure that the CDSS can effectively retrieve and generate accurate clinical recommendations based on comprehensive and reliable medical information.

1. **Approach (Machine Learning or Deep Learning):**

For this project, a deep learning approach will be used, specifically a Retrieval-Augmented It combines two primary components:

**Retrieval Component:**

Uses a retrieval model (often based on neural networks) to fetch relevant documents or excerpts from a knowledge base. This model is typically trained on text data to understand the context of queries.

**Generation Component:**

Utilizes a generative model (like a transformer) to produce responses based on the information retrieved. This model generates text that is contextually relevant, leveraging the retrieved content to enhance the quality of its output.