Project Proposal

Title

DeepMed: Multi-Model Comparative Analysis and Evaluation of Advanced Deep Learning Techniques for Medical Diagnosis and Research.

1. Introduction

Artificial Intelligence (AI) is increasingly transforming the healthcare sector, with Deep Learning (DL) emerging as the dominant approach for medical data analysis. Numerous research groups have proposed deep learning–based models for disease diagnosis, including cancer, tumors, Alzheimer's disease, and others. These models employ advanced architectures such as Convolutional Neural Networks (CNNs) for medical imaging, Recurrent Neural Networks (RNNs) and Transformers for sequential and textual patient data, and hybrid approaches for multi-modal learning.

However, these models are often scattered across different research papers, repositories, and institutions, making it difficult for practitioners, researchers, and students to explore, compare, and evaluate them.

This project proposes the development of a web and mobile application that integrates existing pre-trained deep learning models in a unified platform. The system will provide categorized access to medical models (e.g., cancer, tumor, Alzheimer's), enable users to input medical data (e.g., MRI images, handwritten patient data), and return predictions from multiple models simultaneously. Additionally, the platform will provide links to the original research papers for academic reference and ensure transparency in evaluation.

2. Objectives

The main objectives of this project are:

1. To collect, organize, and deploy pre-trained machine learning models from different medical domains such as cancer detection, tumor classification, and Alzheimer's diagnosis.
2. To design a web and mobile application where users can upload input data (MRI images, tabular data, handwritten data, etc.) for evaluation.
3. To enable comparative analysis by running multiple models on the same input and generating a combined summary (e.g., "8 out of 10 models predicted positive").
4. To provide easy access to related research papers and citations for each model.
5. To contact research authors, with permission, for acquiring and deploying their models responsibly.

3. Scope of the Project

- **Domain Coverage**:
  - Medical → subdivided into:
    - Cancer Models
    - Tumor Models
    - Alzheimer's Models (both MRI-based and data-based)
    - (Expandable to other diseases in future)
- **User Interaction**:
  - Upload medical data (image or structured input).
  - Get predictions from all relevant models in that category.
  - View a combined aggregated prediction result.
  - Access original research papers through direct links.
- **Example Use Case**:
  - A user selects (Alzheimer's → MRI models)
  - Uploads an MRI scan.
  - The system runs the scan across all Alzheimer's MRI models.
  - Displays individual predictions of each model.
  - Provides an aggregated result (e.g., "Positive: 8 models, Negative: 2 models").
  - Displays links to all related research papers.

4. Methodology

1. **Model Collection & Permissions**
    - Identify relevant research papers in top medical AI domains.
    - Contact authors to obtain pre-trained models (with consent).
    - Maintain links to each paper for reference.
2. **Backend Development**
    - Deploy models in a centralized server environment.
    - Build APIs to handle input (MRI, text, tabular data) and return predictions.
3. **Frontend Development**
    - **Web Application**: User-friendly interface for desktop use.
    - **Mobile Application**: Android/iOS app for portable use.
4. **Model Comparison & Aggregation**
    - Design a system to run multiple models concurrently.
    - Implement aggregation logic (majority voting, weighted results).
5. **Database & Documentation**
    - Store metadata of each model (name, paper link, author, accuracy, input type).
    - Maintain an organized library for future expansion.

5. Expected Outcomes

1. A working prototype of a web and mobile application integrating multiple medical ML models.
2. A structured database of models, categorized by domain and input type.
3. Comparative prediction results for user inputs.
4. Access to original research papers through linked references.
5. Potential future extensions to include more diseases and research domains.

6. Tools and Technologies

- **Programming Languages**: HTML, CSS, Python, JavaScript, Dart/Flutter
- **Frameworks**: Django/Flask (backend), Flutter (frontend)
- **Machine Learning**: TensorFlow, PyTorch, ONNX Runtime
- **Databases**: PostgreSQL, Firebase, Supabase
- **Deployment**: Cloud servers (AWS/GCP/Azure)

7. Significance

This project will serve as a bridge between research and practice by making scattered medical ML models accessible in one platform. It will help:

- Students and researchers test models without complex setup.
- Medical practitioners explore AI models with transparency.
- Academics by providing quick access to research papers and reproducibility.

9. Conclusion

This project aims to provide an innovative and practical platform for organizing and testing existing machine learning models in the medical domain. By combining web and mobile accessibility, integrated predictions, and links to academic resources, the project will contribute to research accessibility, model transparency, and medical AI awareness.

We, MD Walid Waccub Swadhin and MD Hirok Reza, request approval to carry out this project under the supervision of our respected teacher.