Proposal for Tech Stack & Solution

Technology Stack and Solution Proposal

Technical Approach and Model Architecture

Our group’s project involves developing an AI-driven chest X-ray report automatic generation system, combining advanced machine learning and deep learning techniques. The solution consists of multiple core components:

Image Feature Extraction Module:

Uses a multimodal visual-language transformer model such as MedViLL or VisualBERT to extract visual features from chest X-ray images.

Alternatively, domain-specific encoders such as BioViL-T can be fine-tuned to improve performance.

Prompt Building Module:

Combines visual embeddings and findings from CheXpert tags to create structured prompts.

These prompts help generate radiology reports that meet clinical standards.

Report on Generation Model:

Uses a Large Language Model (LLM) fine-tuned on a radiology-specific dataset to generate coherent and accurate diagnostic reports.

Uses techniques such as domain adaptation to ensure that the report matches the radiologist’s writing style.

Interactive QA Model:

Integrates RaDialog, a radiology-specific question-answering model.

Allow radiologists to ask detailed questions about pathology or report sections.

Software and Tools

To implement the proposed solution, the team will use the following technologies:

PyTorch – Model training and development.

Hugging Face Transformers – Fine-tuning LLM.

scikit-learn – Evaluation and analysis.

NLTK and BERTScore – NLP tasks such as text similarity evaluation.

Streamlit – Model deployment and interactive interface.

OpenCV – X-ray image preprocessing.

Evaluation Metrics

To ensure clinical accuracy and language coherence, multiple evaluation techniques will be used:

Clinical Efficacy (CE) – Compares the generated pathology findings to the ground truth labels.

BERTScore (BS) – Measures the semantic similarity between the generated report and the actual report.

NLG Metrics (BLEU, ROUGE, METEOR) – Evaluate language accuracy and fluency.

Human Evaluation – Experts review the generated reports to ensure medical correctness.