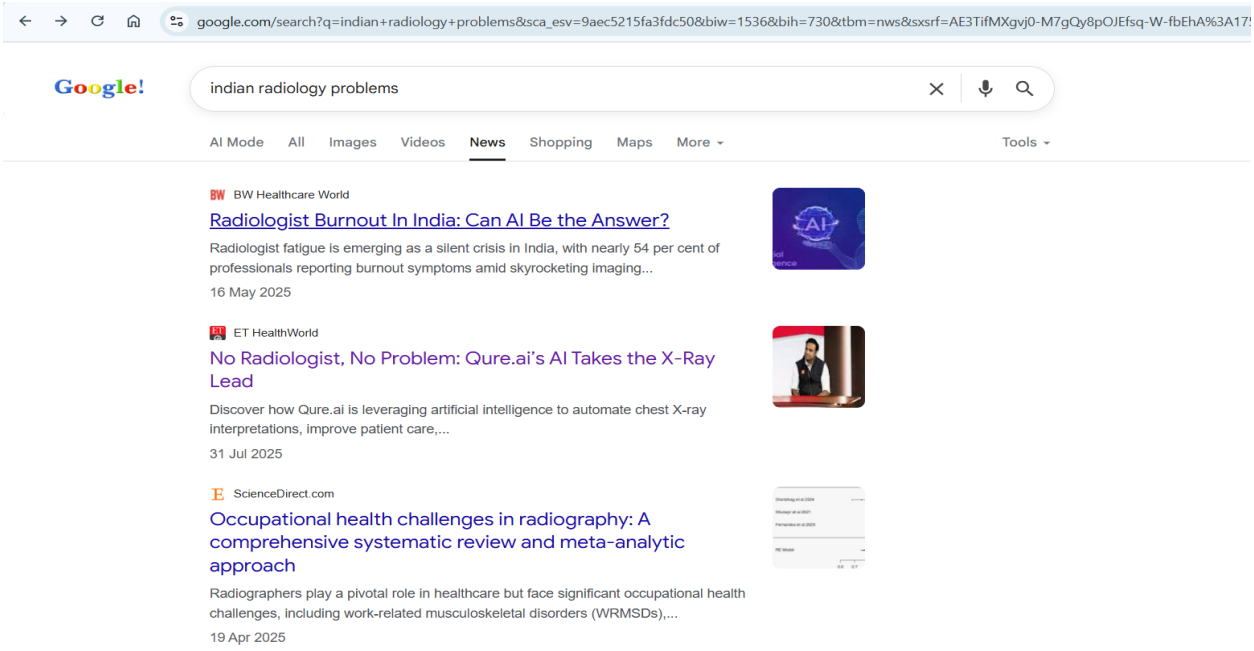
Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering and Technology** **Department of Information and Communication Technology**	
Subject: Capstone Project (01CT0715)	**Implementation- Continuous progress review**	
Implementation	**Date: 25/09/2025**	**Enrolment No: 92200133018**

MRI Impression Assistant

Introduction

Radiology is one of the most resource-intensive domains in healthcare, requiring high levels of expertise for interpreting complex imaging studies such as MRI scans.

In countries like India, there is a significant scarcity of radiologists, which often leads to reporting delays and diagnostic backlogs and also leads to mental health overload to radiologists. Artificial Intelligence (AI) offers promising solutions by supporting radiologists in the reporting process.



This project introduces an MRI Impression Assistant, an AI-powered tool that automatically generates concise impressions from MRI findings. The system is designed to reduce the workload of radiologists by providing a first draft impression using a fine-tuned BioBART model, followed by refinement with GPT.

This hybrid approach ensures both medical relevance and professional quality of the final report.

Novel Approach

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Radiologists face multiple challenges while drafting MRI reports:

- **High workload and fatigue**: A single radiologist may need to review hundreds of scans daily, leading to reporting delays and reduced consistency.
- **Scarcity of experts**: In India and many developing countries, there is a shortage of trained radiologists, especially in rural and semi-urban areas.
- **Repetitive nature of reporting**: Writing impressions often involves rephrasing similar patterns of findings, which consumes valuable time.
- **Human variability**: Two radiologists may word the same findings differently, leading to inconsistencies in reports.

This project addresses these challenges through a **two-layer AI pipeline**:

1. **Data Preprocessing and Filtering**
   - We sourced radiology notes from the MIMIC-IV dataset via PhysioNet.
   - Using Python scripts, we **filtered only MRI-related reports** and cleaned the findings to remove noise, headers, and unrelated clinical notes.
   - This preprocessing step ensured the model was trained on **domain-specific, high-quality input data** instead of mixed radiology content (like CT, X-ray, etc.).
2. **AI-Powered Draft Generation (BioBART Fine-Tuning)**
   - The filtered MRI dataset was used to fine-tune the **BioBART model**, which is specialized for biomedical text.
   - The fine-tuned model generates an **initial draft impression** from MRI findings, capturing the key diagnostic insights in a concise manner.
3. **Refinement with GPT**
   - Since raw AI outputs may miss nuances or lack clinical polish, the draft impression is passed through a GPT refinement stage.
   - GPT ensures **clarity, completeness, and standard radiology style** by cross-checking with the full findings text.

Comparison with Existing Solutions

Most current solutions for radiology reporting fall into three categories:

1. **PACS / RIS Systems (Hospital Software)**
   - These platforms mainly act as storage and workflow management tools.
   - They do not provide automated **impression drafting** — radiologists still manually write reports.
2. **Commercial AI Radiology Tools**
   - Some advanced platforms exist (mostly in the US/Europe), but they are **expensive, proprietary, and not tailored for MRI text reports**.
   - They also often focus more on **image analysis** (detecting lesions or tumors on scans) rather than **text-to-impression assistance**.

How our approach is different

- ✓ **MRI-Specific Dataset**: Unlike general AI tools, our system is trained only on MRI textual reports (preprocessed from MIMIC-IV), ensuring higher accuracy and relevance.
- ✓ **Dual-Layer AI**: Instead of depending on a single model, we combine a fine-tuned BioBART (for draft generation) with GPT refinement (for completeness + clinical style).
- ✓ **Validation Layer**: We added an **input validation step** using GPT to reject non-MRI or irrelevant text (e.g., random sentences like *"Rajnikant is a hero"*).
- ✓ **Lightweight & Accessible**: The solution runs efficiently on CPU and is integrated into a simple **Streamlit interface**—making it usable for hospitals in resource-constrained settings.
- ✓ **Focus on Time-Saving**: Unlike PACS which just organizes data, our tool directly reduces the **time spent on repetitive reporting tasks**.

Contribution to ICT Field

Our project contributes to the ICT domain in multiple meaningful ways:

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Healthcare + AI Integration

- Bridges the gap between clinical radiology and AI-driven automation.
- Instead of being a black-box, it allows human-in-the-loop reporting where the AI drafts and the radiologist validates.

Efficiency & Scalability

- Cuts down reporting time for radiologists by providing structured first-draft impressions.
- Especially valuable in India, where there is a shortage of radiologists, particularly in rural hospitals.
- A single radiologist can validate more reports in less time, improving patient care delivery.

Technical Innovation in ICT

- Demonstrates how domain-specific fine-tuning (BioBART on MRI reports) + general LLM refinement (GPT) can work together in a hybrid pipeline.
- Introduces an input validation mechanism using GPT, reducing risk of irrelevant or misleading outputs.
- Shows effective use of open-source NLP + cloud AI integration within a simple Streamlit-based deployment.

Broader ICT Impact

- Encourages low-cost, accessible AI tools in healthcare ICT, reducing dependency on costly proprietary platforms.
- Sets a precedent for future ICT projects that combine open-source, clinical datasets, and cloud-based LLMs for solving real-world problems.
- The same architecture can be extended to other medical domains (CT scans, X-rays, pathology reports), enabling cross-domain scalability.

The MRI Impression Assistant is successfully deployed and publicly accessible.

- Live URL: https://huggingface.co/spaces/Vrajk/mri