
 Marwadi University Marwadi Chandarana Group	 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 Generation

Introduction

The project focuses on developing an assistive tool that supports doctors as well as radiologists in generating consistent and time-efficient MRI impressions. The system is not meant to replace medical expertise but to act as a supportive layer that reduces repetitive work and ensures accuracy.

Implementation

The project was built with a focus on **clean, easy-to-understand code**, a **modular structure**, and **smooth performance** so that it fully supports the goals of the MRI impression assistant.



1. Code Quality

The code is written in a **clear and consistent style**. Functions have meaningful names, comments are added wherever logic might be complex, and sensitive keys are kept safe using environment variables instead of being hardcoded. A requirements.txt file is included so that the setup can be easily reproduced, and the project is version-controlled using Git.

```

app5.py > ...
83 def enhance_with_gpt(raw_impression: str, original_findings: str):
107
108     **FINAL IMPRESSION:**
109     """
110     response = client.chat.completions.create(
111         model=AZURE_OPENAI_DEPLOYMENT_NAME,
112         messages=[{"role": "user", "content": prompt}],
113         temperature=0.2,
114         max_tokens=300
115     )
116     return response.choices[0].message.content.strip()
117
118 def extract_findings_from_pdf(pdf_file):
119     with tempfile.NamedTemporaryFile(delete=False, suffix=".pdf") as tmp_file:
120         tmp_file.write(pdf_file.getvalue())
121         tmp_path = tmp_file.name
122         elements = partition_pdf(filename=tmp_path)
123         os.remove(tmp_path)
124         full_text = "\n".join([el.text for el in elements if el.text])
125         impression_keywords = ["Impression", "IMPRESSION"]
126         findings_start_patterns = ["SEQUENCES:", "HISTORY:", "FINDINGS:"]
127         start_idx = 0
128         for pat in findings_start_patterns:
129             idx = full_text.find(pat)
130             if idx != -1:
131                 start_idx = idx + len(pat)
132                 break
133         end_idx = len(full_text)
134         for kw in impression_keywords:
135             idx = full_text.find(kw)
136             if idx != -1:
137                 end_idx = min(end_idx, idx)
138         findings_text = full_text[start_idx:end_idx].strip()
139         return re.sub(r"(\n\s*)+\n+", "\n", findings_text).strip()

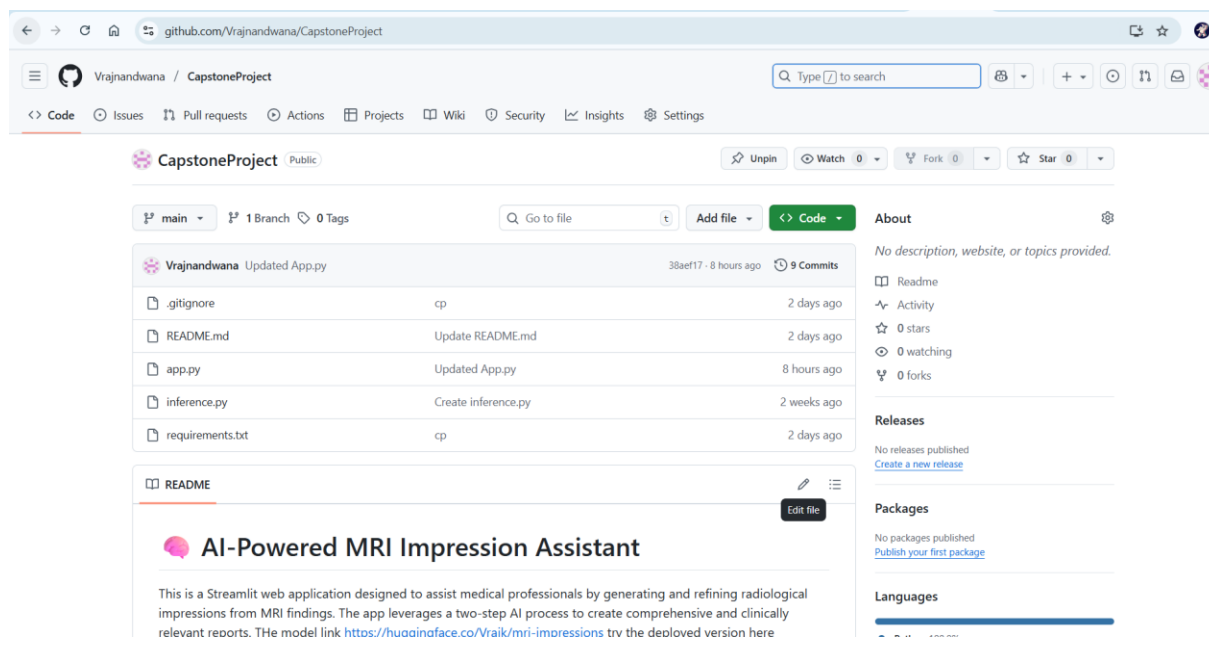
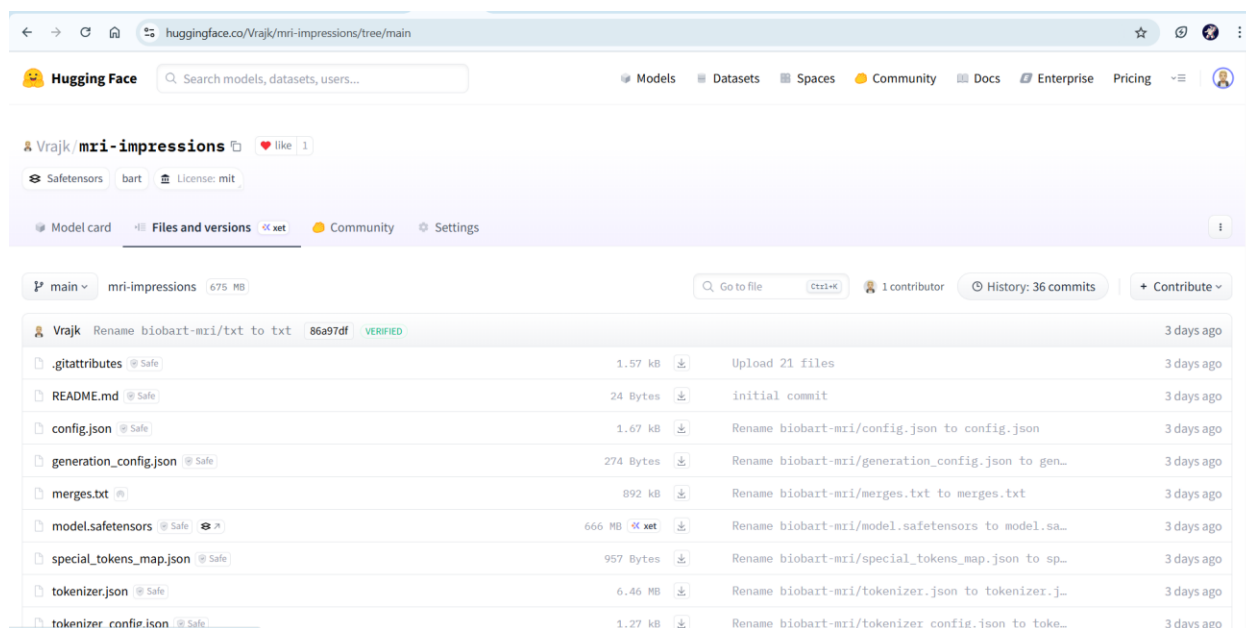
```



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Sample output :

Check on github link: <https://github.com/Vrajnandwana/CapstoneProject/blob/main/app.py>

<https://huggingface.co/spaces/Vrajk>



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2. Modular Design

The system is broken down into **separate modules**, each handling a specific part of the workflow:

- **Input Handling** – allows users to provide MRI findings either by typing text or uploading PDFs which are related to MRI only as it will not take the reports that are non mri , any other domain reportor any person who is just taking .

>  Know About MRI

 **Input**
 Raw Impression
 Enhanced Impression




Input MRI Findings

 Follow the steps below to generate a report.


Choose Your Input Method

☒ Text Input
 ☐ PDF Upload

Provide the Findings

 **Input**
 Raw Impression
 Enhanced Impression

Input MRI Findings


 Follow the steps below to generate a report.

Choose Your Input Method

☐ Text Input
 ☒ PDF Upload

Provide the Findings



Upload an MRI Report PDF


 Drag and drop file here
 Limit 200MB per file • PDF

Browse files

Generate the Report

Generate Impressions

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Provide the Findings

Upload an MRI Report PDF



Drag and drop file here
Limit 200MB per file • PDF

Browse files



MRI LS.pdf 152.5KB



✓ Findings extracted from PDF

Edit or Add to the Extracted Findings:

Postoperative findings of posterior intrapedicular spinal fusion at L2-L3 noted. The L2-L3 disk is preserved. Enhancing peridural fibrosis noted at L2-L3 level mildly deforming the thecal sac with dominant extrinsic impression on the right lateral thecal sac. Non enhancing cystic foci noted along the posterior elements representing small pseudomeningoceles. Postoperative fusion and laminectomy noted at L4-L5 level with osseous fusion anteriorly. Osseous hypertrophy of the posterior elements noted at L4 and L5. Lumbar lordosis is decreased. Multilevel endplate, disk and facet degenerative changes noted. Conus medullaris terminates at approximately mid L1 vertebral body level. L1-L2 shows moderate broad-based disc bulging contributing to mild to moderate left greater than right neuroforamina narrowing. Spinal canal is grossly patent. Approximately 2 mm L1 on L2 retrolisthesis noted. L2-L3 shows moderate nonenhancing bi foraminal broad-based disk bulging contributing to mild-to- moderate right greater than left neural foramina narrowing. Moderate acquired spinal canal stenosis noted due to enhancing peridural fibrosis with asymmetric more focal extrinsic impression on the right lateral ventral thecal sac. Negligible spondylolisthesis of L2 on L3 noted. L3-L4 level shows mild disk desiccation and height loss. Extraforaminal focal annular tears noted on both sides. Spinal canal and foramina are patent.

Generate the Report



Generate Impressions

- **Model Inference** – uses the fine-tuned BioBART model to generate a first draft impression. The BioBART model is based on the **encoder-decoder (sequence-to-sequence)** architecture. It uses a Transformer backbone where:

The **encoder** reads the detailed MRI findings and captures the important clinical context.

The **decoder** then generates a concise impression, step by step, based on that context.


Since it is pre-trained on large biomedical text and later fine-tuned on **MRI-specific radiology reports**, the model learns both medical terminology and the style of radiology summaries. This makes it well-suited for transforming long, complex findings into short, meaningful impressions.


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>>


MRI Impression Assistant

>  Know About MRI

 Input
 • Raw Impression
• Enhanced Impression


Raw Impression From Findings


1. Postoperative findings of posterior intrapedicular spinal fusion at L2-L3 level with multilevel degenerative changes as described above. 2. No gross thecal sac deformity. 3. Postoperative changes at L4-L5 level with osseous fusion anteriorly. 4. L5-S1 level shows subtle left central broad-based disk protrusion. PREVALENCE: Prevalence of lumbar degenerative disk disease in subjects without low back pain: Overall evidence of disk degeneration 91% (decreased T2 signal, height loss, bulge) T2 signal loss 83% Disk height loss 58% Jarvik, et al. Spine ____ 26(10):11

>  About / Instructions

- **Ai Refinement** – improves the draft by cross-checking with the findings and producing a polished impression.


MRI Impression Assistant


>  Know About MRI

 Input
 • Raw Impression
• Enhanced Impression

Enhanced Impression (GPT)



1. Postoperative findings of posterior intrapedicular spinal fusion at L2-L3 level with enhancing peridural fibrosis mildly deforming the thecal sac, predominantly affecting the right lateral thecal sac, and moderate acquired spinal canal stenosis. 2. Postoperative changes at L4-L5 level with anterior osseous fusion, bilateral laminectomies, and osseous hypertrophy of the posterior elements. Spinal canal and foramina are patent at this level. 3. Multilevel degenerative changes, including: - L1-L2: Moderate broad-based disc bulging with mild-to-moderate left greater than right neuroforaminal narrowing and approximately 2 mm retrolisthesis of L1 on L2. - L2-L3: Moderate bi-foraminal broad-based disc bulging with mild-to-moderate right greater than left neuroforaminal narrowing and negligible spondylolisthesis of L2 on L3. - L3-L4: Mild disc desiccation and height loss with extraforaminal focal annular tears bilaterally. - L5-S1: Subtle left central broad-based disc protrusion. 4. Non-enhancing cystic foci along the posterior elements at L2-L3, representing small pseudomeningoceles. 5. Decreased lumbar lordosis with no suspicious prevertebral or posterior paraspinal soft tissue abnormalities

 Download Enhanced Impression

>  About / Instructions

- **User Interface** – built with Streamlit, giving a simple and interactive experience.

This separation makes the code easier to maintain, extend, and debug.

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3. Meeting Requirements

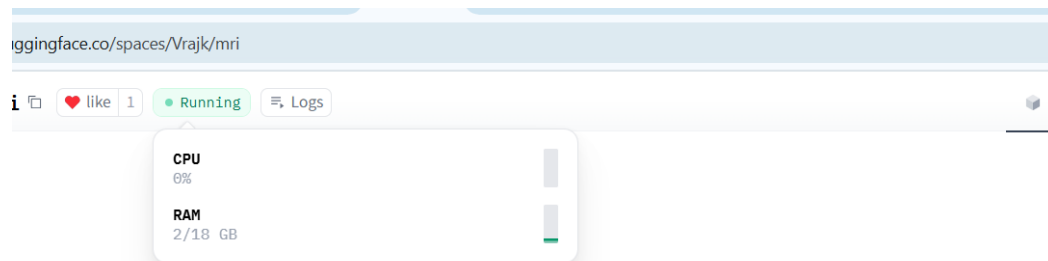
All the planned features are implemented:

- Users can input findings through text or PDFs.
- The system generates both a raw impression and an enhanced final version.
- The enhanced version can be downloaded as a text file.
- Settings like beam size and impression length can be customized from the sidebar.



Every requirement is fully covered, and the workflow is easy to follow for the end user.


4. Performance and Reliability




The system runs smoothly even on CPU. To avoid delays, the model is cached after the first load so it doesn't reload repeatedly. Input validation checks help ensure that only proper MRI findings are processed. Errors like missing files, invalid text, or API issues are handled gracefully with clear messages.




 **MRI Impression Assistant**

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Hugging Face

Spaces:

Vrajk/mri
 like 1
 Running
 Logs

Want to edit your Spaces's metadata? Head to the [README.md and metadata UI](#) instead.







Space Hardware ⓘ


Choose a hardware for your Space.
 You'll be billed on a per minute basis.
 View usage in your [billing settings](#).



CPU basic ✓




2 vCPU · 16 GB RAM


Current · Free



Hugging Face


 Models
  Datasets




Spaces:

Vrajk/mri
 like 1
 Running
 Logs




 main ▾




mri 13.3 kB





Vrajk Update src/app.py b4bd67d VERIFIED

 src

 .gitattributes  Safe 1.52 kB 

 Dockerfile  Safe 426 Bytes 



 README.md  Safe 369 Bytes 

 requirements.txt  Safe 340 Bytes 

5. Integration of Components

Each part of the pipeline connects seamlessly to the next:

1. Findings are given as input.
2. The text is validated.

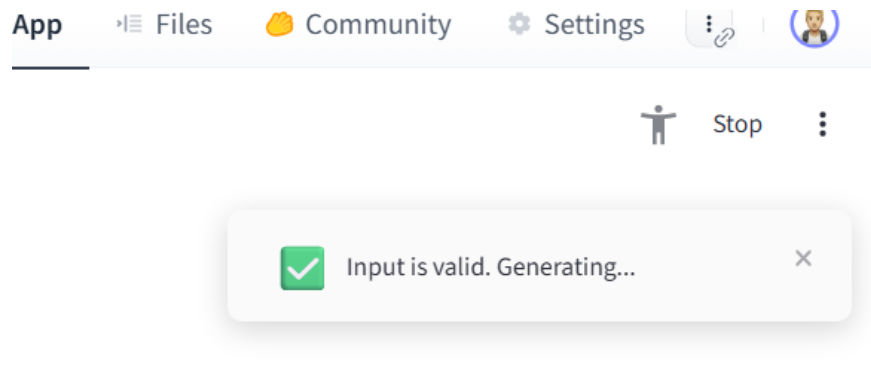
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3. Our fine tuned trained BioBART model generates the raw draft.
4. GPT refines it into a professional impression.
5. The result is displayed and can be downloaded.

The Streamlit interface keeps users informed through status messages, spinners, and notifications at each step.

6. Testing

Different parts of the system were tested separately (PDF extraction, input validation, impression generation). End-to-end tests were done by giving actual MRI text and checking the generated impressions. Edge cases like empty inputs or extra-long text were also tested to make sure the tool responds properly.





It only generates if input is valid

Generate the Report


Generate Impressions

- ☐ Validating input text...
- ☐ Enhancing impression with GPT...

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Then only you see a success message which means that a valid mri report is detected and the impressions are generated first in our model than with help of gpt its generated the missed impression.

MRI Impression Assistant

 Impressions generated successfully!
see the raw impressions

>  Know About MRI

 Input  Raw Impression  Enhanced Impression

Rajinikanth

 55 languages

Article Talk

Read View source View history Tools

From Wikipedia, the free encyclopedia



For his biography, see *Rajinikanth: The Definitive Biography*. For other uses, see *Rajini (disambiguation)*.

Not to be confused with *Shivajirao Gaekwad*.

Shivaji Rao Gaikwad^{[a][4]} (born 12 December 1950), known professionally as **Rajinikanth**,^[b] is an Indian actor who predominantly works in Tamil cinema.^[6] In a career spanning over five decades, he has done 170 films^[c] that includes films in Tamil, Hindi, Telugu, Kannada, Bangla, and Malayalam.^[7] He is widely regarded to be one of the most successful and popular actors in the history of Indian cinema.^{[8][9]} Known for his uniquely styled mannerism and one liners in films, he has a huge fan base and a cult following. The Government of India honoured him with the Padma Bhushan in 2000 and the Padma Vibhushan in 2016, India's third and second highest civilian honours respectively, and the Dadasaheb Phalke Award in 2019, the highest Indian award in the field of cinema, for his contributions to Indian cinema.^{[10][11]} He has won numerous film awards including one National Film Award, seven Tamil Nadu State Film Awards, a Nandi Award, one Filmfare Award and two Maharashtra State Film Awards.

Following his debut in K. Balachander's 1975 Tamil drama *Apoorva Raagangal*, Rajinikanth's acting career commenced with a brief phase of portraying antagonistic characters in Tamil films. His major positive role as a scorned lover in S. P. Muthuraman's *Rhuvana Oru Kelvi Kuri* (1977), 1978's *Mullum Malarnum* and *Aval*



Rajinikanth



Rajinikanth in 2019

Born

Shivaji Rao Gaikwad

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Choose Your Input Method

☒ Text Input
 ☐ PDF Upload

Provide the Findings

Paste MRI Findings Here:

Shivaji Rao Gaikwad[a][4] (born 12 December 1950), known professionally as Rajinikanth,[b] is an Indian actor who pre has done 170 films[c] that includes films in Tamil, Hindi, Telugu, Kannada, Bangla, and Malayalam.[7] He is widely rega cinema.[8][9] Known for his uniquely styled mannerism and one liners in films, he has a huge fan base and a cult follow the Padma Vibhushan in 2016, India's third and second highest civilian honours respectively, and the Dadasaheb Phal contributions to Indian cinema.[10][11] He has won numerous film awards including one National Film Award, seven T Maharashtra State Film Awards.

Generate the Report ↺

Generate Impressions

🚨 Validation Failed: The provided text does not appear to be MRI findings. Please provide a relevant medical report.

> [About / Instructions](#)

So this is a not valid as it says about Rajnikant out of context so the validation will invalidate it.

cinema.[8][9] Known for his uniquely styled mannerism and one liners in films, he has a huge fan base and a cult following. The Government of India hon the Padma Vibhushan in 2016, India's third and second highest civilian honours respectively, and the Dadasaheb Phalke Award in 2019, the highest Indian contributions to Indian cinema.[10][11] He has won numerous film awards including one National Film Award, seven Tamil Nadu State Film Awards, a Nai Maharashtra State Film Awards.

Generate the Report



Generate Impressions

🚨 Validation Failed: The provided text does not appear to be MRI findings. Please provide a relevant medical report.

Code Structure & Organization

The system is organized in a clean, modular way to make it easy to maintain, extend, and understand:

- **app.py** – Main Streamlit application that connects all components. Handles UI, user input, output display, and integration of modules.

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- **Environment Variables** – All sensitive keys (like Azure OpenAI API) are stored in a .env file to keep the system secure.
- **Model Loading & Caching** – The BioBART model is loaded and cached to prevent reloading for every request, improving performance.
- **Input Handling Module** – Handles text input and PDF extraction, validating that only MRI findings are processed.
- **Model Inference Module** – Uses the fine-tuned BioBART model to generate a raw draft impression.
- **AI Refinement Module** – Uses GPT via Azure OpenAI to enhance and polish the impression for clinical accuracy.
- **User Interface Module** – Streamlit UI handles tabs, sidebar settings (beam size, min/max length), status messages, and download functionality.

Instructions for Running the System

To set up and run the MRI Impression Assistant:

1. Clone the Repository



```
git clone https://github.com/Vrajnandwana/CapstoneProject.git
cd CapstoneProject
```

2. Create a Virtual Environment

```
python -m venv env
# Activate environment

# Windows
.\env\Scripts\activate

# macOS/Linux
source env/bin/activate
```

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3. Install Dependencies

`pip install -r requirements.txt`

4. Add Environment Variables

Create a .env file in the root folder with your Azure OpenAI credentials:

`AZURE_OPENAI_API_KEY="YOUR_KEY"`

`AZURE_OPENAI_ENDPOINT="YOUR_ENDPOINT"`

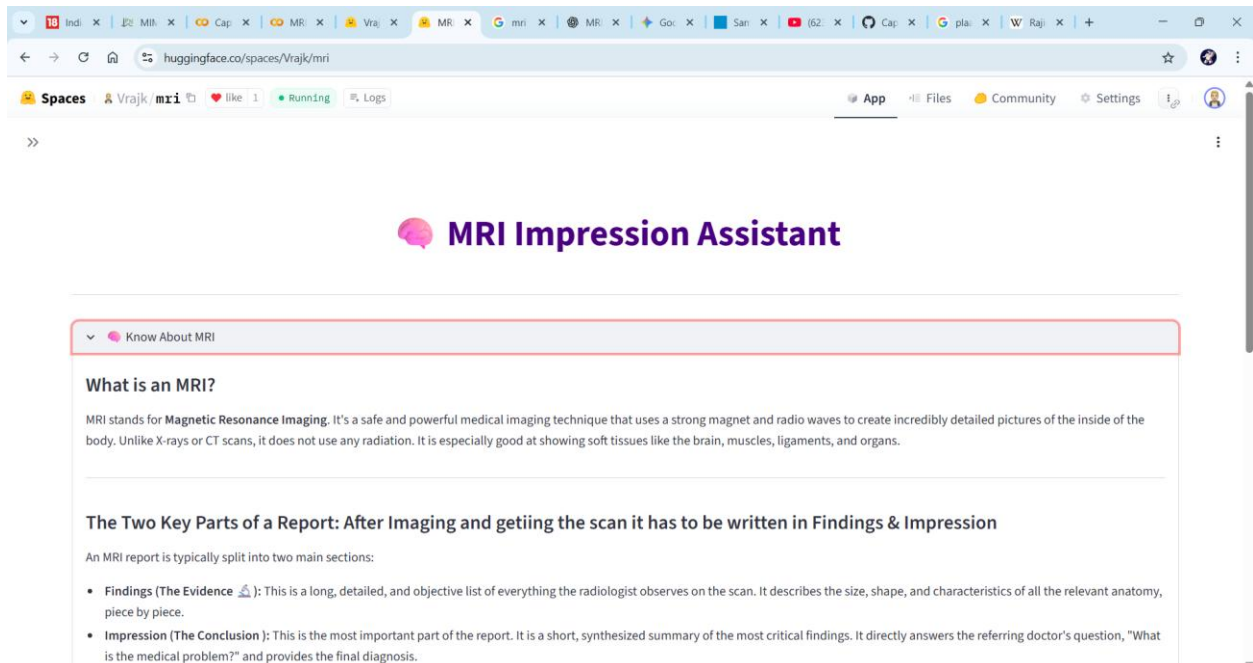
`AZURE_OPENAI_API_VERSION="2023-03-15-preview"`



`AZURE_OPENAI_DEPLOYMENT_NAME="YOUR_DEPLOYMENT"`

5. Run the App

`streamlit run app.py`

Screenshots



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huggingface.co/spaces/VrajK/mri

Follow the steps below to generate a report.

Choose Your Input Method

☒ Text Input
 ☐ PDF Upload

Provide the Findings

Paste MRI Findings Here:

C4/5 and C5/6. The facet joints are normal. There is no evidence of spinal canal or foraminal stenosis. The visualized spinal cord and posterior fossa are normal in signal and contour. There is no evidence of intra or extradural mass lesion.

There is a T2 and T1 hyperintense encapsulated mass in the left posterior cervical space, between the sternocleidomastoid muscle and left paraspinal muscles. The mass is posterior to the carotid space without appreciable mass effect in the carotid space. The mass measures approximately 4 x 1.3 x 6 cm in AP, lateral and craniocaudad dimensions respectively. The mass follows normal fat in signal intensity. This most likely represents an incidental lipoma. Consider further evaluation with contrast enhanced CT or MRI to exclude an en

Generate the Report

Generate Impressions

☐ Validating input text...
 ☐ Generating raw impression...

MRI Impression Assistant

>

Know About MRI

Input

Raw Impression

Enhanced Impression



Raw Impression From Findings

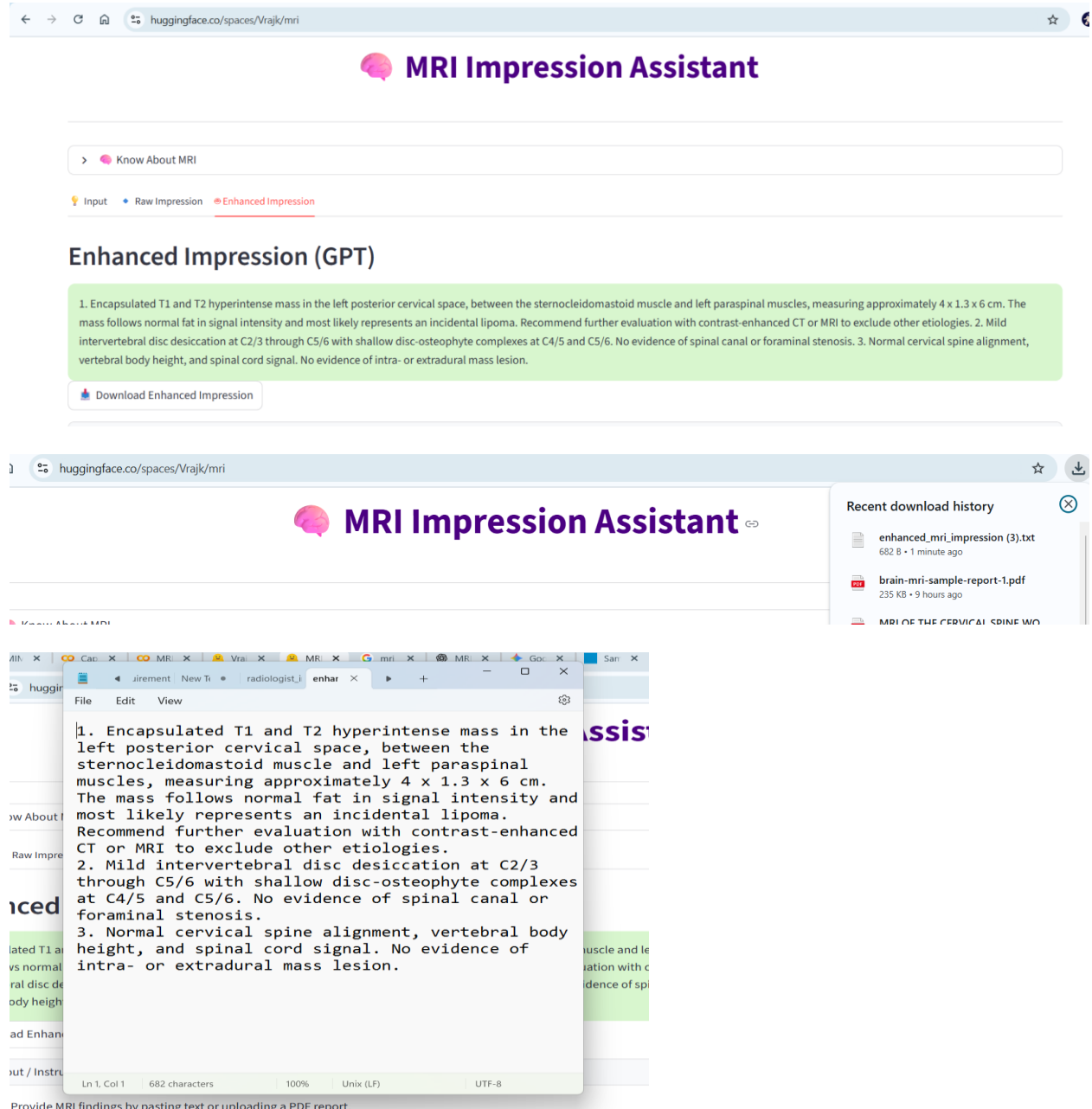
1. Encapsulated mass in the left posterior cervical space, between the sternocleidomastoid muscle and left paraspinal muscles without appreciable mass effect on the carotid space. This most likely represents an incidental lipoma. Consider further evaluation with contrast enhanced CT or MRI to exclude an enchondroma. 2. No evidence of spinal canal or foraminal stenosis.

NOTIFICATION: The impression and recommendation above was entered by Dr. ____ on ____ at 17:45 into the Department of Radiology critical communications system for direct communication to the referring provider.

About / Instructions

- Step 1:** Provide MRI findings by pasting text or uploading a PDF report.
- Step 2:** The app validates the input. If it's a valid report, our model model fine tuned on mimic 4 radiology mri textual clinical data with biobart model generates a raw impression draft.
- Step 3:** An expert AI (GPT) refines this generated impression draft using the original findings to create a complete, professional mri radiology report.
- Use the tabs to navigate between the different stages of the output.

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MRI Impression Assistant

> Know About MRI

Input • Raw Impression • **Enhanced Impression**

Enhanced Impression (GPT)

1. Encapsulated T1 and T2 hyperintense mass in the left posterior cervical space, between the sternocleidomastoid muscle and left paraspinal muscles, measuring approximately 4 x 1.3 x 6 cm. The mass follows normal fat in signal intensity and most likely represents an incidental lipoma. Recommend further evaluation with contrast-enhanced CT or MRI to exclude other etiologies. 2. Mild intervertebral disc desiccation at C2/3 through C5/6 with shallow disc-osteophyte complexes at C4/5 and C5/6. No evidence of spinal canal or foraminal stenosis. 3. Normal cervical spine alignment, vertebral body height, and spinal cord signal. No evidence of intra- or extradural mass lesion.

Download Enhanced Impression

Recent download history

- enhanced_mri_impression (3).txt
682 B • 1 minute ago
- brain-mri-sample-report-1.pdf
235 KB • 9 hours ago
- MRI OF THE CERVICAL SPINE WO

1. Encapsulated T1 and T2 hyperintense mass in the left posterior cervical space, between the sternocleidomastoid muscle and left paraspinal muscles, measuring approximately 4 x 1.3 x 6 cm. The mass follows normal fat in signal intensity and most likely represents an incidental lipoma. Recommend further evaluation with contrast-enhanced CT or MRI to exclude other etiologies.

2. Mild intervertebral disc desiccation at C2/3 through C5/6 with shallow disc-osteophyte complexes at C4/5 and C5/6. No evidence of spinal canal or foraminal stenosis.

3. Normal cervical spine alignment, vertebral body height, and spinal cord signal. No evidence of intra- or extradural mass lesion.

Ln 1, Col 1 • 682 characters • 100% • Unix (LF) • UTF-8

Provide MRI findings by pasting text or uploading a PDF report.

The MRI Impression Assistant is successfully deployed and publicly accessible.

- Live URL: <https://huggingface.co/spaces/Vrajik/mri>
- Gitub : <https://github.com/Vrajnandwana/CapstoneProject>