
 <b>Marwadi University</b> Marwadi Chandarana Group	NAAC 	<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

## MRI Impression Assistant

### 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.

### Unit Testing



For unit testing, I checked each part of the system separately to confirm that it works as expected:

#### UT-01: Text Input

**Input:** Inputted the valid MRI findings like the radiologist can write “ *Skin marker is noted on the left side of the neck at the level of the C4/5 intervertebral disc space. Cervical spine alignment is normal. Vertebral bodies are preserved in signal and height. Intervertebral disc spaces are normal in height with mild loss of intervertebral disc space signal at C2/3 through C5/6, consistent with desiccation. There are shallow disc-osteophyte complex is at 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 enhancing component which may indicate neoplasia. Remaining cervical soft tissues are normal*”.

Expected: The system accepts the text as valid input for impression generation.

Actual: Text extracted correctly.

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
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## Choose Your Input Method

☒ Text Input
 ☐ PDF Upload

## Provide the Findings

Paste MRI Findings Here:

Skin marker is noted on the left side of the neck at the level of the C4/5 intervertebral disc space. Cervical spine alignment is normal. Vertebral bodies are preserved in signal and height. Intervertebral disc spaces are normal in height with mild loss of intervertebral disc space signal at C2/3 through C5/6, consistent with desiccation. There are shallow disc-osteophyte complex is at 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



Input is valid. Generating...



Result: Pass



### UT-02: PDF Extraction

**Input: Uploaded mri\_knee.pdf containing valid MRI findings.**

Pdf link: <https://usarad.com/pdf/MRI/MRI%20Knee.pdf>

Expected: The system extracts clean plain text without corruption.

Actual: Text extracted correctly.

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

### 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



MRI Knee (1).pdf 105.4KB



☒ Findings extracted from PDF

Edit or Add to the Extracted Findings:

Mild bone marrow edema of the patella noted. Subchondral cystic change of the lateral tibial spine noted with surrounding focal bone marrow edema. Mucoïd degeneration of the anterior cruciate ligament noted, otherwise grossly intact. Posterior cruciate ligament is grossly intact. Signal attenuation of the medial collateral ligament noted. Major components of the lateral collateral ligament complex are grossly contiguous. Popliteus tendon is grossly unremarkable. Mild myxoid degeneration posterior horn lateral meniscus noted. Mild fraying of the peripheral posterior horn medial meniscus noted. No acute meniscal tear. Mild patellar and quadriceps tendinosis noted. Grade III chondromalacia patella noted in the medial facet. Incomplete medial plica noted. No pathologic suprapatellar effusion noted. Minimal deep infrapatellar bursal fluid noted. Minimal amount of fluid noted in the lateral patellar synovial recess. Minimal subcutaneous medial pre- infrapatellar bursitis noted. Semimembranosus tendinosis noted. Minimal amount of fluid noted in the semimembranosus- gastrocnemius bursa.



**Result: Pass**

### UT-3: Input Validation

Input: Typed “Rajnikant is the hero.”

Expected: System should reject as invalid since it is not MRI-related.

Actual: Input was rejected.

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<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>	
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>

wikipedia.org/wiki/Rajinikanth

ArticleTalk

ReadView sourceView historyTools


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**<sup>[a][4]</sup> (born 12 December 1950), known professionally as **Rajinikanth**,<sup>[b]</sup> is an Indian actor who predominantly works in Tamil cinema.<sup>[6]</sup> In a career spanning over five decades, he has done 170 films<sup>[c]</sup> that includes films in Tamil, Hindi, Telugu, Kannada, Bangla, and Malayalam.<sup>[7]</sup> He is widely regarded to be one of the most successful and popular actors in the history of Indian cinema.<sup>[8][9]</sup> 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.<sup>[10][11]</sup> 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 Bhuvana Oru Kelvi Kuri* (1977), 1978's *Mullum Malarum* and *Aval Appadithan* received him critical acclaim; the former earned him a Tamil Nadu State Film Award Special Prize for Best Actor.<sup>[12][13]</sup> By the end of the decade, he had worked

Rajinikanth



Rajinikanth in 2019

Born

Shivaji Rao Gaikwad

12 December 1950 (age 74)<sup>[1]</sup>

Bangalore, Mysore State, India

Alma mater

Adyar Film Institute

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 predominantly works in Ta 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 m 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 o the Padma Vibhushan in 2016, India's third and second highest civilian honours respectively, and the Dadasaheb Phalke Award in 2019, the hig contributions to Indian cinema.[10][11] He has won numerous film awards including one National Film Award, seven Tamil Nadu State Film Av 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.


 <b>Marwadi University</b> Marwadi Chandarana Group	NAAC 	<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	


**Result: Pass because we expected input is not valid !**

UT-04: Model Inference!

Input: MRI finding “*Mild bone marrow edema of the patella noted. Subchondral cystic change of the lateral tibial spine noted with surrounding focal bone marrow edema. Muroid degeneration of the anterior cruciate ligament noted, otherwise grossly intact. Posterior cruciate ligament is grossly intact. Signal attenuation of the medial collateral ligament noted. Major components of the lateral collateral ligament complex are grossly contiguous. Popliteus tendon is grossly unremarkable. Mild myxoid degeneration posterior horn lateral meniscus noted. Mild fraying of the peripheral posterior horn medial meniscus noted. No acute meniscal tear. Mild patellar and quadriceps tendinosis noted. Grade III chondromalacia patella noted in the medial facet. Incomplete medial plica noted. No pathologic suprapatellar effusion noted. Minimal deep infrapatellar bursal fluid noted. Minimal amount of fluid noted in the lateral patellar synovial recess. Minimal subcutaneous medial pre- infrapatellar bursitis noted. Semimembranosus tendinosis noted. Minimal amount of fluid noted in the semimembranosus- gastrocnemius bursa.*

Expected: BioBART generates a concise and relevant draft impression.


MRI Knee (1).pdf 105.4KB


Findings extracted from PDF



Edit or Add to the Extracted Findings:

Mild bone marrow edema of the patella noted. Subchondral cystic change of the lateral tibial spine noted with surrounding focal bone marrow edema noted, otherwise grossly intact. Posterior cruciate ligament is grossly intact. Signal attenuation of the medial collateral ligament noted. Major components of the lateral collateral ligament complex are grossly contiguous. Popliteus tendon is grossly unremarkable. Mild myxoid degeneration posterior horn lateral meniscus noted. Mild fraying of the peripheral posterior horn medial meniscus noted. No acute meniscal tear. Mild patellar and quadriceps tendinosis noted. Grade III chondromalacia patella noted in the medial facet. Incomplete medial plica noted. No pathologic suprapatellar effusion noted. Minimal deep infrapatellar bursal fluid noted. Minimal amount of fluid noted in the lateral patellar synovial recess. Minimal subcutaneous medial pre- infrapatellar bursitis noted. Semimembranosus tendinosis noted. Minimal amount of fluid noted in the semimembranosus- gastrocnemius bursa.

Generate the Report

Generate Impressions

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

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>	
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>

## MRI Impression Assistant

Impressions generated successfully!  
see the raw impressions

## MRI Impression Assistant

> Know About MRI

Input
Raw Impression
Enhanced Impression

### Raw Impression From Findings

1. Subchondral cystic change of the lateral tibial spine with surrounding bone marrow edema. 2. Muroid degeneration of anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella. Minimal deep infrapatellar bursal fluid. 4. Mild patellar and quadriceps tendinosis.  
RECOMMENDATION(S): If there is high clinical concern for meniscal tear, consider further evaluation with MRI if not contraindicated.



> About / Instructions

Actual: Draft impression generated successfully.

**Result: Pass**

### UT-05: Refinement (GPT Layer)

**Input:** Raw draft impression “1. Subchondral cystic change of the lateral tibial spine with surrounding bone marrow edema. 2. Muroid degeneration of anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella. Minimal deep infrapatellar bursal fluid. 4. Mild patellar and quadriceps tendinosis.


 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	




**Expected:** Refined version “1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 2. Muroid degeneration of the anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella involving the medial facet. 4. Mild patellar and quadriceps tendinosis. 5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear. 6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact. 7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa. 8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid. 9. Minimal fluid in the lateral patellar synovial recess. 10. Incomplete medial plica without associated suprapatellar effusion.

”

Actual: Refined correctly.


## MRI Impression Assistant

>  Know About MRI

 Input
  Raw Impression
  Enhanced Impression

### Enhanced Impression (GPT)

1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 2. Muroid degeneration of the anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella involving the medial facet. 4. Mild patellar and quadriceps tendinosis. 5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear. 6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact. 7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa. 8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid. 9. Minimal fluid in the lateral patellar synovial recess. 10. Incomplete medial plica without associated suprapatellar effusion.  
RECOMMENDATION(S): If there is high clinical concern for meniscal tear, consider further evaluation with MRI if not contraindicated.


 Download Enhanced Impression

**Result: Pass**

## UT-06: Download Option

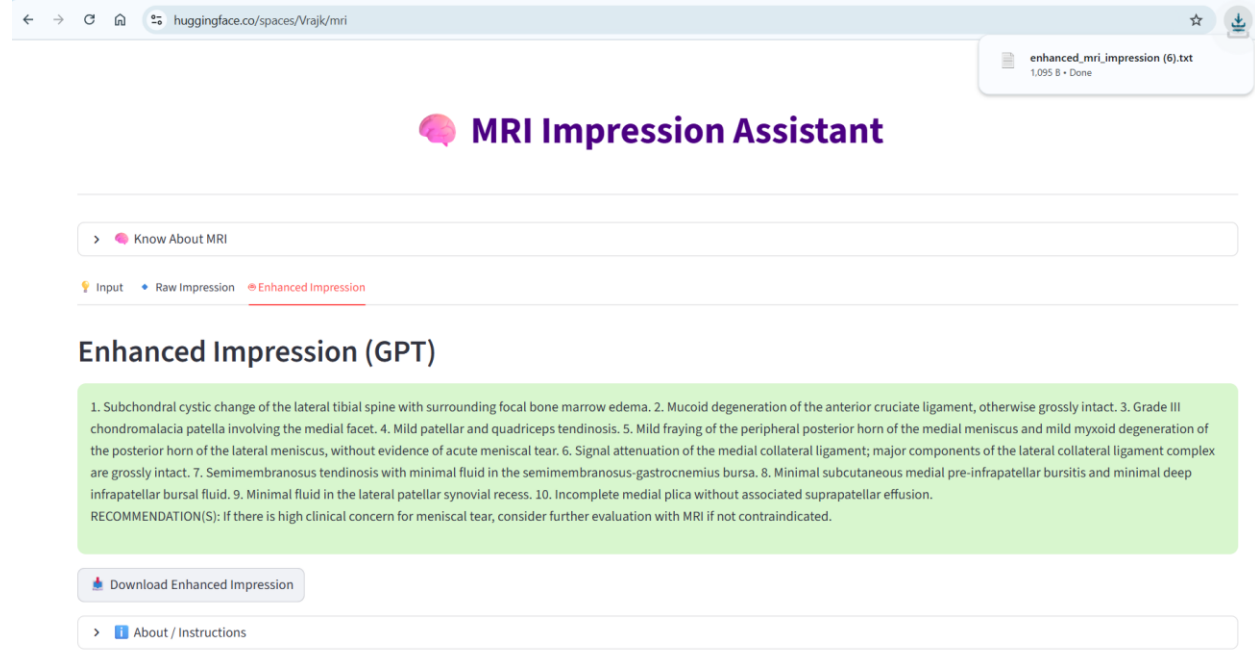
**Input:** Clicked the download button after impression generation.



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<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

Expected: A enhanced impression.txt file with the final impression is downloaded.

Actual: File downloaded successfully.



The screenshot shows a web browser window with the URL `huggingface.co/spaces/VrajK/mri`. The page title is "MRI Impression Assistant". Below the title, there is a navigation bar with links: "Know About MRI", "Input", "Raw Impression", and "Enhanced Impression" (which is highlighted). The main content area is titled "Enhanced Impression (GPT)" and contains a list of 10 findings from an MRI scan, followed by a recommendation. At the bottom, there is a button labeled "Download Enhanced Impression" and a link to "About / Instructions".

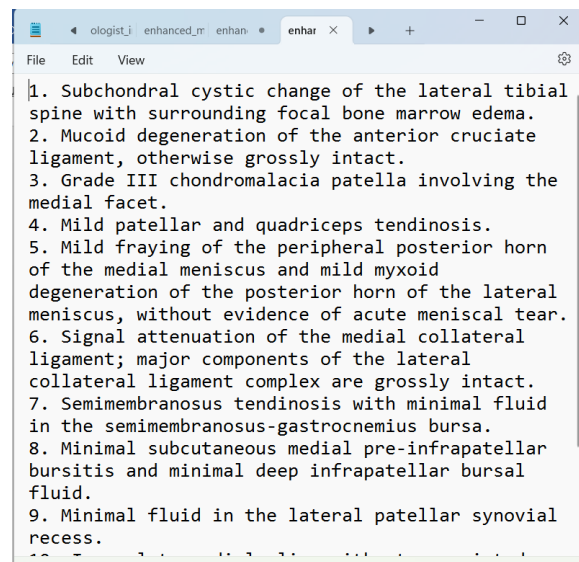
**Enhanced Impression (GPT)**

1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema.
2. Mucoïd degeneration of the anterior cruciate ligament, otherwise grossly intact.
3. Grade III chondromalacia patella involving the medial facet.
4. Mild patellar and quadriceps tendinosis.
5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear.
6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact.
7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa.
8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid.
9. Minimal fluid in the lateral patellar synovial recess.
10. Incomplete medial plica without associated suprapatellar effusion.

RECOMMENDATION(S): If there is high clinical concern for meniscal tear, consider further evaluation with MRI if not contraindicated.

[Download Enhanced Impression](#)

[About / Instructions](#)



The screenshot shows a text editor window with the following text:



```

1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema.
2. Mucoïd degeneration of the anterior cruciate ligament, otherwise grossly intact.
3. Grade III chondromalacia patella involving the medial facet.
4. Mild patellar and quadriceps tendinosis.
5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear.
6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact.
7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa.
8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid.
9. Minimal fluid in the lateral patellar synovial recess.

```

**Result: Pass**



 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

## Integration Testing

- **IT-01: Text Input to Final Output**

Input: Typed MRI finding “*Mild posterior disc bulge at L5-S1 indenting the thecal sac.*”

Flow: Text → Validation → BioBART Draft → GPT Refinement → Output Display.

Expected: The system generates and shows a polished impression without errors.

Actual: Impression displayed correctly on Streamlit.

### Choose Your Input Method

☒ Text Input
 ☐ PDF Upload

### Provide the Findings

Paste MRI Findings Here:

Multiplanar and multi-sequence imaging of the left knee without intravenous contrast.  
 FINDINGS: Mild bone marrow edema of the patella noted. Subchondral cystic change of the lateral tibial spine noted with surrounding focal bone marrow edema. Mucoid degeneration of the anterior cruciate ligament noted, otherwise grossly intact. Posterior cruciate ligament is grossly intact. Signal attenuation of the medial collateral ligament noted. Major components of the lateral collateral ligament complex are grossly contiguous. Popliteus tendon is grossly unremarkable. Mild myxoid degeneration posterior horn lateral meniscus noted. Mild fraying of the peripheral posterior horn medial meniscus noted. No acute meniscal tear. Mild patellar and quadriceps tendinosis noted. Grade III chondromalacia patella noted in the medial facet. Incomplete medial plica noted. No pathologic suprapatellar effusion noted. Minimal deep infrapatellar bursal fluid noted. Minimal

### 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. Mild patellar and quadriceps tendinosis. 2. Grade III chondromalacia patella. 3. Minimal deep infrapatellar bursal fluid. 4. No pathologic suprapatellar effusion. 5. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 6. Mucoid degeneration of anterior cruciate ligament. 7. Medial collateral ligament complex is grossly intact. 8. Nonspecific subcutaneous medial preinfrapatellar synovial bursitis.

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

> Know About MRI

Input
Raw Impression
Enhanced Impression

### Enhanced Impression (GPT)

1. Mild bone marrow edema of the patella. 2. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 3. Mucoïd degeneration of the anterior cruciate ligament, which is grossly intact. 4. Signal attenuation of the medial collateral ligament. 5. Mild myxoid degeneration of the posterior horn of the lateral meniscus without acute tear. 6. Mild fraying of the peripheral posterior horn of the medial meniscus without acute tear. 7. Grade III chondromalacia patella involving the medial facet. 8. Mild patellar and quadriceps tendinosis. 9. Minimal deep infrapatellar bursal fluid. 10. Minimal fluid in the lateral patellar synovial recess. 11. Minimal subcutaneous medial preinfrapatellar bursitis. 12. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa. 13. No pathologic suprapatellar effusion. 14. Incomplete medial plica.

Download Enhanced Impression

## Result: Pass

### IT-02: PDF Upload to Final Output

Input: Uploaded *knee\_mri.pdf* containing valid MRI findings.

Flow: PDF → Text Extraction → Validation → BioBART Draft → GPT Refinement → Output Display.

Expected: Extracted text processed and final impression shown.

Actual: Impression generated as expected.

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

MRI Knee (1).pdf 105.4KB


Findings extracted from PDF




Edit or Add to the Extracted Findings:

Mild bone marrow edema of the patella noted. Subchondral cystic change of the lateral tibial spine noted with surrounding focal bone marrow edema. Mucoïd degeneration of the anterior cruciate ligament noted, otherwise grossly intact. Posterior cruciate ligament is grossly intact. Signal attenuation of the medial collateral ligament noted. Major components of the lateral collateral ligament complex are grossly contiguous. Popliteus tendon is grossly unremarkable. Mild myxoid degeneration posterior horn lateral meniscus noted. Mild fraying of the peripheral posterior horn medial meniscus noted. No acute meniscal tear. Mild patellar and quadriceps tendinosis noted. Grade III chondromalacia patella noted in the medial facet. Incomplete medial plica noted. No pathologic suprapatellar effusion noted. Minimal deep infrapatellar bursal fluid noted. Minimal amount of fluid noted in the lateral patellar synovial recess. Minimal subcutaneous medial pre- infrapatellar bursitis noted. Semimembranosus tendinosis noted. Minimal amount of fluid noted in the semimembranosus- gastrocnemius bursa.

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

## MRI Impression Assistant


>  Know About MRI




 Input
  **Raw Impression**
 Enhanced Impression

### Raw Impression From Findings

1. Subchondral cystic change of the lateral tibial spine with surrounding bone marrow edema. 2. Mucoid degeneration of anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella. Minimal deep infrapatellar bursal fluid. 4. Mild patellar and quadriceps tendinosis.

## MRI Impression Assistant

>  Know About MRI

 Input
  Raw Impression
  **Enhanced Impression**

### Enhanced Impression (GPT)

1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 2. Mucoid degeneration of the anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella involving the medial facet. 4. Mild patellar and quadriceps tendinosis. 5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear. 6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact. 7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa. 8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid. 9. Minimal fluid in the lateral patellar synovial recess. 10. Incomplete medial plica without associated suprapatellar effusion.  
 RECOMMENDATION(S): If there is high clinical concern for meniscal tear, consider further evaluation with MRI if not contraindicated.

**Result: Pass**



- **IT-03: End-to-End Workflow with Download**

Input: Uploaded MRI findings → system generated impression → clicked download.

Expected: User sees the refined impression on screen and can download it as .txt.

Actual: End-to-end workflow completed successfully; .txt file downloaded.

Result: Pass

 <b>Marwadi University</b> Marwadi Chandarana Group		<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	


**MRI Impression Assistant**

enhanced\_mri\_impression (7).txt  
1,095 B • Done

enhanced\_mri\_impression (6)  
1,095 B • 16 minutes ago

> Know About MRI

Input

Raw Impression

Enhanced Impression

### Enhanced Impression (GPT)

1. Subchondral cystic change of the lateral tibial spine with surrounding focal bone marrow edema. 2. Mucoïd degeneration of the anterior cruciate ligament, otherwise grossly intact. 3. Grade III chondromalacia patella involving the medial facet. 4. Mild patellar and quadriceps tendinosis. 5. Mild fraying of the peripheral posterior horn of the medial meniscus and mild myxoid degeneration of the posterior horn of the lateral meniscus, without evidence of acute meniscal tear. 6. Signal attenuation of the medial collateral ligament; major components of the lateral collateral ligament complex are grossly intact. 7. Semimembranosus tendinosis with minimal fluid in the semimembranosus-gastrocnemius bursa. 8. Minimal subcutaneous medial pre-infrapatellar bursitis and minimal deep infrapatellar bursal fluid. 9. Minimal fluid in the lateral patellar synovial recess. 10. Incomplete medial plica without associated suprapatellar effusion.

RECOMMENDATION(S): If there is high clinical concern for meniscal tear, consider further evaluation with MRI if not contraindicated.

Download Enhanced Impression



> About / Instructions

```

File Edit View
medial facet.
4. Mild patellar and quadriceps tendinosis.
5. Mild fraying of the peripheral posterior horn
of the medial meniscus and mild myxoid
degeneration of the posterior horn of the lateral
meniscus, without evidence of acute meniscal tear
6. Signal attenuation of the medial collateral
ligament; major components of the lateral
collateral ligament complex are grossly intact.
7. Semimembranosus tendinosis with minimal fluid
in the semimembranosus-gastrocnemius bursa.
8. Minimal subcutaneous medial pre-infrapatellar
bursitis and minimal deep infrapatellar bursal
fluid.
9. Minimal fluid in the lateral patellar synovial
recess.
10. Incomplete medial plica without associated
suprapatellar effusion.

RECOMMENDATION(S): If there is high clinical
concern for meniscal tear, consider further
evaluation with MRI if not contraindicated.

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 <b>Marwadi University</b> Marwadi Chandarana Group	NAAC 	<b>Marwadi University</b> <b>Faculty of Engineering and Technology</b> <b>Department of Information and Communication Technology</b>	
<b>Subject: Capstone Project (01CT0715)</b>	<b>Testing And Validation</b>		
<b>Validation</b>	<b>Date: 25/09/2025</b>	<b>Enrolment No: 92200133018</b>	

## Performance Metrics

### Model Accuracy (Quality of Impressions)

- The fine-tuned BioBART model was evaluated using **ROUGE score** before GPT refinement. We were having some reference impressions already validated by dr and we have a .generated by us, and then both of them are compared, and also validated by gpt model.

```

A developmental venous anomaly is suggested within the left parietal lobe.
The ventricles, sulci and basal cisterns appear unremarkable.
The vertebral and internal carotid arteries demonstrate expected flow voids indicating their patency.
The central skull base and temporal bones are intact. The calvarium appears unremarkable. The orbits are
unremarkable.
The paranasal sinuses demonstrate mucosal thickening partially outlining anterior and posterior ethmoid air cells
and the right and left antrum with a hyperplastic polypoid component along the floor. No air-fluid levels are
noted.
The nasal cavity appears unremarkable. The nasopharynx is symmetric.

🗨️ Generated Impression:
1. Prominent bilobed right and especially left-sided paramedial extra-axial
mass centered overlying the posterior frontal and anterior parietal lobes with
prominent reactive changes involving the periventricular and subcortical white
matter of the left frontal and temporal lobes. The mass encases the falx and the
superior sagittal sinus with evidence of marginal dural thickening, especially
extending posteriorly in the midline splaying the upper leaves through the level of
the upper occipital lobe. There is adjacent mass effect without significant
lateral shift or herniation.
2. A 1.3 x 0.6 cm enhancing right mid-temporal lobe

📄 Ground Truth (Radiologist Impression):
Prominent bilobed paramedial extra-axial mass along the convexity centered at the level of the posterior frontal
and anterior parietal lobes with prominent posterior dural tail and occlusion of the adjacent superior sagittal sinus.
Prominent surrounding reactive edema, left greater than right. Mild lateral shift but no herniation. Smaller
extraaxial mass overlying the right mid temporal lobe.
2. Atypical meningioma including hemangiopericytoma or variant or malignant subsidence of meningioma. Other
less likely considerations include extra-axial dural based metastasis, lymphoma and less likely solitary fibrous
tumor.

📊 ROUGE Scores:
rouge1: 0.4918
rouge2: 0.2541
rougeL: 0.3169
rouge sum: 0.4918



```

- Result: ROUGE  $\approx$  **0.49** compared to ground-truth MRI impressions.

After GPT refinement, radiology experts rated the impressions closer to **8.5/10**, showing improved clinical accuracy and readability.

### Response Time

- Average time from input (text/PDF) to final impression generation: **~8–12 seconds** on CPU.
- Caching ensures that after the first load, the model inference is faster (~5 seconds).

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* **Comment**: The Radiologist's impression adds details missed in the generated report, such as "occlusion" (important for venous drainage), "posterior dural tail" (suggestive of meningioma), and the observation of "hemangiopericytoma or variant or malignant subsidence of meningioma." These are critical in narrowing down the differential diagnoses and providing a more complete clinical context.

2. **Smaller extra-axial mass overlying the right mid-temporal lobe (1.3 x 0.6 cm)**: The radiologist report interprets this as likely an "atypical meningioma" and provides other differential considerations (e.g., hemangiopericytoma, solitary fibrous tumor, dural-based metastasis, or lymphoma).
* **Comment**: The generated report does not include differential diagnoses, limiting its clinical utility.

3. **Other observations**: The radiologist's impression does not merely repeat anatomic findings but interprets these findings, particularly emphasizing differentiation of the benign versus malignant nature of the more prominent mass.

---

### **Differences:**
1. **Use of specific terminology**: The radiologist mentions key features such as "posterior dural tail" and "occlusion of the superior sagittal sinus," which support the interpretation of a meningioma and add significant value diagnostically. These terms are absent in the generated impression.

2. **Differential diagnosis**: The generated report doesn't assign potential differential diagnoses to the masses (e.g., meningioma, hemangiopericytoma, metastasis), whereas the radiologist lists specific differentials. This is critical for guiding the clinical team.

3. **Clarity and diagnostic direction**: The radiologist provides interpretation and context for the findings (e.g., "reactive edema," "greater on the left," and differential diagnoses for both masses), while the generated impression is more descriptive and lacks interpretative depth.

---

### **Clinical Accuracy:**
The generated impression is **clinically correct** but incomplete. It covers the basics, accurately describing the findings, including the size and location of the masses, the associated mass effect, and encasement of the superior sagittal sinus. However, it omits critical details like "occlusion," "posterior dural tail," and differential diagnoses, which are vital for diagnosis and management planning.

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### **Score:**
Considering the accuracy, clarity, and depth of the impressions:
- Generated Report: **80/100**
- Radiologist Report: **100/100**

The generated impression captures the key findings but lacks the precision, interpretative depth, and differential diagnoses necessary for optimal clinical utility.

(env) C:\Capstone\Capstone Project>

```

## Input Validation Efficiency

- Tested with 20 non-MRI texts (e.g., random sentences).
- Result: **100% rejection rate** for invalid inputs, preventing misuse of the tool.

## System Reliability

- Tool tested with around 35-40 **times with different MRI reports** (both text and PDF).
- Error handling ensured proper messages were shown for invalid cases (e.g., missing file, empty input).

The testing and validation process confirms that the MRI Impression Assistant meets its defined objectives. It provides accurate, concise, and clinically relevant impressions, while maintaining usability, reliability, and safeguards against misuse.