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Neurorad Lecturer LLM Agent: Evaluation and development of a Neuroradiology Teaching LLM Agent for Trainee Case Practice

Sevcan Turk, MD, University of Pennsylvania

Briefly describe what attendees will see during your demo.
We plan to demonstrate Neurorad Lecturer GPT through a live, interactive neuroradiology case. An audience member or presenter will review an imaging case and enter responses regarding the imaging modality, sequence, anatomical location, key findings, final diagnosis, and differential diagnosis. The GPT will evaluate each response and provide adaptive feedback in real time. Correct answers will be reinforced, partially or fully incorrect answers will receive targeted guidance, and unrelated responses will be redirected toward the relevant imaging features without immediately revealing the diagnosis. We will demonstrate several response pathways to show how the tool supports stepwise diagnostic reasoning rather than functioning as a static answer generator. We will also briefly present the curated case dataset, evaluation framework, current performance assessment, known limitations, and planned trainee validation.

Problem & Motivation: What clinical or operational problem does your MVP address?
Developing competency in neuroradiology requires repeated exposure to imaging cases, active interpretation, and timely feedback. However, individualized faculty teaching is constrained by clinical workload, limited educator availability, and unequal access to subspecialty expertise. Traditional case repositories support self-study but are largely static and do not provide personalized, real-time feedback based on a learner's specific response. We sought to develop an interactive generative AI teaching tool that allows trainees to independently practice neuroradiology cases and receive immediate, structured, case-specific educational feedback.

What You Built: Describe your MVP, tool, or workflow in plain language
We developed Neurorad Lecturer LLM Agent, an interactive large language model-based educational interface designed to simulate guided neuroradiology case practice. A curated dataset of 434 annotated 2D-images from 94 neuroradiology cases was assembled from an open-access educational repository. Cases were annotated for imaging modality, MRI sequence when applicable, anatomical location, key imaging findings, final diagnosis, and differential diagnosis. The interface guides learners through case interpretation and evaluates responses across predefined educational domains. Rather than immediately revealing the answer, the LLM Agent responds dynamically to the learner's input and optimized to select and reveal following images from the predefined educational file and display in accordance with the learners response. Correct responses are reinforced, incorrect responses receive targeted corrective feedback and additional guidance, and unrelated responses are redirected toward relevant imaging features and diagnostic reasoning.

Tech Stack & Development Approach: What tools, frameworks, or methods did you use to build it?
The educational interface prototype was developed using a commercially available instruction-tuned large

language model (ChatGPT, OpenAI, San Francisco, CA, USA) within Penn Workspace (Penn GPT Edu). Neurorad Lecturer integrates structured system prompting, a curated contextual knowledge base of neuroradiology cases with annotated images and case metadata, and stateful multi-turn conversational context to deliver adaptive, case-specific educational interactions. The system accepts imaging and case information and conducts a stepwise educational dialogue addressing modality, imaging plane or sequence, anatomical location, findings, impression, final diagnosis, and differential diagnosis. The prototype has demonstrated the ability to distinguish among correct, incorrect, and unrelated learner responses and generate corresponding educational feedback. Structured evaluation of accuracy and response quality across educational domains is ongoing.

Feedback You're Seeking: What specific feedback, help, or collaboration are you hoping to get from the CAIMI26 community?

The project is a functional prototype undergoing structured evaluation. We seek feedback on optimizing adaptive educational feedback, validating learning effectiveness beyond model accuracy, measuring improvement in diagnostic reasoning, and scaling the platform across institutions and subspecialties.

Known Limitations & Honest Failures: What isn't working yet, or what have you already tried that failed?

Limitations include variability in LLM outputs, occasional incomplete or incorrect feedback, and challenges in evaluating partially correct responses. Prospective trainee testing has not yet established improvement in learner performance. If validated, Neurorad Lecturer LLM Agent could provide scalable, personalized, interactive radiology education and expand access to subspecialty teaching.

Potential for Impact: If this MVP were fully developed and deployed, who would benefit and how?

The primary beneficiaries are radiology residents, fellows, medical students, and other trainees seeking additional case-based practice outside scheduled teaching sessions. An interactive AI tutor could provide on-demand access to structured neuroradiology cases, immediate formative feedback, and individualized learning without requiring continuous faculty participation.

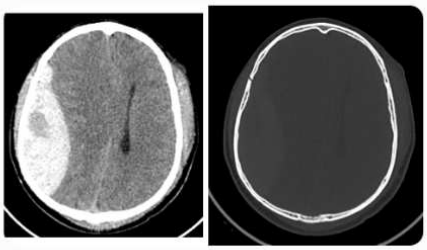
Neurorad Lecturer · Note: The creator recommends GPT-5.5 Pro. You are using GPT-5.6 Thinking. · Convert chat to PDF · Share

I'll give you one oral-board style case and hold the diagnosis back initially. I'll use a single uploaded case image and ask targeted questions, then you can answer.

Thought for 39s ›

Board-style case

Clinical vignette: 20-year-old man after high-speed motor vehicle collision with loss of consciousness.



Question:
Describe the imaging study and key abnormality. Then give:

1. **Most likely diagnosis**
2. **One critical associated finding to look for**
3. **Most urgent management concern**

Source case drawn from the uploaded neuroradiology teaching deck.

Sources · Convert to PDF · Edit Image

New version of GPT available - Continue chatting to use the old version, or start a new chat for the latest version.

Ask anything

+ Thinking

Activity · 39s

Thinking

Extracting images from PowerPoint slides

Python

```
import os, zipfile, re, json, textwrap, gl
ppt='/mnt/data/Radiopaedia-ppt-Test+AllAZU
os.path.exists(ppt), os.path.getsize(ppt)
```

```
(True, 112900391)
```

- Considering slide count and title extraction
  I need to figure out how to extract slides and potentially convert a selected slide to PNG. To do that, I'll want to check the number of slides and their titles. Maybe I can use a Python library like python-pptx to help with

Counting slides in PowerPoint presentation

Python

```
import zipfile, os, re, xml.etree.ElementT
from pptx import Presentation
prs=Presentation(ppt)
len(prs.slides)
```

```
93
```

Extracting text and image count per slide

Python

```
from pptx import Presentation
prs=Presentation(ppt)
slide_infos=[]
for i,slide in enumerate(prs.slides, start
    texts=[]
```

Unrelated answer response

this is an elephant sitting in the room

Honestly, after this deck's behavior, I believe you. 😄

If the image is an **elephant sitting in a room**, the correct oral-board opening is:

> "This is not a CT head. This is a photograph/image of an elephant in a room, so it does not match the clinical history or requested neuroimaging interpretation."

Finding:

Large elephant occupying the room.

Differential:

- Actual elephant
- Sculpture/statue
- AI-generated elephant
- Metaphorical elephant in the room: the image set is unusable for neuro oral boards

Final impression:

Image-content mismatch. Recommend abandoning this extracted deck for case-based neuro teaching and using properly verified DICOM/screenshots instead.