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Application of Large Language Models in Neuroradiology

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1. LLM Application in Radiology Field

- **Topics in radiology research**
  - Performance evaluation using radiologic cases
  - Radiology reporting
  - Performance in answering radiology-related questions or recommendations
  - Radiology request form
  - Decision support system

2. Vision Capability of LLM

- **Vision capability of LLMs (Vision-Language Models)**
  - Since the release of GPT-4V (OpenAI) in September 2023, many multimodal LLMs capable of processing both text and image inputs have emerged.
  - Rising expectations for supportive roles in radiology, particularly in image interpretation and differential diagnosis.
- **What studies consistently show about LLMs on radiologic tasks**
  - Diagnostic accuracy continues to improve across model generations.
  - LLMs perform well when both image and textual information are provided; accuracy drops with image-only inputs.
  - Descriptions of radiologic image findings most strongly enhance diagnostic performance.
  - Longer texts generally help.
  - Importance of image descriptions even in multimodal settings.
  - Hallucinations persist: fabricated imaging findings, misidentifying anatomic regions, and overconfident errors.
- **Limitations of previous studies**
  - Medical-quiz vignettes: well-organized scenarios that include selected key images and clinical information necessary to reach the correct diagnosis.
  - Multiple-choice formats can inflate accuracy and don’t reflect real-world clinical practice.

3. Application in Neuroradiology

- **Diagnostic Performance**
  - LLM vs. Radiologists
  - Competitive accuracy in interpreting brain tumor MRI reports (European Radiology, 2025)
  - Good at identifying imaging features, but underperformed in diagnosis (Academic Radiology, 2025)

- **Clinical History Summarization**
  - High accuracy and quality in summarizing longitudinal radiologic courses in glioblastoma patients (Radiology, 2024)
  - Good at automatic generating clinical histories for radiologists by extracting key information from medical notes (Radiology, 2025)
- **Clinical Decision Making**
  - Glioma Treatment Planning
  - LLMs provided treatment recommendations with moderate-to-good performance depending on the task (BMJ Health Care Inform, 2023)

4. Future Research Direction

- **Open-Source LLMs**
  - Advantages: Customizability, cost-effective, lightweight deployment, better data privacy.
  - Disadvantages: Safety concerns, inconsistent performance.
- **Real-World Data Integration**
  - Evaluate LLMs using authentic, diverse real-world datasets to bridge the gap between research and clinical practice.

LLM agent

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