# **Web-Based Video Analysis and Visualization of Magnetic Resonance Imaging Reports for Enhanced Patient Understanding**

## **Introduction: Bridging the Gap in MRI Report Understanding**

Magnetic Resonance Imaging (MRI) has become an indispensable tool in modern medicine, providing detailed insights into the human body's internal structures. The reports generated from these scans, however, are often dense with medical jargon, anatomical terms, and technical specifications that can be perplexing for patients.1 This complexity creates a significant barrier to patient comprehension, potentially leading to anxiety, confusion, and a diminished capacity for individuals to actively participate in their own healthcare journey. As online patient portals become increasingly prevalent, offering patients direct access to their medical records, including radiology reports 2, the need for these reports to be understandable is paramount. If patients can readily view their MRI results but struggle to decipher the information, the intended benefits of transparency and engagement are undermined, potentially exacerbating their concerns.To address this critical gap in understanding, web-based video analysis and visualization technologies offer promising solutions. These innovative approaches can transform complex medical information contained within MRI reports into more accessible and engaging formats, such as explanatory videos and interactive three-dimensional (3D) models.5 By leveraging multimedia formats, these technologies can cater to a wider range of learning styles, potentially fostering improved comprehension compared to relying solely on text-based reports.8 Visual and auditory explanations can simplify abstract medical concepts through dynamic representations, making the information more digestible for patients. This report aims to provide a comprehensive overview of the current state and future potential of these technologies in the context of MRI report analysis. It will delve into existing systems designed to aid patient understanding, explore the application of artificial intelligence (AI) techniques like Optical Character Recognition (OCR) and Natural Language Processing (NLP), investigate methods for generating explanatory videos, examine the use of Augmented Reality (AR) and Virtual Reality (VR) for visualization, discuss key enabling technologies, identify current challenges and limitations, and ultimately assess the potential impact on patient comprehension and communication with healthcare providers. The goal is to provide healthcare innovation leaders and radiology department administrators with a holistic view of this evolving field, covering both the technical feasibility and the practical implications for enhancing patient care.

## **Current Landscape of Web-Based MRI Report Analysis Systems**

Several platforms and software solutions have emerged with the aim of improving how patients understand their MRI reports. These systems employ various strategies, from providing direct access to imaging data to offering expert-led video explanations and simplified textual interpretations.

Medicai offers a free online MRI viewer accessible through any web browser without requiring software installation.9 This platform allows patients to view their MRI scans in the DICOM format, supporting multi-planar image exploration, enabling them to navigate through axial, coronal, and sagittal views.9 While Medicai focuses on providing access to the raw imaging data, empowering patients to directly view their scans, it is important to note that patients may still require assistance in interpreting these images and the associated technical reports.Mediphany directly tackles the interpretation challenge by providing custom-made video explanations of MRI and CT scan results delivered by radiology doctors.5 These videos include comparisons to normal imaging examples and utilize 3D models to illustrate findings, all explained in layman's terms.5 This approach acknowledges the difficulties patients face in understanding complex radiology reports and offers a personalized, easy-to-digest explanation created by medical experts.Smart Reporting primarily focuses on providing medical reporting and documentation software for healthcare professionals, utilizing AI to enhance efficiency and perform quality checks.11 While not explicitly designed for patient use, the platform's emphasis on multimedia reports suggests a potential future direction where such features could be incorporated into patient-facing solutions. The increasing use of visuals and automated summaries in professional reporting tools indicates a broader recognition of the benefits of multimedia in communicating medical information effectively.Cincinnati Children's Hospital Technology has developed an AI-powered system for analyzing MRI scans to accurately quantify the degree of liver fibrosis in patients.12 This technology is primarily focused on diagnosis and monitoring within clinical settings and is not directly intended for patient explanation. However, the application of AI to analyze MRI images for specific conditions lays the groundwork for potential future applications in patient communication, where AI could identify key findings that need to be explained in a patient-friendly manner.PostDICOM offers a cloud-based Picture Archiving and Communication System (PACS) solution that includes a DICOM viewer.13 This platform primarily serves as a cost-effective solution for storing and sharing medical images among healthcare professionals and with patients. While PostDICOM facilitates image accessibility, which is a prerequisite for web-based analysis and explanation systems, it does not inherently provide tools for report analysis or explanation tailored for patient understanding.Academic research has also explored the concept of patient-friendly radiology reports accessible through web-based patient portals. For example, the PORTER (Patient-Oriented Radiology Reporter) system incorporates a lay-language glossary and illustrations to help patients understand the content of their radiology reports.4 The glossary defines thousands of medical concepts at an 8th-grade reading level, and a significant percentage of patients who used the system found it helpful.14 These research findings highlight the importance of simplified language and visuals in improving patient comprehension within online portal environments.

These diverse systems and research initiatives demonstrate the various approaches being taken to address the challenge of patient understanding of MRI reports. From providing access to raw imaging data to offering expert video summaries and simplified textual interpretations, the field is evolving, with different solutions being explored to meet the needs of a diverse patient population.

**Table 1: Comparison of Web-Based MRI Report Analysis Systems**

| Platform Name | Key Features for Patient Understanding | Accessibility | Focus |
| --- | --- | --- | --- |
| Medicai | 100% browser-based MRI viewer, multi-planar image exploration, DICOM support | Free | Image viewing |
| Mediphany | Custom video explanations by radiologists, comparisons to normal scans, 3D models, layman's terms | Paid service | Expert video explanation of reports |
| Smart Reporting | Multimedia reports (potential future patient feature), AI for report quality checks | Professional software | Medical reporting and documentation for professionals |
| Cincinnati Children's Hospital | AI analysis for quantifying liver fibrosis from MRI scans | Research/Clinical use | AI-powered diagnosis and monitoring of specific conditions |
| PostDICOM | Cloud-based PACS, DICOM viewer for storage and sharing | Subscription-based | Medical image storage and sharing |
| PORTER (Research) | Web-based patient portal, lay-language glossary, anatomical illustrations | Research platform | Simplified report access with educational aids |

## **The Role of Artificial Intelligence in MRI Report Analysis**

Artificial intelligence plays an increasingly significant role in enhancing the analysis and interpretation of MRI reports, with two key technologies at the forefront: Optical Character Recognition (OCR) and Natural Language Processing (NLP).

### **Optical Character Recognition (OCR): Extracting Textual Data from MRI Reports**

Optical Character Recognition is a crucial technology for converting image-based MRI reports, such as scanned documents or images, into machine-readable text.15 This conversion is a foundational step that enables AI-driven analysis of reports that are not already in a digital text format, unlocking the vast amounts of information contained in historical and paper-based medical records. OCR engines, such as the widely used open-source Tesseract, employ machine learning algorithms and image processing techniques to identify and extract text from images.17While Tesseract is recognized for its accuracy and versatility 17, its performance in the context of medical reports can be influenced by several factors. The accuracy can range from 80-90% on good-quality images but may significantly decrease with poor image quality, variations in font types, and complex document layouts.17 Medical reports, especially older ones, might present challenges due to these issues, including handwriting which Tesseract typically struggles with.19 Given the sensitive nature of medical information, achieving high accuracy is paramount.15 Studies have shown Tesseract achieving around 90% accuracy in extracting text from ultrasound images 20, but this level might not be sufficient for all critical details in MRI reports. To enhance accuracy, various pre-processing techniques are essential, such as resizing the image, converting it to grayscale, and applying binarization to improve contrast.17 Additionally, selecting the appropriate page segmentation mode and specifying the language of the report can significantly impact the results.17 For specialized medical terminology or unique fonts, creating custom language models for Tesseract can further boost accuracy.17

### **Natural Language Processing (NLP): Interpreting and Simplifying Medical Language**

Natural Language Processing is a branch of AI that focuses on enabling computers to understand, interpret, and generate human language. In the context of MRI report analysis, NLP techniques are used to extract key findings, identify medical entities (like diseases, anatomical structures, and procedures), and generate patient-friendly summaries from the complex medical language used in these reports.15 NLP algorithms can analyze the unstructured text within radiology reports to pinpoint abnormalities, extract diagnoses, and understand the clinical context of the findings.15 Common NLP techniques applied in this domain include text summarization, which condenses lengthy reports while retaining essential information; sentiment analysis, which can potentially gauge the urgency or severity of findings based on the language used; and named entity recognition, which identifies and categorizes key medical terms within the text.34The emergence of large language models (LLMs) like ChatGPT has significantly advanced the capabilities of NLP in simplifying medical reports for patients.1 Research has demonstrated that AI-interpreted MRI reports generated using LLMs can lead to substantial improvements in patient comprehension, clarity, and overall satisfaction compared to the original, technically written radiology reports.1 However, it is crucial to emphasize that the accuracy of AI interpretations must be carefully reviewed and validated by healthcare professionals before being shared with patients.1 While patients often find the clarity of AI-generated translations preferable, studies have indicated that they might have less trust in AI interpretations compared to reports directly from a radiologist.42 Beyond patient-facing applications, NLP also plays a vital role in assisting healthcare professionals by automating the generation of detailed and structured reports, improving efficiency and consistency in documentation.32

**Table 2: Accuracy and Limitations of Tesseract OCR in Medical Imaging**

| Scenario | Expected Accuracy Range | Key Limitations in Medical Context | Potential Optimization Strategies |
| --- | --- | --- | --- |
| Good Quality Printed Report | >95% 29 | Standard medical terminology generally well-recognized 17 | Ensure proper scanning resolution (300 DPI or higher) 25, use appropriate page segmentation mode 17 |
| Poor Quality Scanned Report | 60-80% (may vary) 23 | Noise, skew, low contrast can significantly reduce accuracy 17 | Apply pre-processing techniques like binarization, noise reduction, deskewing 17 |
| Handwritten Notes | <50% (highly variable) 19 | Tesseract primarily trained on printed fonts, struggles with handwriting 19 | Consider alternative OCR engines optimized for handwriting, or manual transcription for critical information 24 |
| Complex Layouts (Tables, Forms) | Variable, may misinterpret structure 17 | Medical reports often contain structured data in tables 40 | Use specific configuration settings for layout analysis, or combine with NLP techniques for structured data extraction 17 |
| Reports with Specialized Terminology | May require custom training for optimal accuracy 17 | Medical vocabulary can be nuanced and specific 26 | Train Tesseract on custom datasets containing medical terms and report formats 17 |

## **Generating Explanatory Videos from Medical Text Data**

The translation of complex medical text data from MRI reports into engaging and understandable formats can be significantly enhanced through the use of AI-driven text-to-video generation techniques.43 These technologies have the potential to transform intricate medical content into accessible visual formats, benefiting both healthcare professionals for educational purposes and patients seeking to understand their conditions.43 By converting simplified summaries of MRI reports into videos, patients can receive explanations that combine text, visuals, and narration, catering to a broader range of learning preferences and potentially improving comprehension.43Several tools and platforms are available for creating medical explainer videos, including free AI video generators like CapCut.45 These platforms often provide a user-friendly interface and features such as AI voiceover capabilities, options for incorporating animated text and graphics, and libraries of background music and sound effects.45 More advanced platforms, such as Veo on Vertex AI, also allow for the generation of videos from text or even image prompts.46 This increasing accessibility of AI-powered video creation tools empowers healthcare professionals to produce their own patient education materials efficiently, without requiring extensive expertise in video editing.48To ensure the effectiveness and accuracy of medical explainer videos generated using AI, it is crucial to adhere to best practices.8 These include a thorough understanding of the target audience's needs and knowledge level, emphasizing the problem being addressed by the medical information, using intuitive analogies to simplify complex concepts, and visualizing AI's role in the analysis or explanation.8 It is also vital to simplify medical and AI-related jargon, use clear and engaging visuals and narration, and keep the videos concise, typically aiming for a duration of 2-5 minutes for medical explainers.8 Above all, ensuring the medical accuracy of the video content is paramount, which often necessitates human review and customization of the AI-generated material.8 This combination of AI efficiency and human oversight is key to creating high-quality, trustworthy educational resources for patients.

**Table 3: Best Practices for Generating Medical Explainer Videos Using AI**

| Best Practice | Description | Relevance to Medical Content |
| --- | --- | --- |
| Understand Target Audience | Tailor content and language to the patient's level of health literacy and specific needs 45 | Ensures the video is accessible and relevant to the intended viewer, improving comprehension |
| Emphasize Problem-Solving | Focus on how the medical information addresses a specific health concern or question 49 | Helps patients understand the importance and relevance of the information to their own health situation |
| Use Intuitive Analogies | Employ familiar comparisons to explain complex medical concepts or AI processes 45 | Simplifies abstract ideas and makes them easier for patients to grasp |
| Visualize AI Decisions (if applicable) | Use illustrations or simple graphics to show how AI assists in analyzing reports or generating explanations 49 | Increases transparency and builds trust in the AI-driven aspects of the video |
| Simplify Jargon | Avoid or clearly explain medical and technical terms 8 | Ensures the video is understandable to a broad audience, regardless of their medical background |
| Clear Visuals & Narration | Use high-quality graphics, animations, and a professional, easy-to-understand voiceover 8 | Enhances engagement and helps convey information effectively |
| Keep it Concise | Aim for a video duration of 2-5 minutes to maintain patient attention 8 | Respects the viewer's time and ensures key information is delivered efficiently |
| Ensure Medical Accuracy | Verify all medical information for correctness and consult with healthcare professionals 8 | Crucial for patient safety and building trust in the information provided |
| Human Review & Customization | Have medical professionals review and refine AI-generated content for accuracy and clarity 8 | Adds a layer of expert validation and ensures the video meets the specific needs of the patient |
| Include Captions | Add subtitles for accessibility and to improve comprehension, especially when viewed without sound 45 | Makes the video accessible to a wider audience, including those with hearing impairments or language barriers |

## **Enhancing Patient Comprehension through Augmented and Virtual Reality**

Augmented Reality (AR) and Virtual Reality (VR) technologies offer exciting possibilities for transforming how patients understand their MRI data by providing immersive and interactive experiences.6 AR enhances the real world by overlaying digital information onto it, often through devices like smartphones or AR glasses, while VR creates fully immersive digital environments that can simulate real or imagined scenarios.7Several examples illustrate the potential of AR/VR in visualizing MRI data for patient education. VR can be used to generate detailed 3D models of a patient's anatomy based on their MRI scans, allowing them to explore and understand their own body in an interactive way.7 For instance, a patient scheduled for brain surgery could take a virtual tour inside a 3D reconstruction of their own brain derived from their MRI, increasing their understanding of the procedure.7 AR applications can overlay 3D images from MRI scans directly onto a patient's body as viewed through a device, enabling them to visualize internal structures in relation to their physical form.65 Systems like HoloView provide interactive learning of human anatomical structures through immersive AR visualizations, allowing medical students and potentially patients to dynamically interact with and navigate through the human body.56 Furthermore, VR can be employed to prepare patients for the MRI examination itself by simulating the experience, thereby reducing anxiety and increasing their comfort with the procedure.66The potential of these immersive experiences extends to improving patient understanding of their medical conditions, available treatment options, and the intricacies of their own anatomical structures.6 AR and VR can significantly enhance patient engagement and motivation, particularly in areas like physical therapy and rehabilitation, by making potentially monotonous exercises more interactive and enjoyable through gamification.65 This deeper level of understanding and engagement can lead to improved adherence to treatment plans and ultimately better health outcomes for patients.

**Table 4: Examples of AR/VR Applications in MRI Data Visualization for Patient Understanding**

| Application | Technology Used | Benefit for Patient Understanding |
| --- | --- | --- |
| Virtual Brain Tour | VR (based on MRI scans) 7 | Allows patients to visualize their own brain in 3D, aiding understanding of conditions and surgical procedures |
| 3D Anatomical Overlay | AR (displaying MRI data on patient's body) 65 | Helps patients visualize internal structures and understand their condition in a tangible way |
| Interactive Anatomy Learning | AR (e.g., HoloView) 56 | Enables dynamic interaction with anatomical structures, improving learning and comprehension |
| MRI Exam Simulation | VR 66 | Reduces patient anxiety and increases preparedness for the actual MRI procedure |
| 3D Body Mapping | AR (from MRI scans) 7 | Provides a detailed view of internal organs and abnormalities, improving understanding of diagnosis and treatment plans |
| Virtual Support Groups/Therapy | VR 7 | Offers immersive environments for mental health treatment related to medical conditions or procedures |

## **Technical Deep Dive: Key Frameworks and Tools**

### **Tesseract OCR Engine**

The Tesseract OCR engine is a powerful open-source tool widely used for converting images of text into machine-encoded text.17 It employs a combination of machine learning techniques, including neural networks, and traditional image processing methods to accurately recognize text within images.17 While its accuracy can be high, particularly for printed text on good-quality images, achieving optimal results with medical reports often requires careful consideration of its functionality, limitations, and optimization strategies.Tesseract's accuracy in medical contexts can vary. Studies have reported accuracy around 80-90% on good-quality images, but this can drop significantly with poor image quality, such as low resolution, noise, or skew.20 Medical reports, especially older scanned documents, frequently present these challenges. To mitigate these issues, several optimization strategies can be employed. Pre-processing the input image is crucial; techniques like resizing, converting to grayscale, and applying thresholding or binarization can significantly improve recognition rates.17 Selecting the correct page segmentation mode (PSM) offered by Tesseract, which analyzes different image layouts, can also help the engine better interpret text arrangements.17 Specifying the correct language using the -l flag is essential for accurate character recognition.17 For medical reports containing rare terms, custom symbols, or unique fonts, creating a custom language model can substantially enhance accuracy by allowing Tesseract to better interpret specific characters.17 Regular testing and evaluation of the OCR results are necessary to ensure the engine performs as expected and to make any necessary adjustments.17

### **Three.js and WebXR**

Three.js and WebXR are key frameworks for creating 3D and immersive experiences for web-based medical data visualization, particularly for MRI scans.10 Three.js is a lightweight, cross-browser JavaScript library and application programming interface (API) used to create and display animated 3D computer graphics directly in a web browser.10 Built on top of WebGL, it abstracts away many of the complexities of low-level graphics programming, making it accessible to a wide range of developers.74WebXR is a set of APIs that directly enable immersive virtual reality (VR) and augmented reality (AR) experiences within the web browser itself.73 It allows developers to use JavaScript to access and control VR and AR devices, such as head-mounted displays (HMDs), motion controllers, and environmental sensors.73 Together, Three.js and WebXR provide the foundation for creating interactive 3D visualizations of medical data, including MRI scans, that can be experienced in both VR and AR environments.75 For example, Three.js can be used to render 3D brain models from MRI data within a web browser 79, while WebXR allows users to view and interact with these models in an immersive VR setting using a headset or in an augmented reality context overlaid onto their physical environment via a mobile device.75 These frameworks also facilitate the creation of medical simulations for educational purposes, allowing students and professionals to practice procedures in a safe and controlled virtual environment.74

## **Challenges and Limitations in Current MRI Report Analysis and Patient Communication**

Despite the advancements in technology, several challenges and limitations persist in the current approaches to MRI report analysis and patient communication in radiology.

Data privacy and security are paramount concerns when handling sensitive medical information like MRI reports.9 Any web-based system that stores, analyzes, or displays patient data must adhere to stringent regulations, such as HIPAA in the United States, to ensure confidentiality and prevent unauthorized access. Robust security measures, including data encryption and access controls, are essential.Integrating new technologies with existing healthcare systems, such as Picture Archiving and Communication Systems (PACS) and Electronic Health Records (EHRs), presents another significant challenge.84 These systems often have varying data formats and interoperability standards, which can complicate the seamless exchange of information required for comprehensive MRI report analysis and patient communication workflows.84The accuracy and reliability of AI-driven interpretations and visualizations are also critical concerns.1 Inaccurate AI analyses can lead to patient misunderstandings and potentially impact their care. Similarly, visualizations, whether in video or AR/VR formats, must be medically accurate to provide genuine educational value and avoid misinformation. Rigorous validation and quality control processes are necessary to ensure the clinical utility of these AI-powered tools.Communicating incidental findings, which are discoveries made during an MRI that are unrelated to the primary reason for the scan, poses a unique challenge.85 Determining the most effective way to communicate these findings to patients, ensuring they understand the implications and receive appropriate follow-up care without causing undue anxiety, remains an area of ongoing discussion and research.85Finally, effectively communicating complex medical information in MRI reports to patients with varying levels of health literacy is a persistent challenge.1 Medical jargon, the often technical language used in reports, and variations in report formats can all contribute to patient confusion.86 The emotional impact of potential findings also needs to be considered in communication strategies.87 Furthermore, communication errors within radiology departments can occur at various stages of the imaging process, including during the communication of results, highlighting the need for improved processes and tools.92

## **Impact on Patient Comprehension and Healthcare Provider Communication**

The integration of AI-powered video analysis and AR/VR visualization holds significant potential to revolutionize patient understanding of MRI results and improve the dynamics of communication between patients and healthcare providers.

Studies have shown that AI-translated MRI reports can lead to substantial improvements in patient comprehension compared to traditional radiology reports.1 The use of simplified language generated by AI can make complex findings more accessible to patients. Furthermore, explanatory videos and AR/VR visualizations can enhance this understanding by providing visual context and simplifying intricate medical information.3 By seeing a virtual representation of their MRI findings or watching a clear explanation of the results, patients can gain a better grasp of their medical conditions, potentially leading to increased engagement in their healthcare decisions and adherence to treatment plans.Improved patient understanding has a direct impact on the communication between patients and healthcare providers. When patients have a foundational knowledge of their MRI results, consultations can become more focused and productive.5 Instead of spending valuable time explaining basic findings, healthcare providers can concentrate on discussing treatment options, managing the condition, and addressing specific concerns raised by the patient. This shift can also potentially reduce patient anxiety and improve overall satisfaction with the healthcare experience.1Understanding patient preferences for receiving and understanding radiology reports is crucial for developing effective solutions. While patients generally desire timely access to their results, they often prefer to receive these results and explanations from their referring physician, with whom they have an established relationship.3 However, many patients also express a strong desire for direct access to their radiology reports and appreciate when these reports are provided in simplified formats, with features like glossaries and illustrations to aid comprehension.2 Video reports that offer spoken explanations, along with simple language and annotated images, are also well-received by patients.3 Therefore, patient-centered solutions for MRI report analysis should consider these diverse preferences, potentially offering a combination of direct access to simplified information, multimedia explanations, and opportunities for discussion with their healthcare team to ensure comprehensive understanding and address individual needs.

## **Conclusion and Future Directions**

Web-based video analysis and AR/VR visualization technologies hold significant promise for transforming patient understanding of MRI reports and enhancing communication with healthcare providers. By leveraging AI for report analysis and multimedia for explanation, these tools can bridge the gap created by the complex medical language traditionally used in radiology.

Future research should focus on several key areas. Further validation of the accuracy of AI in analyzing and interpreting MRI reports is essential to ensure the reliability of these tools in clinical practice. Investigating the long-term impact of these technologies on patient outcomes, healthcare costs, and patient engagement will be crucial for justifying their widespread adoption. Optimizing strategies for integrating these tools seamlessly within existing clinical workflows, addressing interoperability challenges with PACS and EHR systems, will also be necessary. Research should continue to explore the broader applicability of AI across various medical imaging modalities and diverse patient populations.1 In the realm of video generation, developing standardized evaluation metrics for AI-generated videos used in medical education and patient information is important.43 Finally, more prospective studies are needed to validate the effectiveness of NLP algorithms in real-world clinical settings.37

Ultimately, the successful implementation of these technologies hinges on a patient-centered approach. Solutions must be designed with the needs and preferences of patients at the forefront, ensuring that they are user-friendly, accessible, and truly enhance understanding. Careful consideration of data privacy, security, and equitable access is paramount to ensure that these advancements benefit all patients and contribute to a more informed and engaged healthcare experience.

#### Works cited

1. Optimizing patient understanding of spine MRI reports using AI: A prospective single-center study - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/389098446_Optimizing_patient_understanding_of_spine_MRI_reports_using_AI_A_prospective_single-center_study>
2. Understanding patient needs and gaps in radiology reports through online discussion forum analysis, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC8055745/>
3. The impact of different radiology report formats on patient ..., accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC12021958/>
4. Full Radiology Report through Patient Web Portal: A Literature Review - PMC, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC7277373/>
5. Mediphany: Clarify Your Medical Imaging Results, accessed May 1, 2025, <https://mediphany.com/>
6. VR/AR Visualization - Medical School, accessed May 1, 2025, <https://med.umn.edu/bmdc/services/vr-ar-visualization>
7. AR and VR in Healthcare: Areas of Application and Real-Life ..., accessed May 1, 2025, <https://www.softeq.com/blog/ar-and-vr-in-healthcare-areas-of-application-and-real-life-examples>
8. Using Explainer Videos to Simplify Medical Information | Levo Health, accessed May 1, 2025, <https://levohealth.com/using-explainer-videos-to-simplify-medical-information/>
9. Free MRI Viewer Online – View & Analyze MRI Scans Instantly - Medicai.io, accessed May 1, 2025, <https://www.medicai.io/free-tools/online-mri-viewer>
10. hongliang666/med3web: Med3Web is a high performance ... - GitHub, accessed May 1, 2025, <https://github.com/hongliang666/med3web>
11. Smart Reporting: Your Medical Reporting and Documentation Software, accessed May 1, 2025, <https://www.smart-reporting.com/>
12. Innovation Ventures Analysis of MRI with Artificial intelligence (AI) for the quantification of Liver Fibrosis - Cincinnati Children's Hospital, accessed May 1, 2025, <https://www.cincinnatichildrens.org/research/support/innovation-ventures/technologies/2020-0405>
13. Cloud PACS For Magnetic Resonance Imaging (MRI) - PostDICOM, accessed May 1, 2025, <https://www.postdicom.com/en/blog/cloud-pacs-for-magnetic-resonance-imaging>
14. Annotated screenshot of the web-based patient radiology portal ..., accessed May 1, 2025, <https://www.researchgate.net/figure/Annotated-screenshot-of-the-web-based-patient-radiology-portal-showing-the-different_fig1_237059474>
15. Role of AI in Medical Imaging Software Development | TestDynamics, accessed May 1, 2025, <https://testdynamics.net/news/ai-in-medical-imaging-software-development/>
16. Key NLP applications in healthcare - N-iX, accessed May 1, 2025, <https://www.n-ix.com/nlp-in-healthcare/>
17. Tesseract Python: Extract text from images using Tesseract OCR | Nutrient - PSPDFKit, accessed May 1, 2025, <https://www.nutrient.io/blog/how-to-use-tesseract-ocr-in-python/>
18. Interactive OCR with Tesseract and Label Studio, accessed May 1, 2025, <https://labelstud.io/blog/interactive-ocr-with-tesseract-and-label-studio/>
19. Tesseract OCR Guide: Exploring Capabilities & Performance, accessed May 1, 2025, <https://unstract.com/blog/guide-to-optical-character-recognition-with-tesseract-ocr/>
20. ceur-ws.org, accessed May 1, 2025, <https://ceur-ws.org/Vol-3792/paper12.pdf>
21. How to extract data using Tesseract OCR? - Docsumo, accessed May 1, 2025, <https://www.docsumo.com/blog/tesseract-ocr>
22. Tesseract OCR: What Is It and Why Would You Choose It? - Klippa, accessed May 1, 2025, <https://www.klippa.com/en/blog/information/tesseract-ocr/>
23. [P] Tesseract OCR - Has anybody used it for reading from PDF-s? - Reddit, accessed May 1, 2025, <https://www.reddit.com/r/MachineLearning/comments/1f87yfg/p_tesseract_ocr_has_anybody_used_it_for_reading/>
24. What is the Best Optical Character Recognition (OCR) Engine - Tenasol, accessed May 1, 2025, <https://www.tenasol.com/blog/what-is-the-best-optical-character-recognition-engine-ocr>
25. Analysis and Benchmarking of OCR Accuracy for Data Extraction Models - Docsumo, accessed May 1, 2025, <https://www.docsumo.com/blogs/ocr/accuracy>
26. Improving the Accuracy of Tesseract 4.0 OCR Engine Using Convolution-Based Preprocessing - MDPI, accessed May 1, 2025, <https://www.mdpi.com/2073-8994/12/5/715>
27. Tesseract OCR vs. CNN-based OCR: Which is Right for You? - Veryfi, accessed May 1, 2025, <https://www.veryfi.com/technology/tesseract-ocr-vs-cnn-based-ocr/>
28. OCR-MRD: Performance Analysis of Different Optical Character Recognition Engines for Medical Report Digitization - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/367972289_OCR-MRD_Performance_Analysis_of_Different_Optical_Character_Recognition_Engines_for_Medical_Report_Digitization/fulltext/63dbb4cbc465a873a27c06a6/OCR-MRD-Performance-Analysis-of-Different-Optical-Character-Recognition-Engines-for-Medical-Report-Digitization.pdf>
29. OCR Benchmark: Text Extraction / Capture Accuracy [2025] - Research AIMultiple, accessed May 1, 2025, <https://research.aimultiple.com/ocr-accuracy/>
30. Artificial Intelligence in Healthcare: Revolutionising Diagnosis and Treatment, accessed May 1, 2025, <https://openmedscience.com/artificial-intelligence-in-healthcare-revolutionising-diagnosis-and-treatment/>
31. Simplifying radiologic reports with natural language processing: a novel approach using ChatGPT in enhancing patient understanding of MRI results - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/375582956_Simplifying_radiologic_reports_with_natural_language_processing_a_novel_approach_using_ChatGPT_in_enhancing_patient_understanding_of_MRI_results>
32. NLP In Radiology: Top Application, Benefits, Challenges & More | Insights AI, accessed May 1, 2025, <https://www.insightsaio.com/blog/nlp-in-radiology/>
33. Advancements and gaps in natural language processing and machine learning applications in healthcare: a comprehensive review of electronic medical records and medical imaging - Frontiers, accessed May 1, 2025, <https://www.frontiersin.org/journals/physics/articles/10.3389/fphy.2024.1445204/full>
34. AI Agents Revolutionizing in Medical Imaging 2024 - Rapid Innovation, accessed May 1, 2025, <https://www.rapidinnovation.io/post/ai-agents-for-medical-image-analysis>
35. Automatic Classification of Tumor Response From Radiology Reports With Rule-Based Natural Language Processing Integrated Into the Clinical Oncology Workflow - ASCO Publications, accessed May 1, 2025, <https://ascopubs.org/doi/10.1200/CCI.22.00139>
36. Natural language processing and machine learning algorithm to identify brain MRI reports with acute ischemic stroke - PMC, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC6394972/>
37. Systematic review of natural language processing (NLP ... - medRxiv, accessed May 1, 2025, <https://www.medrxiv.org/content/10.1101/2024.07.21.24310760v1.full-text>
38. Systematic review of natural language processing (NLP) applications in magnetic resonance imaging (MRI) | medRxiv, accessed May 1, 2025, <https://www.medrxiv.org/content/10.1101/2024.07.21.24310760v1>
39. RadBERT: Adapting Transformer-based Language Models to Radiology - RSNA Journals, accessed May 1, 2025, <https://pubs.rsna.org/doi/full/10.1148/ryai.210258>
40. Extracting laboratory test information from paper-based reports - PMC, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC10629084/>
41. Image Text Extraction and Natural Language Processing of Unstructured Data from Medical Reports - MDPI, accessed May 1, 2025, <https://www.mdpi.com/2504-4990/6/2/64>
42. Artificial Intelligence Large Language Models Improve Patient ..., accessed May 1, 2025, <https://pubmed.ncbi.nlm.nih.gov/40288466/>
43. Application of AI generated text-to-video in medical education ..., accessed May 1, 2025, <https://www.medrxiv.org/content/10.1101/2025.02.03.25321572v1.full-text>
44. Application of AI generated text-to-video in medical education: Systematic review - medRxiv, accessed May 1, 2025, <https://www.medrxiv.org/content/10.1101/2025.02.03.25321572v1>
45. How To Generate A Health Explainer AI Video For Medical Students, accessed May 1, 2025, <https://www.harlemworldmagazine.com/sponsored-love-how-to-generate-a-health-explainer-ai-video-for-medical-students/>
46. Veo | AI Video Generator | Generative AI on Vertex AI - Google Cloud, accessed May 1, 2025, <https://cloud.google.com/vertex-ai/generative-ai/docs/video/generate-videos>
47. Artificial Intelligence for Biomedical Video Generation - arXiv, accessed May 1, 2025, <https://arxiv.org/html/2411.07619v1>
48. The Future of AI in Medical Video Production and Digital Health Content - HIT Consultant, accessed May 1, 2025, <https://hitconsultant.net/2025/03/09/the-future-of-ai-in-medical-video-production-and-digital-health-content/>
49. Best Practices for AI Explainer Video Production | HeyGen, accessed May 1, 2025, <https://www.heygen.com/blog/explainer-video-production>
50. AI Explainer Videos: How to Create [2024 Examples Included] - Mypromovideos, accessed May 1, 2025, <https://mypromovideos.com/blog/ai-explainer-videos-examples/>
51. AI-Powered Instructional Videos: Best Practices - HeyGen, accessed May 1, 2025, <https://www.heygen.com/blog/instructional-videos>
52. The Definitive Guide to Animated Explainer Videos | Breadnbeyond, accessed May 1, 2025, <https://breadnbeyond.com/ultimate-animated-explainer-video-guides/>
53. Healthcare Explainer Video Examples - Content Beta, accessed May 1, 2025, <https://www.contentbeta.com/blog/healthcare-explainer-videos/>
54. 6 Explainer Video Best Practices Backed By Experts - Vyond, accessed May 1, 2025, <https://www.vyond.com/blog/explainer-video-best-practices/>
55. How to Make an Effective Explainer Video in 2025 - Colossyan, accessed May 1, 2025, <https://www.colossyan.com/posts/explainer-video-maker>
56. Holoview: Interactive 3D visualization of medical data in AR - arXiv, accessed May 1, 2025, <https://arxiv.org/html/2501.08736v1>
57. The impact of AR/VR on surgery, patient care and mental health | MobiHealthNews, accessed May 1, 2025, <https://www.mobihealthnews.com/news/impact-arvr-surgery-patient-care-and-mental-health>
58. Leveraging AR/VR in Healthcare Sector - Qentelli, accessed May 1, 2025, <https://qentelli.com/thought-leadership/insights/leveraging-arvr-healthcare-sector>
59. Exploring Augmented Reality Integration in Diagnostic Imaging - PubMed Central, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC11240696/>
60. VR in MRI - VR Software wiki - Brown University, accessed May 1, 2025, <https://www.vrwiki.cs.brown.edu/applications-of-vr/vr-in-medicine/vr-in-mri>
61. Virtual and augmented reality for biomedical applications - PMC - PubMed Central, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC8324499/>
62. Augmented Reality and Virtual Reality in Medical Devices - FDA, accessed May 1, 2025, <https://www.fda.gov/medical-devices/digital-health-center-excellence/augmented-reality-and-virtual-reality-medical-devices>
63. Virtual and Augmented Reality in Medical Imaging - Medical Professionals, accessed May 1, 2025, <https://www.medical-professionals.com/en/virtual-augmented-reality-medical-imaging/>
64. Virtual Reality for Interactive Medical Analysis - Frontiers, accessed May 1, 2025, <https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/frvir.2022.782854/full>
65. AR in Healthcare: Use Cases, Challenges, Implementation Advice, accessed May 1, 2025, <https://mobidev.biz/blog/augmented-and-virtual-reality-in-healthcare-use-cases-challenges-opportunities>
66. Patient Experience and Virtual Reality: The Use of an MRI Exam Simulator, accessed May 1, 2025, <https://pxjournal.org/journal/vol11/iss2/11/>
67. Patient Experience and Virtual Reality: The Use of an MRI Exam Simulator, accessed May 1, 2025, <https://pxjournal.org/cgi/viewcontent.cgi?article=1967&context=journal>
68. Comparing a Virtual Reality–Based Simulation App (VR-MRI) With a ..., accessed May 1, 2025, <https://www.jmir.org/2021/9/e22942/>
69. Can virtual reality improve the patient experience in MRI? - AuntMinnie, accessed May 1, 2025, <https://www.auntminnie.com/imaging-informatics/advanced-visualization/article/15629043/can-virtual-reality-improve-the-patient-experience-in-mri>
70. 92 Virtual & augmented reality projects to improve patient experience | Archives of Disease in Childhood, accessed May 1, 2025, <https://adc.bmj.com/content/104/Suppl_4/A36.1>
71. Augmented Reality in Healthcare: Key Use Cases & Trends - Fingent, accessed May 1, 2025, <https://www.fingent.com/blog/augmented-reality-in-healthcare-use-cases-examples-and-trends/>
72. Deep learning-based NLP data pipeline for EHR-scanned document information extraction, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC9188320/>
73. 3D Web Applications: Definition and Guidelines | Ramotion Agency, accessed May 1, 2025, <https://www.ramotion.com/blog/3d-web-applications/>
74. Building 3D Medical Simulations With Three.js - Shane Brumback, accessed May 1, 2025, <https://www.shanebrumback.com/blog/building-3d-medical-simulations.html>
75. WebXRManager – three.js docs, accessed May 1, 2025, <https://threejs.org/docs/api/en/renderers/webxr/WebXRManager.html>
76. Exploring Three.js for AR Experiences, accessed May 1, 2025, <https://www.threejsdevelopers.com/blogs/exploring-three-js-for-ar-experiences/>
77. Introduction to Three.js and WebGL for 3D Graphics · akash-coded mern · Discussion #217, accessed May 1, 2025, <https://github.com/akash-coded/mern/discussions/217>
78. Interactive, in-browser cinematic volume rendering of medical images - PMC, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC10292767/>
79. WebGL/Three.js used to visualize MRI brain scans in 3D. : r/javascript - Reddit, accessed May 1, 2025, <https://www.reddit.com/r/javascript/comments/11yy2t/webglthreejs_used_to_visualize_mri_brain_scans_in/>
80. SlicerTMS: Real-Time Visualization of Transcranial Magnetic Stimulation for Mental Health Treatment - MICCAI, accessed May 1, 2025, <https://papers.miccai.org/miccai-2024/paper/2402_paper.pdf>
81. Volumetric MRI segmentation (New Feature) - Showcase - three.js forum, accessed May 1, 2025, <https://discourse.threejs.org/t/volumetric-mri-segmentation-new-feature/41141>
82. A Web Platform for the Interactive Visualization and Analysis of the 3D Fractal Dimension of MRI Data. | Request PDF - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/262941552_A_Web_Platform_for_the_Interactive_Visualization_and_Analysis_of_the_3D_Fractal_Dimension_of_MRI_Data>
83. Delivering Innovation in Medical Image Visualization - Kitware, Inc., accessed May 1, 2025, <https://www.kitware.com/delivering-innovation-in-medical-image-visualization/>
84. Challenges & Solutions in Radiology Information Systems - RamSoft, accessed May 1, 2025, <https://www.ramsoft.com/blog/challenges-solutions-in-radiology-information-systems>
85. The Challenges of Communicating Incidental Findings - RSNA, accessed May 1, 2025, <https://www.rsna.org/news/2025/march/communicating-incidental-findings>
86. Insider Guide to Understanding Your Radiology Report - DocPanel, accessed May 1, 2025, <https://www.docpanel.com/insider-guide-understanding-your-radiology-report/>
87. Communicating Findings: A Justification and Framework for Direct Radiologic Disclosure to Patients | AJR - American Journal of Roentgenology, accessed May 1, 2025, <https://ajronline.org/doi/10.2214/AJR.12.9468>
88. Optimizing Patient Communication in Radiology | RadioGraphics, accessed May 1, 2025, <https://pubs.rsna.org/doi/full/10.1148/rg.230002>
89. Failures in communication or follow-up of unexpected significant radiological findings - Investigation report, accessed May 1, 2025, <https://www.hssib.org.uk/patient-safety-investigations/failures-in-communication-or-follow-up-of-unexpected-significant-radiological-findings/investigation-report/>
90. Strategies for Radiology Reporting and Communication. Part 1: Challenges and Heightened Expectations - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/239076655_Strategies_for_Radiology_Reporting_and_Communication_Part_1_Challenges_and_Heightened_Expectations>
91. RadReport reporting templates - RSNA, accessed May 1, 2025, <https://www.rsna.org/practice-tools/data-tools-and-standards/radreport-reporting-templates>
92. Impact of Communication Errors in Radiology on Patient Care, Customer Satisfaction, and Work-Flow Efficiency | AJR - American Journal of Roentgenology, accessed May 1, 2025, <https://www.ajronline.org/doi/10.2214/AJR.15.15117>
93. Impact of Communication Errors in Radiology on Patient Care, Customer Satisfaction, and Work-Flow Efficiency | AJR - American Journal of Roentgenology, accessed May 1, 2025, <https://ajronline.org/doi/abs/10.2214/AJR.15.15117>
94. Communication in Diagnostic Radiology: Meeting the Challenges of Complexity | Request PDF - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/publication/267731487_Communication_in_Diagnostic_Radiology_Meeting_the_Challenges_of_Complexity>
95. Radiologists' Role in the Communication of Imaging Examination Results to Patients: Perceptions and Preferences of Patients | AJR - American Journal of Roentgenology, accessed May 1, 2025, <https://ajronline.org/doi/full/10.2214/AJR.14.12470>
96. Study Shows Patients' Preferences for Radiology Reports, Physician Communication, accessed May 1, 2025, <https://radiology.ucsf.edu/blog/study-shows-patients%E2%80%99-preferences-radiology-reports-physician-communication>
97. Study Shows Patient Preferences for Receiving Imaging Results - RSNA, accessed May 1, 2025, <https://www.rsna.org/news/2019/march/patient-preference-for-imaging-results>
98. Participants' preferences for receiving the results of actual specific recent radiology tests (n 53) - ResearchGate, accessed May 1, 2025, <https://www.researchgate.net/figure/Participants-preferences-for-receiving-the-results-of-actual-specific-recent-radiology_tbl1_42974797>
99. Radiology report format preferred by requesting physicians: prospective analysis in a population of physicians at a university hospital, accessed May 1, 2025, <https://pmc.ncbi.nlm.nih.gov/articles/PMC6472864/>