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# Radiology Report Generation for Scanned Images through Transfer Learning

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**ABSTRACT:** Image The automated generation of radiology reports has potential to know the medical state of the patient. This study demonstrates how transfer learning from deep learning models can be used to generate the report of scanned images from three most commonly used medical imaging modes x-ray, ultrasound, and CT scan. Identifying a suitable convolutional neural network (CNN) model through initial comparative study of several popular CNN models.

**KEYWORDS:** Deep Learning, Transfer Learning, CNN.

## I. INTRODUCTION

Image Radiology is the medical discipline that uses medical imaging to diagnose diseases and guide their treatment. When doctors need to get a better look at what's going on in their patient's bodies, they will often refer them to receive some type of diagnostic imaging. There are several different types of diagnostic imaging tests. Each creates images based on different technology. Some of the most common types of diagnostic imaging tests are X-rays and Computed Tomography scans (CT), and Ultrasound, where the resulting images or pictures will help in making an accurate diagnosis, and choosing the best treatment. There has been a recent interest and developments in the automatic generation of radiology reports by analysing scanned images. Such a technology would reduce the workload of radiologist, streamline the clinical process and speed up the necessary medical intervention preventing serious illnesses or undesired outcomes.

Medical imaging techniques are widely used in hospitals worldwide. The detailed information generated from medical images is necessary for diagnosing illnesses or tracking patients' progress. However, every image requires a radiologist to carefully examine and write a fulltext report to describe the findings. Diagnosing medical images requires an appropriate amount of experience from the radiologists to develop more confident and accurate reports. Nevertheless, many reports conclude with indecisive findings that require the patient to take further tests, including pathology or other advanced imaging methods, as the spectrum of possible cases is too broad. Furthermore, a more glaring issue is the amount of time it takes the radiologist to write a full-text report. It would take on average 10 min or more based on the radiologist's degree of experience, so this would prove very time-consuming when considering the number of cases a radiologist should investigate per day, and in crowded hospitals, regions, and cities, this would be problematic. These reasons combined provided good motives for us to research deep learning models capable of automating report writing.

Radiology report generation plays a crucial role in today's healthcare industry by providing comprehensive and accurate information about radiological studies. These reports are generated based on the analysis and interpretation of medical imaging scans, such as X-rays, CT scans, MRIs, and ultrasounds. They serve as critical communication tools between radiologists, referring physicians, and other healthcare professionals involved in patient care. Enhanced Accuracy and Consistency: Radiology report generation utilizes advanced image analysis algorithms and machine learning techniques, which can improve the accuracy and consistency of the interpretation. Automated processes help minimize human errors, ensuring reliable and consistent reports across different radiologists and healthcare facilities. Efficient Workflow and Time Savings: With automated report generation, radiologists can streamline their workflow and save valuable time. The use of structured report templates, predefined phrases, and standardized terminology allows for quick and efficient documentation, reducing the time required for manual data entry and report creation. Improved Communication and Collaboration: Radiology reports serve as a crucial means of communication between



radiologists and referring physicians. The reports provide detailed findings, observations, and diagnostic impressions, aiding referring physicians in making informed treatment decisions. Electronic sharing and integration of reports with electronic health records (EHRs) facilitate seamless communication and collaboration among healthcare professionals involved in patient care. Data-driven Decision Making: Radiology reports contain essential information that assists healthcare providers in making accurate diagnoses and developing appropriate treatment plans. The structured and comprehensive nature of these reports enables the extraction of relevant data for research, quality improvement initiatives, and clinical decision support systems. Analysing large datasets of radiology reports can help identify patterns, trends, and predictive insights that contribute to evidence-based medicine. Remote Accessibility and Telemedicine: In the era of telemedicine and remote healthcare delivery, radiology reports play a vital role in facilitating remote consultations. Radiologists can generate reports from any location and share them securely with referring physicians or specialists, enabling efficient virtual collaborations and timely patient management. Long-term Documentation and Patient Follow-up: Radiology reports are essential for maintaining a longitudinal record of a patient's imaging history. These reports enable easy retrieval and review of previous studies, facilitating comparison and monitoring of disease progression.

Long-term documentation also supports continuity of care, allowing future healthcare providers to access the patient's radiology findings for ongoing treatment or follow-up. Although having an automated medical report generating system is essential, developing a robust system is highly challenging with a growing number of related research works. Notably, many existing efforts primarily focus on image-based captioning problems by summarizing visual information in images or videos. Compared to regular image captioning problems where there is no need for expert knowledge, medical report generation is much more difficult because medical images usually lack rich contextual information and are more difficult to understand. Moreover, each radiology study is domain-specific and precise, where each report typically consists of many long sentences describing different disease findings. Thus, the main challenges associated with radiology report generation lie in: Accurately recognizing diseases from medical scans (factual correctness). Describing the disease findings with correct medical terminology (language fluency). Handling potential inconsistencies between the detected diseases and generated reports due to long-range dependency issues (clinical coherence).

## II. PROBLEM STATEMENT

Medical imaging techniques are widely used in hospitals worldwide. The detailed information generated from medical images is necessary for diagnosing illnesses or tracking patient's progress. Diagnosing medical images requires an appropriate amount of experience and consumes time of the radiologist to write a full-text report, so this would prove very time consuming in crowded hospitals, regions, and cities, this would be problematic. These reasons combined provided good motives for us to research deep learning models capable of automating report generation. The system needs to analyze the scanned images and extract key features and abnormalities. This involves techniques such as image segmentation, pattern recognition, and feature extraction to identify anatomical structures, lesions, tumours, fractures, or other abnormalities present in the images. The system should be adaptable to various specialties within radiology, such as musculoskeletal, neurology, cardiovascular, or oncology. It should be able to generate specialized reports specific to each specialty, considering the unique characteristics and requirements of different imaging modalities and clinical scenarios. By addressing these challenges, the automated radiology report generation system aims to streamline the reporting process, improve efficiency and accuracy, reduce the burden on radiologists, enhance communication among healthcare professionals, and ultimately contribute to improved patient care and outcomes.

## III. METHODOLOGY

In order to reduce the workload of radiologist, streamline the clinical process and speedup the necessary intervention preventing serious illness and undesired outcomes. The development of such a system will make a great impact for instant diagnosis and medication by generating the automatic radiology report. Through this project a patient can get a rough idea about his health in one stop with various detection techniques such as X-Ray CT Scan and Ultrasound thus decreasing costs for common man and by reducing the number of tests required and thus reducing time constraint.

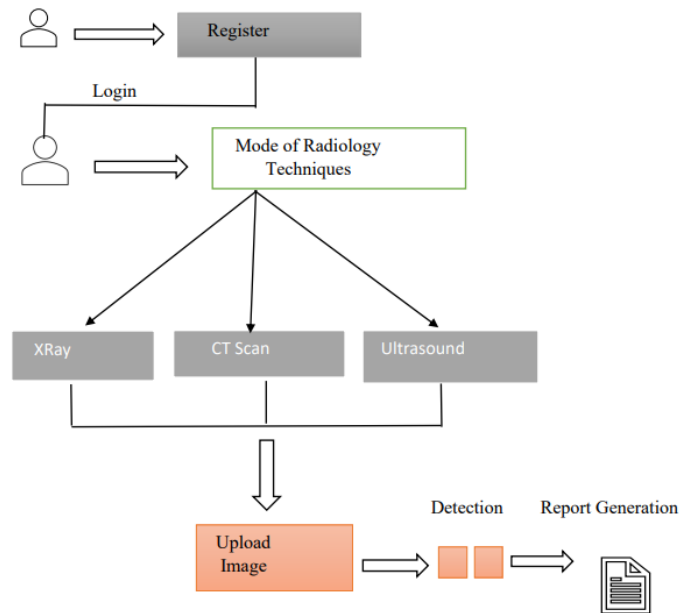


FIGURE 1: SYSTEM ARCHITECTURE

#### IV. EXPERIMENTAL RESULTS

The system architecture for report generation in radiology typically follows a modular and scalable design to handle the complex process of analysing medical images and generating accurate reports. The presentation layer includes user interfaces for user registration and login. Users can provide their details, such as name, email, and password, to create an account. The system verifies the user credentials during the login process. The application layer handles user registration and authentication. It stores user information in a User Database and manages user sessions for secure access to the system.

**Patient Information:** The user interface would include a section for entering or accessing patient information. This may include fields such as patient name, ID, age, gender, and relevant medical history. Users can search for and select patients from a database or create new patient records. In this section, users can choose the imaging study they want to generate a report for. It may involve selecting the modality (e.g., X-ray, CT scan, and MRI) and specific study (e.g., chest X-ray, brain MRI) from a dropdown menu or search bar. Relevant images or scan slices may also be displayed for reference. The main component of the user interface would be a text editor or form where users can document their findings and interpretations.

This section typically provides a structured template or customizable fields for capturing essential details, such as clinical history, radiological findings, impressions, and recommendations. Provides an interface for users to upload radiology images. Users can select and upload images from their local devices or provide URLs for remote images. The application layer processes the uploaded images. It checks for image formats, validates the images for integrity, and applies any necessary pre-processing steps.

The system stores the uploaded images in an Image Repository or a designated storage location. The images are associated with user accounts for later retrieval during report generation. Provides options for users to select the radiology technique used for Scan, or Ultrasound. Users can also specify additional details related to the image acquisition process. The application layer includes algorithms and models specific to each radiology technique for image analysis and detection of abnormalities or specific features. These algorithms process the uploaded images and extract relevant information. The presentation layer enables users to initiate report generation based on the uploaded images and detection results. Users can select the desired images and provide any additional information or notes. The application layer includes a report generation engine that utilizes the extracted information, user provided details, and predefined report templates to generate comprehensive radiology reports. The engine may leverage natural language processing techniques to compose structured and coherent reports. The system stores the generated reports in a Report



Database or designated storage location, associating them with the corresponding user accounts for future retrieval and reference.

Radiology images, such as X-rays, CT scans, MRIs, or ultrasounds, are acquired using specialized imaging devices. Image processing begins with the acquisition of these digital images from the imaging modalities. The images are typically stored in DICOM (Digital Imaging and Communications in Medicine) format, which is the standard for medical image storage and transmission. Before analysis, medical images often undergo pre-processing steps to enhance image quality, correct artefacts, and remove noise. Pre-processing techniques may involve image resizing, noise reduction filters, contrast adjustment, image normalization, and geometric corrections to align and standardize the images.

#### V. CONCLUSION

We have implemented an automatic text detection technique from an image for Inpainting. Our algorithm successfully detects the text region from the image which consists of mixed text-picture-graphic regions. We have applied our algorithm on many images and found that it successfully detect the text region.

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