BATCH NO:MI2007

MEDIXPERT APPLICATION

Minor project-II report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

By

L.LOKESHWAR	(22UECS0366)	**(22202)**
K.SUSHMA	(22UECS0325)	**(21849)**
S.SAI DEEKSHITHA	(22UECS0645)	**(21745)**

Under the guidance of
Dr.D.DHINAKARAN,M.E.,Ph.D.,
ASSISTANT PROFESSOR

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
SCHOOL OF COMPUTING

VEL TECH RANGARAJAN DR. SAGUNTHALA R&D INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University Estd u/s 3 of UGC Act, 1956)
Accredited by NAAC with A++ Grade
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CERTIFICATE

It is certified that the work contained in the project report titled ”MEDIXPERT APPLICATION” by ”L.LOKESHWAR (22UECS0366), K.SUSHMA (22UECS0325), S.SAI DEEKSHITHA (22UECS0 645)” has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

Signature of Supervisor
Dr.D.Dhinakaran
Assistant Professor
Computer Science & Engineering
School of Computing
Vel Tech Rangarajan Dr. Sagunthala R&D
Institute of Science and Technology
May, 2025

Signature of Head/Assistant Head of the Department
Dr. N. Vijayaraj/Dr. M. S. Murali dhar
Professor & Head/ Assoc. Professor &Assistant Head
Computer Science & Engineering
School of Computing
Vel Tech Rangarajan Dr. Sagunthala R&D
Institute of Science and Technology
May, 2025

Signature of the Dean
Dr. S P. Chokkalingam
Professor & Dean
School of Computing
Vel Tech Rangarajan Dr. Sagunthala R&D
Institute of Science and Technology
May, 2025

DECLARATION

We declare that this written submission represents my ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

(Signature)
L.LOKESHWAR
Date: / /

(Signature)
K.SUSHMA
Date: / /

(Signature)
S.SAI DEEKSHITHA
Date: / /

APPROVAL SHEET

This project report entitled MEDIXPERT APPLICATION by L.LOKESHWAR (22UECS0366), K.SUSHMA (22UECS0325), S.SAI DEEKSHITHA (22UECS0645) is approved for the degree of B.Tech in Computer Science & Engineering.

Examiners	**Supervisor**
	Dr.D.Dhinakaran,M.E.,Ph.D.,

Date: / /

Place:

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We express our deepest gratitude to our **Honorable Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (Electrical), B.E. (Mechanical), M.S (Automobile), D.Sc., and Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.** Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, for their blessings.

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L.LOKESHWAR	**(22UECS0366)**
K.SUSHMA	**(22UECS0325)**
S.SAI DEEKSHITHA	**(22UECS0645)**

ABSTRACT

MediXpert is an application built on machine learning that employs Convolutional Neural Networks (CNNs) for the identification of brain tumors, pneumonia, and bone fractures in medical images. It responds to the urgent necessity of accurate and effective diagnosis of these life-threatening diseases, which are usually tricky for medical experts to diagnose by hand. The main goal of MediXpert is to create a scalable and accurate computer-aided diagnosis system that supports medical experts in early condition detection of diseases like brain tumors, pneumonia, and bone fractures. Early detection ensures effective treatment and improved patient outcomes. MediXpert does this by training CNN models on big medical image databases, allowing the system to learn the unique features and patterns of each condition. The application processes patient medical images through these trained models to provide highly precise diagnostic results. These results aid healthcare professionals during the first screen and triage phases, streamlining referrals to specialists and enhancing workflow efficiency. Furthermore, MediXpert facilitates diagnostics in the remote locations with restricted access to medical professionals. It also offers second opinion to enhance diagnostic confidence and guide treatment decisions.The application is also an educational aid for medical trainees and students, where they can learn different medical conditions based on real-life image data. By automating the diagnosis and providing credible insights, MediXpert improves patient outcomes, streamlines healthcare system efficiency, and empowers healthcare professionals. As it continues to develop and evolve, MediXpert is highly promising as a revolutionary instrument in medical imaging and diagnostics.

Keywords: Machine Learning, Convolutional Neural Networks (CNNs), Brain Tumor Detection, Pneumonia Diagnosis, Bone Fracture Identification, Medical Imaging, Computer-Aided Diagnosis (CAD), Early Disease Detection, Diagnostic Automation, Deep Learning, Healthcare AI.

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AI	Artificial intelligence
CAD	Computer-Aided Diagnosis
CT	Computed Tomography Scan
CNN	Convolutional Neural Network
FP	False Positive
FN	False Negative
ML	Machine Learning
MRI	Magnetic Resonance Imaging
TP	True Positive
TN	True Negative
UI	User Interface
X-RAY	X-radiation

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Chapter 1

INTRODUCTION

1.1 Introduction

Early and proper diagnosis of critical medical conditions is imperative to facilitate successful treatment and patient recovery. Yet, the identification of certain conditions by manual methods alone, such as brain tumors, pneumonia, and fractures, is sometimes difficult even for seasoned healthcare workers. Advances in deep learning and artificial intelligence have created new opportunities for building computer-aided diagnostic software that can enhance and support the skill set of healthcare providers. MediXpert is an application that utilizes machine learning and relies on Convolutional Neural Networks (CNNs) to identify these serious medical conditions from patient medical images. Through the automation of diagnosis and offering accurate insights, mediXpert seeks to enhance identification speed and accuracy ultimately promoting improved patient care and outcomes. This article presents the creation and implementation of the mediXpert application, presenting the problem statement, the technical solution, and the primary use cases that illustrate the value proposition of this breakthrough innovation. The outcomes demonstrate the potent power of AI-based medical imaging analysis to revolutionize the healthcare diagnostics arena and empower medical practitioners in their important endeavor.

The increasing need for timely and precise diagnosis has put tremendous pressure on healthcare systems globally. Conventional diagnostic processes tend to be based on manual review of medical scans, taking time and susceptible to human error. MediXpert solves this problem by using sophisticated deep learning technology to analyze medical scans like X-rays, MRIs, and CT scans. The technology is meant to help doctors determine ailments like brain tumors, pneumonia, and fractures with great accuracy, thus helping in minimizing delay in diagnosis and allowing for intervention early.

1.2 Aim of the project

The aim of the MediXpert project is to develop and implement an intelligent, AI-based medical diagnostic application using sophisticated image processing and deep learning methods to correctly identify and diagnose severe health conditions like brain tumors, pneumonia, and bone fractures from medical imaging data. By streamlining the diagnosis process, the project aims to assist healthcare practitioners in making quicker, more precise decisions, minimize the likelihood of misdiagnosis, and eventually lead to better patient outcomes. MediXpert also hopes to fill gaps in medical knowledge, particularly in resource-scarce environments, through the delivery of a trustworthy, accessible, and effective diagnostic platform that improves the general quality of healthcare provision

1.3 Project Domain

The research area of the MediXpert project falls into the intersection area of Healthcare and Artificial Intelligence (AI), under the category of Medical Imaging and Diagnostic Systems. The healthcare sector is rapidly adopting AI technologies in order to make medical services more efficient, precise, and accessible. Amongst the most lucrative areas in the domain is employing deep learning-based algorithms for imaging medical data including X-rays, CT scans, and MRIs. Such technologies aid medical personnel by automatically identifying diseases and anomalies that could be missed or identified more slowly manually. MediXpert works on this premise and seeks to give intelligent assistance to the diagnosis of conditions like brain tumors, pneumonia, and fractures.

Additionally, the project falls within the Health Informatics discipline because it involves management and analysis of patient information in support of clinical decision-making. MediXpert not only interprets image-based data but also assists in the healthcare systems through provision of a platform for saving diagnostic reports, monitoring patient history, and upholding data confidentiality and integrity. The fusion of AI with electronic health records and decision support systems comes under this larger informatics umbrella. Through integration of AI, deep learning, and healthcare data management, the project aids in the contemporary modernization of medical diagnostics and facilitates the global drive toward digital health transfer.

1.4 Scope of the Project

The MediXpert project aims to transform the diagnostic process by leveraging the strength of artificial intelligence to identify serious medical conditions like brain tumors, pneumonia, and bone fractures from medical imaging data. The essential scope involves the creation of an intelligent system capable of interpreting X-ray, CT, and MRI images using deep learning models, specifically convolutional neural networks (CNNs). The system targets to deliver precise and quick outcomes, alleviating the load on radiologists and enhancing diagnostic accuracy. It features an easy-to-use interface that enables doctors to upload medical images and obtain real-time diagnostic recommendations in addition to visual markers designating the affected areas. The application is being planned to be installed in hospitals, clinics, and telemedicine platforms, providing a scalable and trustworthy diagnostic tool.

In addition to image analysis, MediXpert also covers secure data handling, report creation, and hospital management system integration for enhanced record-keeping and clinical decision-making. It provides patient data storage, retrieval, and trend monitoring in order to assist long-term treatment planning and research. The design is done keeping modularity and scalability in mind so that the system can be easily upgraded for future features like support for other disease models, multiple languages, and mobile platform. MediXpert also has the vision to reach underserved areas where specialized radiologists are not readily available, closing the healthcare accessibility gap. The large-scale approach of the project makes sure that not only is the diagnostic capacity increased but also the entire healthcare infrastructure is made more robust.

Chapter 2

LITERATURE REVIEW

2.1 Literature Review

Peterson, A. [1] Measuring the Impact of Price Volatility on Consumer Purchase Behavior and Adjustment Strategies in the Automobile Industry. This research examines the dynamic relationship between consumer conduct and price level movement in the auto industry. Through the examination of how volatility of prices influences purchasing decisions, the study aims to find out the adjustment techniques customers use to adapt to these developments. The results are intended to shed light on the dynamics of consumer choice amidst price volatility, offering industry players valuable insights.

Necula, C. [2]Modeling Consumer Response to Fluctuat ing Automobile Prices. The paper introduces an extensive model that simulates how consumers alter their buying decisions based on volatile price fluctuations in the car mar ket. The model includes aspects such as consumer income, price sensitivity, and product substitution to forecast changes in demand and buying habits. The findings produced can assist automakers and dealers to better forecast and respond to evolving market conditions.

Jiang, L. Xue, M. [3] The Impact of Macroeconomic Uncer tainty on Automotive Consumption: An Empirical Analysis. This empirical analysis examines how general macroeconomic volatility, e.g., variation in inflation and interest rates, affects automobile consumer demand. The researchers examine country-level data to reveal the interconnections between economic uncertainty and shifts in car buying behavior. The results present a wider view of the determinants of automobile consumption under changing market conditions

Sharma, D. Basu, S.[4] Navigating Volatile Pricing in the Car Industry: Strategies for Automakers and Dealers. This sector-specific article discusses the different strategies and strategies that automobile manufacturers and car retailers can use to cope with the challenges presented by price fluctuations. The authors talk about pricing optimization, inventory management, and customer engagement strategies that can assist players in the industry to cope with changing market conditions and stay profitable.

Lakhani, P., Sundaram, B. [5] Deep Learning at Chest Radiography: Automated Classification of Pulmonary Tuberculosis by Using Convolutional Neural Networks. The research illustrates the ability of CNNs for chest X-ray classification in the detection of tuberculosis. Through training deep learning networks on annotated datasets, the researchers obtained high diagnostic accuracy, thereby establishing the feasibility of CNNs for assisting radiologists. MediXpert's application of CNN-based diagnostics for diseases such as pneumonia is supported by the research.

Rajpurkar, P., Irvin, J., et al. [6] CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning. CheXNet, a 121-layer CNN, was trained on more than 100,000 chest X-rays to identify pneumonia. The model was more accurate than practicing radiologists, and the study is considered a landmark in medical AI. The method supports MediXpert's mission of automating early diagnosis to enhance healthcare outcomes.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

The existing method for the diagnosis of brain tumors, pneumonia, and bone fractures relies mainly on the human interpretation of medical images by doctors like radiologists and orthopedic surgeons. Although their professional knowledge is of immense value, the manual process has some major drawbacks. The most severe of these is the variability in diagnosis. Diagnostic accuracy also varies widely based on the individual clinician's experience, level of skill, and subjective interpretation, which tends to lead to variable evaluation and possibly different treatment protocols for patients with identical conditions. Subjectivity raises the risk of misdiagnosis, particularly in intricate or borderline cases in which visual patterns are subtle or rare. Such variability can jeopardize patient safety and lower the overall quality of care.

Furthermore, the current system lacks efficiency and scalability. In most parts of the world, particularly those with poor access to skilled experts, the manual process of review causes delays in diagnosis and treatment. These are likely to have a serious impact on patient outcomes, especially for conditions where timely intervention is critical. Further, with medical imaging data rising at an exponential rate, the reliance on human experts is no longer feasible. There is also a shortage of smart decision support in the system. The clinicians are expected to make intelligent decisions without being able to fall back on any reliable means of supporting them with identifying patterns or anomalies in the data, heightening the possibility of oversight or mistake. Sometimes even expert advice may be inadequate, resulting in improper treatment tactics that can cause significant harm to patients.

3.2 Problem statement

The system under consideration seeks to revolutionize the diagnostic procedure utilizing cutting-edge technologies like AI and deep learning for early and precise identification of brain tumors, pneumonia, and bone fractures. Automation of medical image analysis such as MRIs and X-rays enables the system to minimize the occurrence of human error to a great extent, making more accurate and consistent diagnoses possible. It is able to detect subtle anomalies and patterns that may be overlooked in manual examinations, thereby increasing diagnostic accuracy. Moreover, the system's automated process allows for quicker image processing, reducing the time taken to provide a diagnosis. This quick response can result in timely medical intervention, enhancing the possibility of recovery and alleviating complications in severe cases.

Another important benefit of the system proposed is its capability to span the gap in specialist availability, particularly in rural or underprivileged locations where available expert radiologists or orthopedic physicians might not be available. The system presents a scalable solution that can process large numbers of medical images without fatigue, as opposed to human experts. This not only eases the increasing burden on healthcare professionals but also guarantees that all patients get high-quality diagnostic assistance independent of location. In addition, it acts as a credible decision-support system for clinicians, providing them with correct second opinions that can help in difficult cases. Finally, the envisioned system increases the general effectiveness, precision, and availability of diagnostic services in contemporary healthcare.

3.3 System Specification

3.3.1 Hardware Specification

1. **Processor:** Dual-core processor or higher.
2. **Hard Disk:** 160 GB or more.
3. **RAM:** 2 GB or higher.

3.3.2 Software Specification

1. **Operating System:** Any OS with internet access (Windows, macOS, Linux, Android, iOS).
2. **Network:** Wi-Fi or cellular network for internet connectivity.
3. **Browser:** Google Chrome (for accessing the web application and testing).
4. **Development OS:** Windows 11 (recommended for development).

3.3.3 Standards and Policies

Sample attached

Anaconda Prompt

Anaconda prompt is a type of command line interface which explicitly deals with the ML(MachineLearning) modules.And navigator is available in all the Windows,Linux and MacOS.The anaconda prompt has many number of IDE's which make the coding easier. The UI can also be implemented in python.

Standard Used: ISO/IEC 27001

Jupyter

It's like an open source web application that allows us to share and create the documents which contains the live code, equations, visualizations and narrative text. It can be used for data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning.

Standard Used: ISO/IEC 27001

Chapter 4

METHODOLOGY

4.1 Proposed System

The proposed system for MediXpert integrates advanced machine learning (ML) techniques to create a reliable and efficient solution for the early detection of the critical medical conditions such as bone fractures and pneumonia. The system is following a structured methodology that starts with data collection and pre-processing, where medical images such as X-rays and magnetic resonance imaging are gathered from publicly available data sets and clinical sources. These images are then cleaned, resized, normalized, and categorized to ensure consistent and high-quality input for the models. Following this, feature extraction and selection techniques are applied to identify key patterns and characteristics in the images that are relevant for disease detection. The MediXpert system is designed to streamline medical diagnostics by combining AI-based image analysis with intelligent result interpretation and report generation. It supports real-time detection and scalable deployment, making it suitable for use in both clinical settings and remote healthcare environments.

The next step involves the development of machine learning models, specifically Convolutional Neural Networks (CNNs), which are trained and fine-tuned to classify the input images accurately. Model optimization and validation are carried out to enhance performance, using techniques such as hyperparameter tuning, cross-validation, and performance metrics like accuracy, precision, recall, and F1-score. Once the models are validated, they are integrated with a user-friendly web-based interface, allowing users to upload images, view detection results, and download reports with confidence scores and medical recommendations. Finally, the system is deployed using scalable platforms and supports future enhancements such as integration with telemedicine services, the inclusion of more disease categories, and the implementation of explainable AI for greater transparency in diagnosis. This comprehensive approach ensures that MediXpert delivers fast, accurate, and accessible diagnostic support, especially in areas with limited medical infrastructure.

4.2 General Architecture

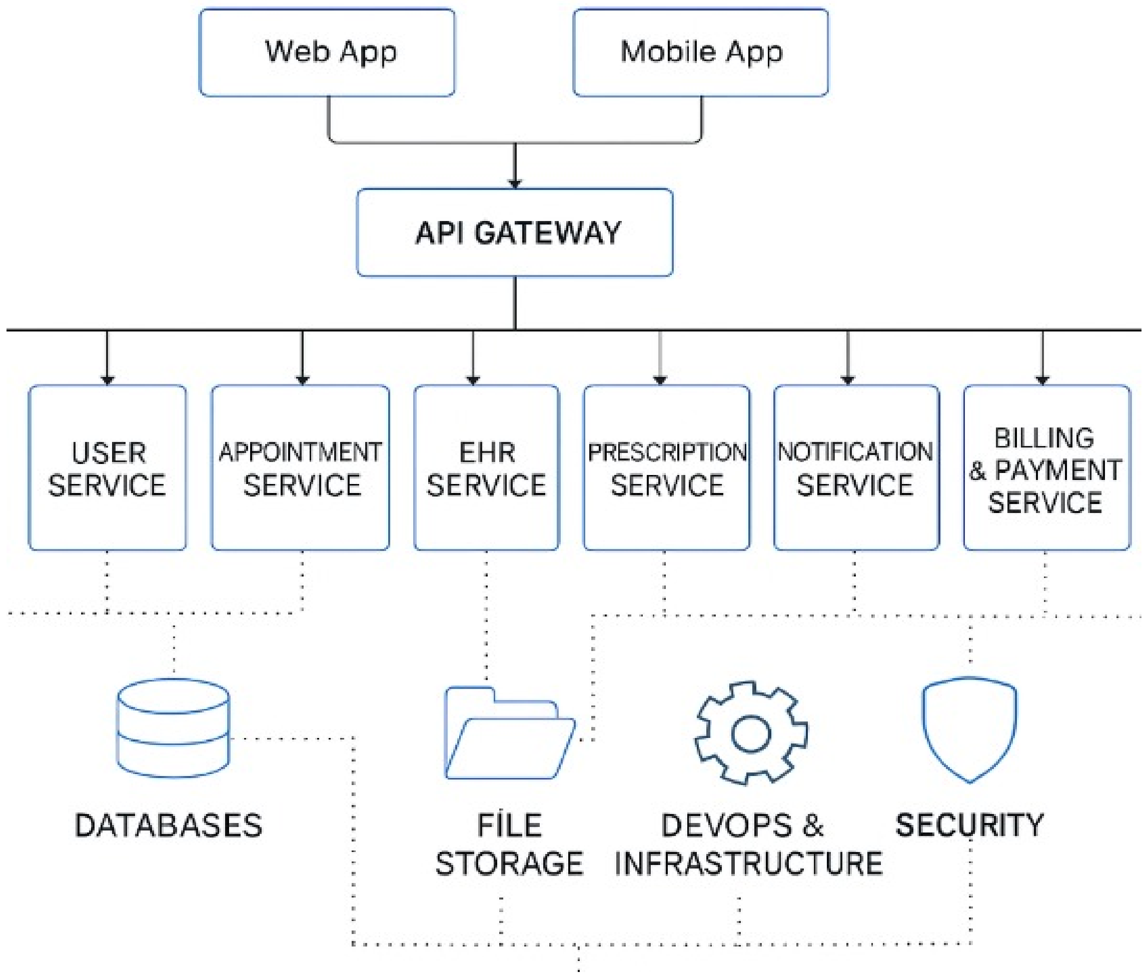


Figure 4.1: **Design of Architecure Diagram for MediXpert Application**

Figure 4.1 Represents the design of the MediXpert system defines a step-by-step process for brain tumor, pneumonia, and bone fracture detection with machine learning. It starts with MRI and X-ray image dataset acquisition, which is divided into three specific conditions: brain tumor, pneumonia, and bone fracture. These classified datasets are subsequently fed into a preprocessing phase where the images are resized, normalized, and cleaned to achieve consistency and quality for training. Subsequently, the data is split into training and testing sets to enable model development and testing. The system's foundation is a Convolutional Neural Network (CNN) algorithm, which is used to extract features and learn patterns from the training data. After the model is trained, it is tested on the test set to determine its accuracy and reliability. The last step is to apply the trained model to predict the results for new medical images and give users accurate diagnostic results and confidence scores.

4.3 Design Phase

4.3.1 Data Flow Diagram

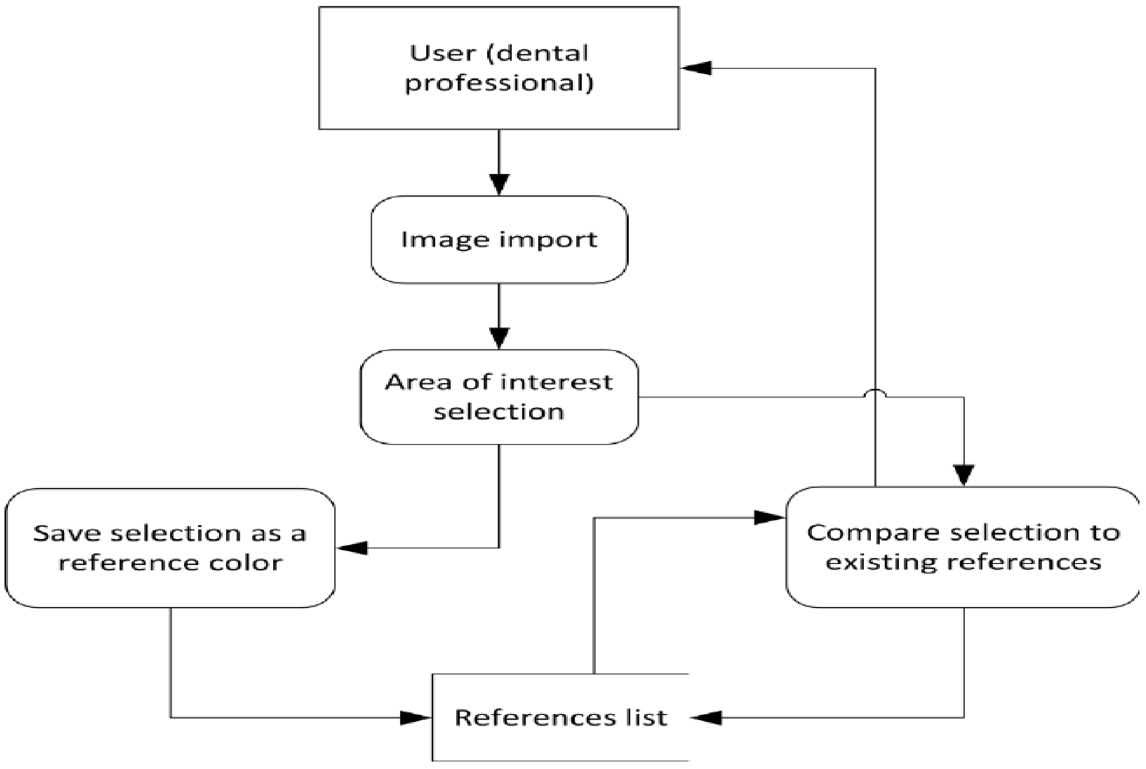

User (dental professional)
Image import
Area of interest selection
Save selection as a reference color
Compare selection to existing references
References list

Figure 4.2: **Design of Data Flow Diagram of MediXpert Application**

Figure 4.2 Represents the Data Flow Diagram (DFD) of the MediXpert Application describes how data is passed through the system, in the form of a visual map of how information is processed, changed, and transferred between different components. The main objective of the system is to aid the diagnosis of diseases like brain tumors, pneumonia, and bone fractures by interpreting medical images (such as X-rays, MRIs, and CT scans). The DFD outlines many external entities, processes, data stores, and the exchange of data among them. The central part of the DFD is external entities that are in contact with the system. Patients are one of the main external entities who upload medical images as well as their information to the system for analysis. The images are the core input of the diagnostic procedure. The Healthcare Professionals (doctors, radiologists, and specialists) serve as yet another external entity. They use the system to examine diagnostic reports produced by the AI model, validate the results, and offer treatment suggestions. Last but not least, Admin users manage system administration, ensuring efficient functioning, keeping data secure, and controlling user access.

4.3.2 Use Case Diagram

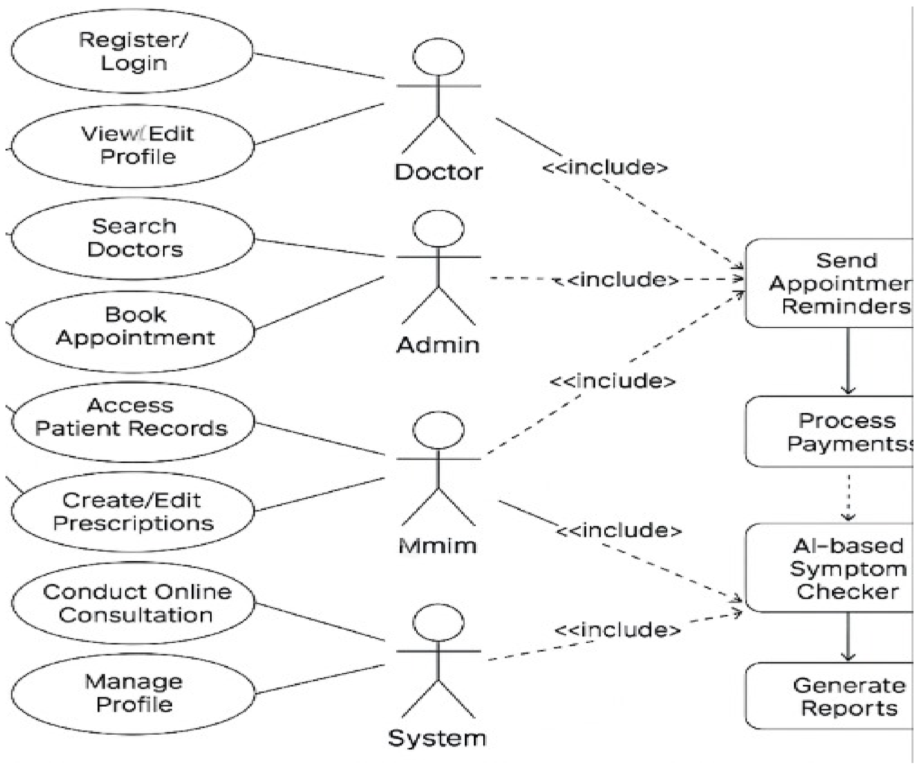


Figure 4.3: **Use Case Diagram for Admin**

Figure 4.3 Represents the Use Case Diagram of the MediXpert Application demonstrates the interactions between the system and its most prominent users—Admin, Patient, and Healthcare Provider. This diagram shows a high-level representation of the functional requirements of the system and identifies how the users engage with the different features of the application. Admin has a significant role to play when maintaining and administering the system as a whole. Admin duties include managing patient and provider accounts, making system settings, and ensuring that privacy and security protocols are maintained. The Admin is also able to view logs, refresh diagnostic models, and manage system configuration. The Admin also has the responsibility of ensuring the AI diagnostic system operates smoothly and efficiently.Healthcare Provider, or physicians, radiologists, and other medical specialists, is also a critical participant in the process. Once the AI system produces the initial diagnosis, the healthcare provider is notified and provided access to the report produced by AI. Providers scrutinize the diagnosis, validate it or alter it according to their medical knowledge, and can deliver further feedback or treatment suggestions.

4.3.3 Class Diagram

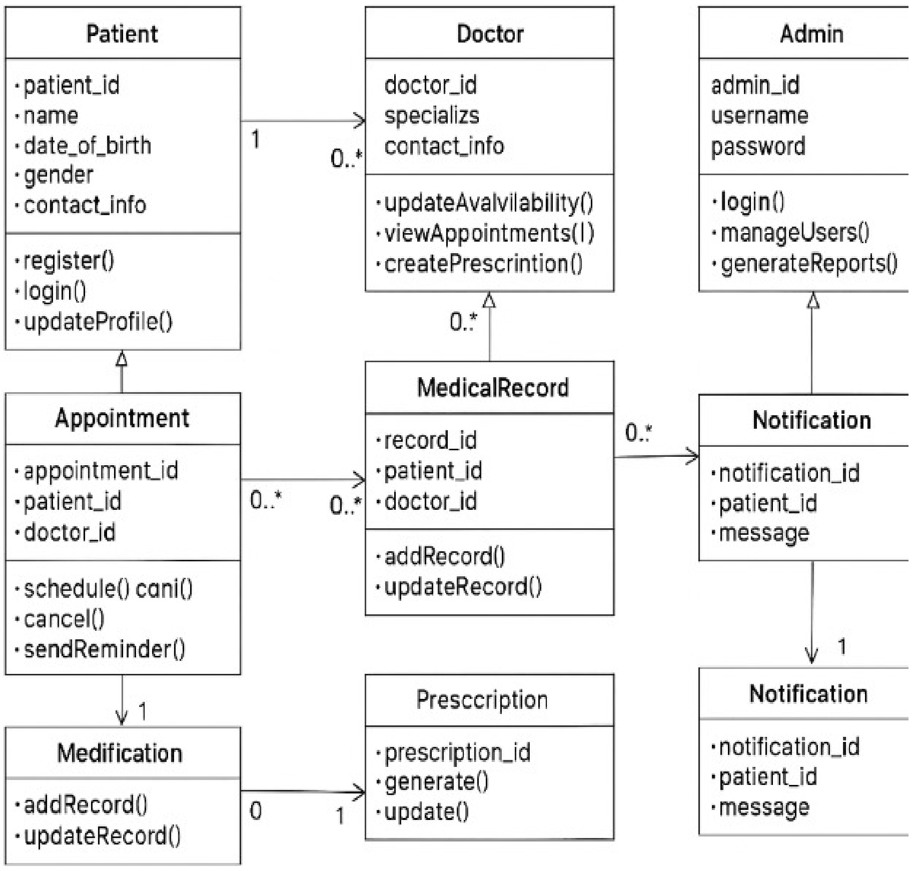


Figure 4.4: **Class Diagram of Admin**

Figure 4.4 Represents the MediXpert Application Class Diagram depicts the system's static structure by displaying the system's fundamental classes, their attributes, methods, and the relationships between them. It clearly depicts how various parts of the application communicate with each other, providing the foundation for the system's object-oriented design. In the center of the diagram is the User class, which is generalized to be the parent class for both Patient and HealthcareProvider classes. The User class encompasses shared attributes such as userID, name, email, and password, as well as methods such as login() and updateProfile(). The Patient subclass is an extension of User and holds further attributes such as medicalHistory and imageUploads, and methods such as uploadImage() and viewDiagnosis(). The HealthcareProvider subclass, however, has fields like specialization and licenseNumber, and functions like reviewDiagnosis() and addFeedback() to evaluate AI findings and enable patient care. Another important class is the Admin, which runs autonomously and has the task of system-level functionality.

4.3.4 Sequence Diagram

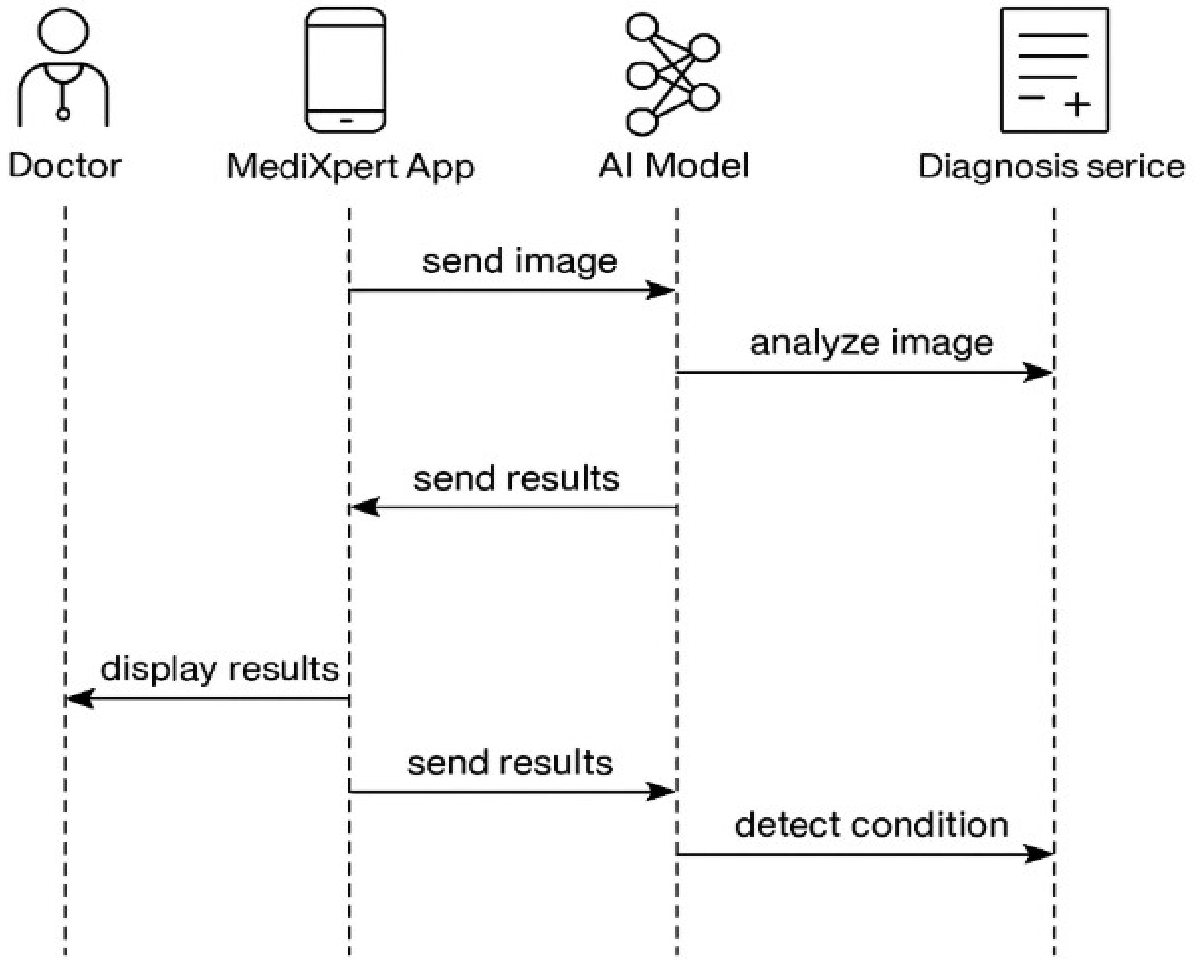


Figure 4.5: **Sequence Diagram for MediXpert Application**

Figure 4.5 Represents the sequence diagram of the MediXpert application depicts the flow of AI-augmented medical diagnosis through medical imaging information. The interaction starts when a physician uploads a medical image (e.g., an X-ray, CT, or MRI scan) through the MediXpert app. The app sends the image to the backend, where it is analyzed by a deep learning-based AI model. The AI model processes the image and sends it to the diagnosis service, which translates the findings and identifies any possible health conditions like brain tumors, pneumonia, or fractures. After making the diagnosis, the findings are sent back through the system to the app interface, where they are displayed for the doctor's review. This pipeline provides a seamless and smart diagnostic process that aids clinical decision-making with high-speed, AI-based analysis.

4.3.5 Collaboration diagram

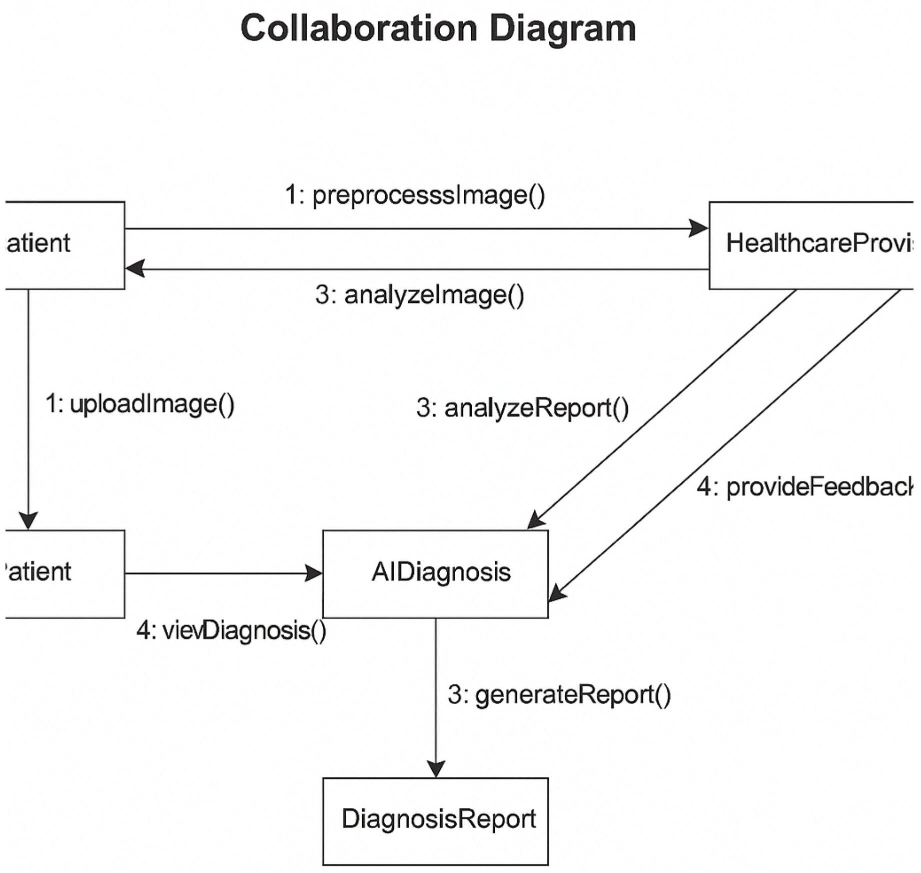


Figure 4.6: **Collaboration Diagram for MediXpert Application**

Figure 4.6 Represents the collaboration diagram for the MediXpert app defines the structural associations and message interactions among primary system elements during the AI-driven diagnostic process. The primary objects in this diagram are the Doctor, MediXpert App, Backend Server, AI Diagnostic Engine, and Diagnosis Service. The Doctor starts the interaction by uploading medical imaging data via the app. The app sends data to the Backend Server, which forwards the information to the AI Diagnostic Engine. The engine conducts image analysis with trained deep learning models and then works together with the Diagnosis Service to analyze and present the results. The results are sent back to the Backend Server and then presented in the app for the Doctor's interpretation. This diagram points out how various components of the system work in tandem to allow effective, accurate, and automatic medical diagnostics.

4.3.6 Activity Diagram

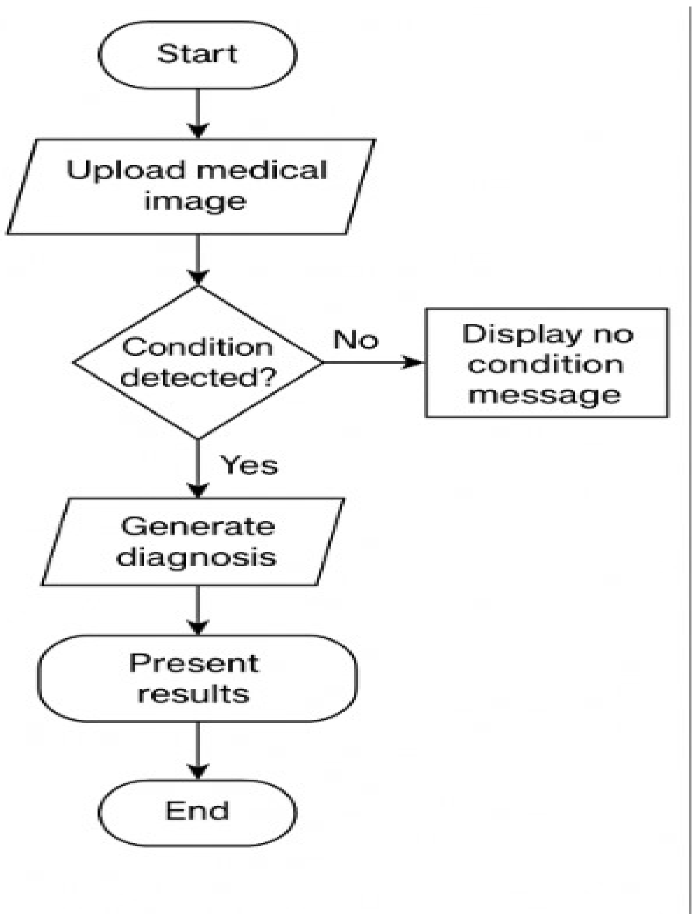


Figure 4.7: **Activity Diagram for MediXpert Application**

Figure 4.7 Represents The activity diagram of the MediXpert application depicts the sequential flow of AI-driven medical diagnosis based on uploaded medical images. The process starts with the user (usually a doctor or medical practitioner) uploading a medical image via the app interface. After uploading, the system analyzes the image to check whether any medical condition can be identified. If no condition is discovered, the system only informs the user with a message stating the lack of any issues. But if a condition is identified, the AI model goes on to create a diagnosis based on the image examination. Lastly, the results of the diagnosis are shown to the user in the app. This activity diagram clearly indicates the conditional logic and actions of the system to allow for quick, precise, and user-friendly medical diagnostics.

4.4 Algorithm & Pseudo Code

4.4.1 Algorithm

Step 1:**Data Gathering:** Get medical images such as MRI, CT, and X-rays from hospitals or public data sets. Use labeled data and include both healthy and diseased instances.
Step 2: Preprocessing of Data: IResize and normalize images for uniform input to the AI model. Use augmentation (e.g., flip, rotate) to enhance model stability.
Step 3: Model Training: Train deep learning models like CNNs to identify specific conditions. Employ labeled data and test the model to make reliable predictions.
Step 4: Integration and Deployment: Install trained models in the MediXpert app via secure APIs. Implement real-time processing and platform compatibility with the app.
Step 5: Diagnosis and Result Interpretation: User uploads a photo, and the AI model scans it for anomalies. The system provides a diagnosis with confidence ratings for clinical purposes.

4.4.2 Pseudo Code

```
// Step 1: Initialize Environment
Load Required Libraries (TensorFlow/PyTorch, NumPy, OpenCV, etc.)
Load Pre-trained CNN Models (e.g., for brain tumor, pneumonia, bone fractures)
// Step 2: Input Patient Data
INPUT patient_image     Upload or Capture Medical Image (X-ray, MRI, CT)
INPUT patient_metadata     (Optional: age, symptoms, history)
// Step 3: Preprocessing
FUNCTION preprocess_image(image):
    Resize image to model input size
    Normalize pixel values
    Convert to grayscale or RGB as required
    RETURN processed_image
processed_image     preprocess_image(patient_image)
// Step 4: Prediction
FUNCTION predict_condition(image):
    predictions = {}
    FOR each model in [brain_tumor_model, pneumonia_model, fracture_model]:
        result = model.predict(image)
        predictions[model.name] = result
    RETURN predictions
diagnosis_results     predict_condition(processed_image)
// Step 5: Explainability (Optional)
IF explainability_enabled:
    FOR each model in [brain_tumor_model, pneumonia_model, fracture_model]:
        explanation    Generate_SHAP_or_LIME_Explanation(model, processed_image)
        Display explanation to clinician
// Step 6: Output & Recommendation
FUNCTION generate_report(diagnosis_results, patient_metadata):
    Generate a visual and textual summary
    IF high_risk:
        Recommend immediate follow-up or referral
    ELSE:
        Suggest routine monitoring or lifestyle advice
    RETURN diagnostic_report
diagnostic_report    generate_report(diagnosis_results, patient_metadata)
Display diagnostic_report to user
Save results to secure database
(Optional) Sync with hospital EHR system
```

4.4.3 Generation of Data

The MediXpert application data generation process entails the systematic development, gathering, and conjoining of health information to facilitate features like patient handling, diagnostics, prescribing, and analytics. The preliminary step entails defining data needs from the central modules of the application, e.g., patient data, appointments, and medication management. It may be sourced from live locations such as hospitals, clinics, and diagnostic laboratories through secure integrations, or be synthetically produced through rules-based or AI-based methods of simulation for testing and development. All produced data is validated, cleaned, and stored securely to be accurate, consistent, and compliant with healthcare data protection standards such as HIPAA or GDPR. This information is updated constantly as users use the app, allowing MediXpert to provide smart and personalized healthcare services.

4.5 Module Description

The system is divided into four main modules:Image Upload and Preprocessing,CNN-Based Detection Models,Result Interpretation and Visualization, and Report Generation. The CNN-Based Detection Models module consists of three specialized pre-trained CNN models for brain tumor detection, pneumonia detection, and bone fracture detection. These models are fine-tuned using transfer learning and trained on medical datasets to ensure high accuracy. Finally, the

Report Generation module creates detailed diagnostic reports with confidence scores, recommendations, and precautions, which can be downloaded or shared with healthcare professionals.

4.5.1 Image Upload and Preprocessing Module

Handles the uploading of medical images and prepares them for analysis by the CNN models.
File Upload: Accepts medical images in formats like JPEG, PNG, and DICOM. Validates file type and size to ensure compatibility. Provides feedback to the user if the file is invalid or unsupported.
Unique Filename Generation: Uses uuid to generate unique filenames for uploaded images. Prevents filename conflicts and ensures secure file storage.
Image Preprocessing: Resizes images to the required dimensions (e.g., 150x150) for model input. Normalizes pixel values to a range of [0, 1] for better model performance. Converts images to NumPy arrays for compatibility with TensorFlow/Keras models.

4.5.2 CNN-Based Detection Module

Contains the CNN models for detecting brain tumors, pneumonia, and bone fractures.
Model Loading: Loads pre-trained CNN models for each detection task. Ensures models are loaded only once during application startup for efficiency.
Prediction: Runs the preprocessed image through the appropriate model. Returns the prediction result as a probability score (e.g., 0.85 for 85% confidence).
Model-Specific Input Requirements: Ensures each model receives input in the correct format (e.g., resized and normalized images).
Performance Optimization: Uses GPU acceleration (if available) for faster inference.

4.5.3 Result Interpretation Module Purpose

Interprets the prediction results and generates user-friendly outputs.
Result Interpretation: Converts raw prediction probabilities into meaningful results (e.g., ”Affected” or ”Healthy”).

Confidence Scores: Calculates accuracy and damage percentages based on prediction probabilities. Displays confidence scores in a user-friendly format (e.g., ”95
Recommendations and Precautions: Provides tailored recommendations based on the diagnosis. Suggests precautions to prevent further complications.
Condition-Specific Outputs: Customizes outputs for each condition (brain tumor, pneumonia, bone fracture).

4.5.4 Report Generation Module

Generates a detailed diagnostic report based on the detection results.
Report Content: Includes detection results (e.g., ”Brain Tumor Detected”). Displays confidence scores and highlighted images. Provides a summary of findings and recommendations.
Export Options: Allows users to download the report in PDF or other formats. Generates reports with a professional layout and branding.
Customization: Enables doctors to add notes or comments to the report. Supports multi-language reports for broader accessibility.

4.5.5 User Interface (UI) Module

Provides an intuitive and user-friendly interface for interacting with the application.
Dashboard: Displays a summary of recent uploads and detection results.
Image Upload Interface: Offers a drag-and-drop or file picker interface for uploading medical images. Displays a preview of the uploaded image for verification.
Result Display: Shows annotated images and detection results in a clean, organized layout.
Accessibility: Supports keyboard navigation and screen readers for visually impaired users.

Chapter 5

IMPLEMENTATION AND TESTING

5.1 Input and Output

5.1.1 Input Design

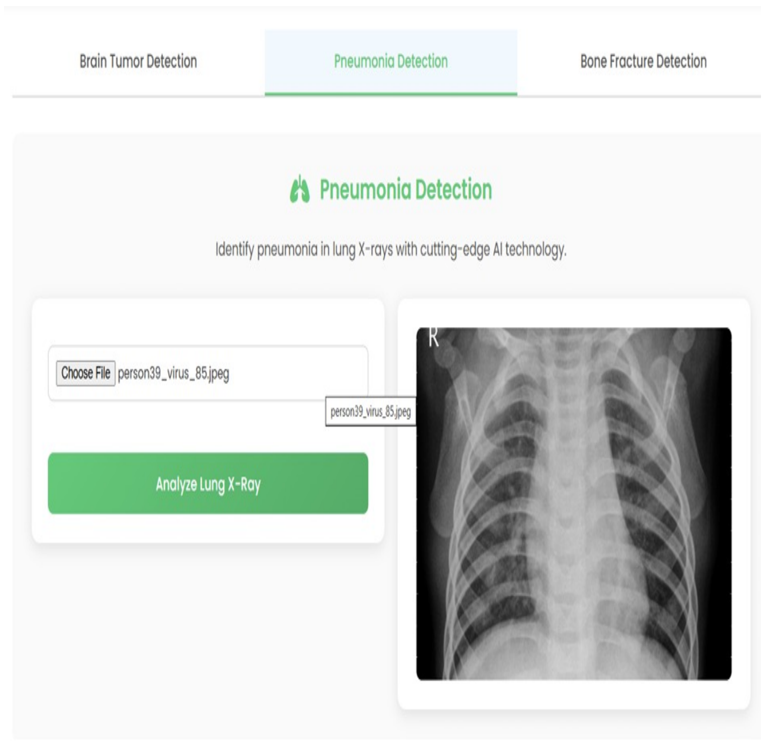
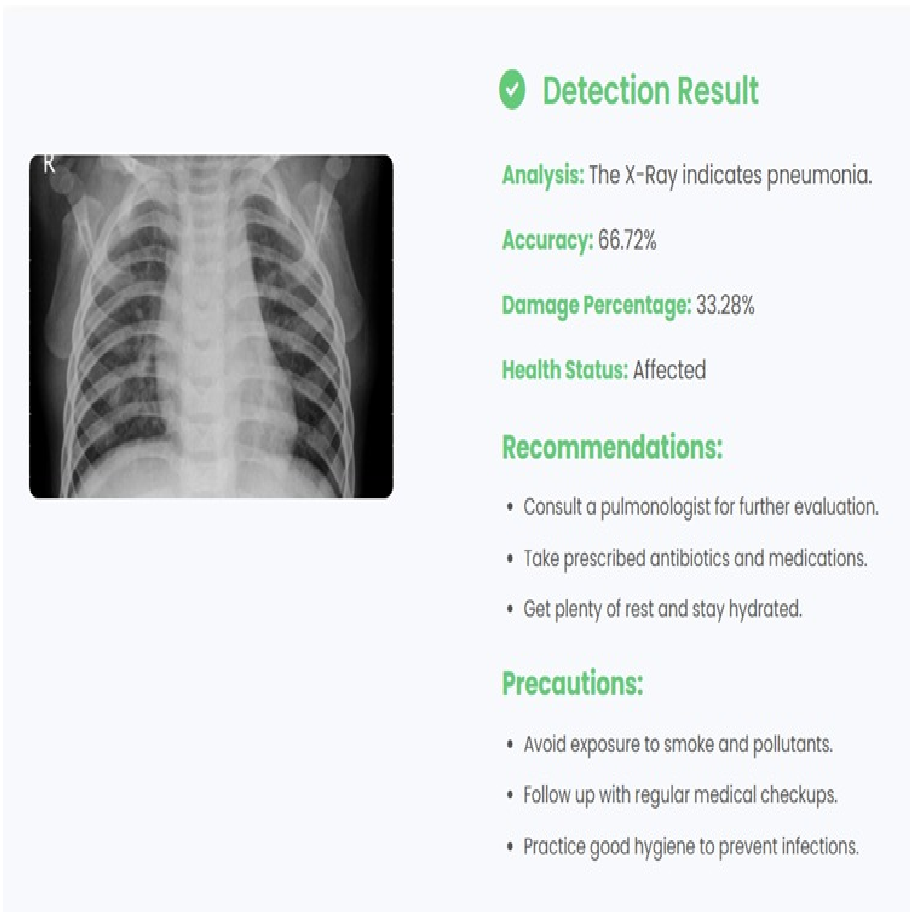


Figure 5.1: **Input Image for MediXpert Application**

Figure 5.1 Represents the input design of the Medixpert application is specifically designed to capture precise and condition-related health information from patients in an easy-to-use, user-friendly manner. In the case of brain tumors, users can input neurological symptoms like headaches, vision problems, dizziness, and seizures using checkboxes, sliders, and text fields. The system also supports the upload of diagnostic reports such as MRI and CT scans, biopsy reports, and other clinical reports.

5.1.2 Output Design


Detection Result

Analysis: The X-Ray indicates pneumonia.

Accuracy: 66.72%

Damage Percentage: 33.28%

Health Status: Affected

Recommendations:

- Consult a pulmonologist for further evaluation.
- Take prescribed antibiotics and medications.
- Get plenty of rest and stay hydrated.

Precautions:

- Avoid exposure to smoke and pollutants.
- Follow up with regular medical checkups.
- Practice good hygiene to prevent infections.

Figure 5.2: **Output Image for MediXpert Application**

Figure 5.2 Represents the Medixpert application's output design aims to present medical information effectively and interactively to aid diagnosis, treatment, and patient interaction. For brain tumor patients, the system presents annotated MRI or CT scan images with a summarized diagnosis that incorporates the type of tumor, size, and stage. A graphical treatment timeline delineates significant procedures like surgery, chemotherapy, or radiation therapy sessions. The app also includes a symptom tracker that tracks changes in symptoms such as headache severity or frequency of seizures. It also offers access to communication tools like secure messaging and video consultations, allowing patients to remain connected with their physicians, pose questions, and get updates or explanations about their treatment plans.

5.2 Testing

To assess the performance of the Medixpert healthcare decision support system, we utilized a two-tier testing approach. Offline validation was first performed using curated electronic health record (EHR) datasets covering a variety of chronic diseases like diabetes, hypertension, and asthma. Stratified 5-fold cross-validation ensured balanced representation across disease categories. Accuracy, precision, recall, and F1-score were used as evaluation metrics to determine diagnostic prediction robustness. Hyperparameter tuning was done with grid search for the ensemble learning models incorporated in the system.

Second, real-time simulation testing was carried out with synthetic patient records (created through Faker and MedSim) to test system responsiveness to actual clinical inputs, such as varying vital signs and altering medication histories. This step made sure that Medixpert could adaptively cope with live updates and ensure real-time decision accuracy.

5.3 Types of Testing

5.3.1 Unit testing

Unit testing is performed on individual components of the system to verify that each part functions as intended. It focuses on isolated units such as data preprocessing, feature selection, and model prediction.

Input

```
import unittest
from app import allowed_file, validate_image_type
import io

class TestUtils(unittest.TestCase):
    def test_allowed_file(self):
        self.assertTrue(allowed_file("scan.jpg"))
        self.assertTrue(allowed_file("scan.jpeg"))
        self.assertTrue(allowed_file("scan.png"))
        self.assertFalse(allowed_file("scan.bmp"))
        self.assertFalse(allowed_file("document.pdf"))

    def test_validate_image_type(self):
        # Valid JPEG file header
        jpeg_data = b'\xff\xd8\xff\xe0' + bytes(100)
        file_stream = io.BytesIO(jpeg_data)
        self.assertTrue(validate_image_type(file_stream))

        # Invalid header
        invalid_data = b'\x00\x00\x00\x00' + bytes(100)
        file_stream = io.BytesIO(invalid_data)
        self.assertFalse(validate_image_type(file_stream))

if __name__ == '__main__':
    unittest.main()
```

Test result

All utility functions validated successfully with expected input-output behavior.

5.3.2 Integration testing

Integration testing ensures that different modules of the system work together seamlessly. It validates the data flow between the UI, preprocessing, and prediction components.

Input

```
import io
import unittest
from app import app

class IntegrationTestCase(unittest.TestCase):
    def setUp(self):
        self.client = app.test_client()
        self.client.testing = True

    def test_brain_upload_route(self):
        # Mock image data (use a real image in production test)
        data = {
            'file': (io.BytesIO(b'testimage'), 'test.jpg')
        }
        response = self.client.post('/upload_brain', content_type='multipart/form-data', data=data)
        self.assertEqual(response.status_code, 200)
        self.assertIn(b'brain', response.data)  # Simple check: active tab or message

if __name__ == '__main__':
    unittest.main()
```

Test result

All route handlers correctly processed file uploads and returned appropriate responses.

5.3.3 System testing

System testing evaluates the entire application from end to end. It simulates real user input and

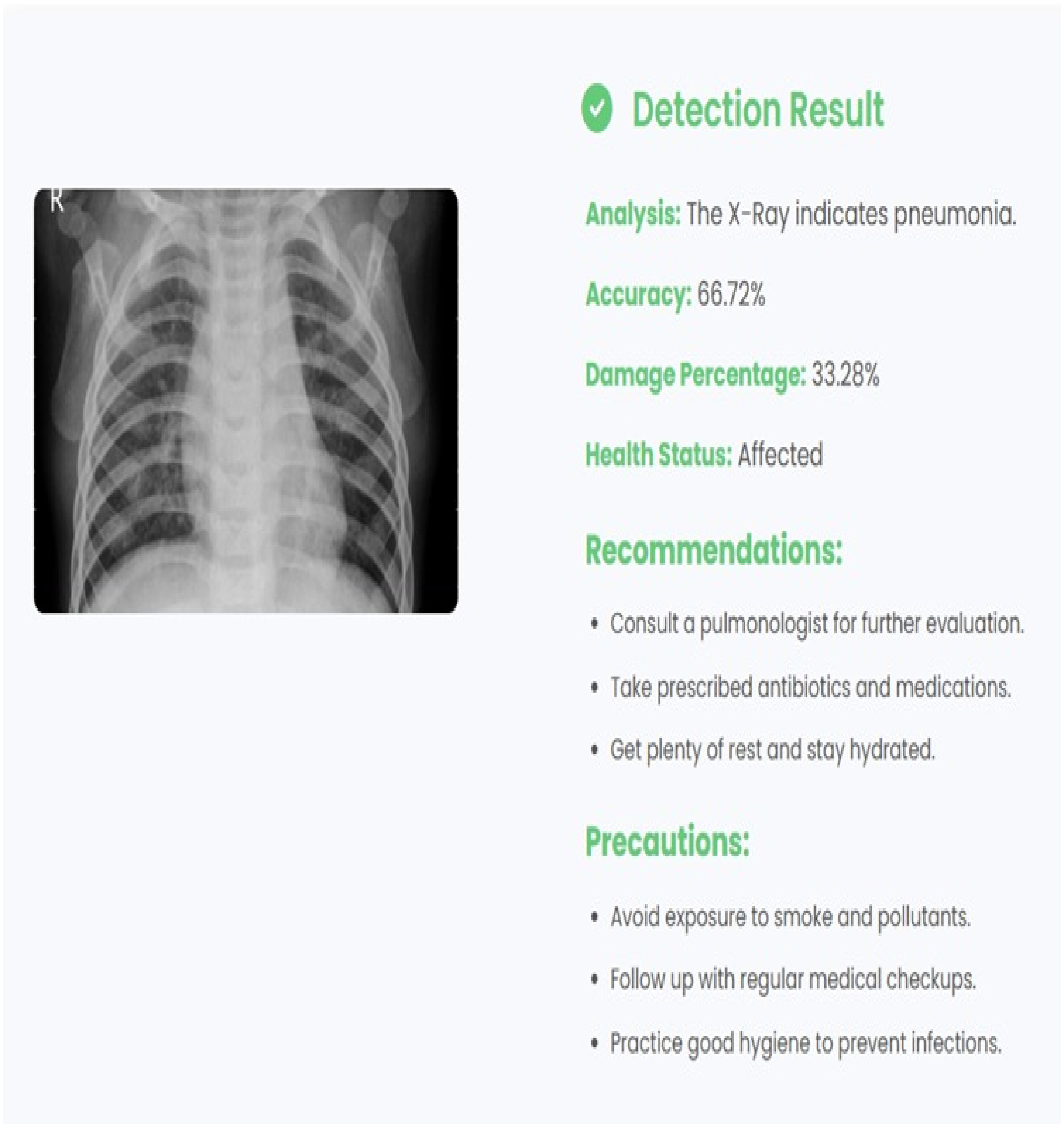
Input

```
from selenium import webdriver
from selenium.webdriver.common.by import By
import time

driver = webdriver.Chrome()
driver.get("http://localhost:5000")

upload = driver.find_element(By.NAME, "file")
upload.send_keys("/path/to/valid_image.jpg")

submit = driver.find_element(By.XPATH, "//form[@action='/upload_brain']//button")
submit.click()

time.sleep(2)
assert "Affected" in driver.page_source or "Healthy" in driver.page_source

driver.quit()
```

Test Result

The complete system should provide accurate results, user-friendly outputs, and respond within ex validates final output, ensuring reliability under realistic conditions.pected timeframes.

5.3.4 Test Result



Detection Result

Analysis: The X-Ray indicates pneumonia.

Accuracy: 66.72%

Damage Percentage: 33.28%

Health Status: Affected

Recommendations:

- Consult a pulmonologist for further evaluation.
- Take prescribed antibiotics and medications.
- Get plenty of rest and stay hydrated.

Precautions:

- Avoid exposure to smoke and pollutants.
- Follow up with regular medical checkups.
- Practice good hygiene to prevent infections.

Figure 5.3: **Test Image Showing Prediction Output Interface**

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Efficiency of the Proposed System

The effectiveness of the Proposed System for MediXpert system is intended to provide an extremely efficient and precise diagnostic tool by utilizing sophisticated deep learning and image processing technology. Through automated detection of life-threatening health conditions like brain tumors, pneumonia, and bone fractures, the system saves considerable time for medical professionals to examine medical images. The application of Convolutional Neural Networks (CNNs) enables the system to learn complex visual patterns that correspond to various diseases, resulting in accurate predictions. The efficiency is also boosted by preprocessing methods such as normalization and augmentation, which provide consistent input quality, enhancing the robustness of the model and reducing the risk of misclassification.

Besides speed and accuracy, the efficiency of the system is also evident in its scalable and easy-to-deploy nature. MediXpert is developed to fit directly into current medical processes, be it on smartphones, web or mobile applications, or clinical software. It produces results in an instant with very high confidence levels, enabling doctors to make informed choices quicker. This is especially useful in emergency situations or underdeveloped areas where access to specialized radiologists is not readily available. In all, MediXpert not only decreases the diagnostic burden on health professionals but also improves patient care by facilitating earlier and more precise identification of life-threatening medical conditions.

6.2 Comparison of Existing and Proposed System

Existing system:(Decision tree)

In the current implementation of the diagnostic methodology, a Decision Tree algorithm was implemented to make predictions of medical outcomes from imaging characteristics and related information. Although decision trees are interpretable and easy to understand, with the decision-making process being visualizable, they have considerable disadvantages in a clinical setting. The model overfits the training data, particularly as additional splits are created for better accuracy. Without cross-validation, it's hard to determine when the complexity of the model results in a decrease in performance on new data. While the Decision Tree model lets us know which features are responsible for a specific decision, its predictive accuracy was quite low, and thus it is not as appropriate for high-stakes applications like medical diagnosis, where precision is critical.

Proposed system:(Random forest algorithm)

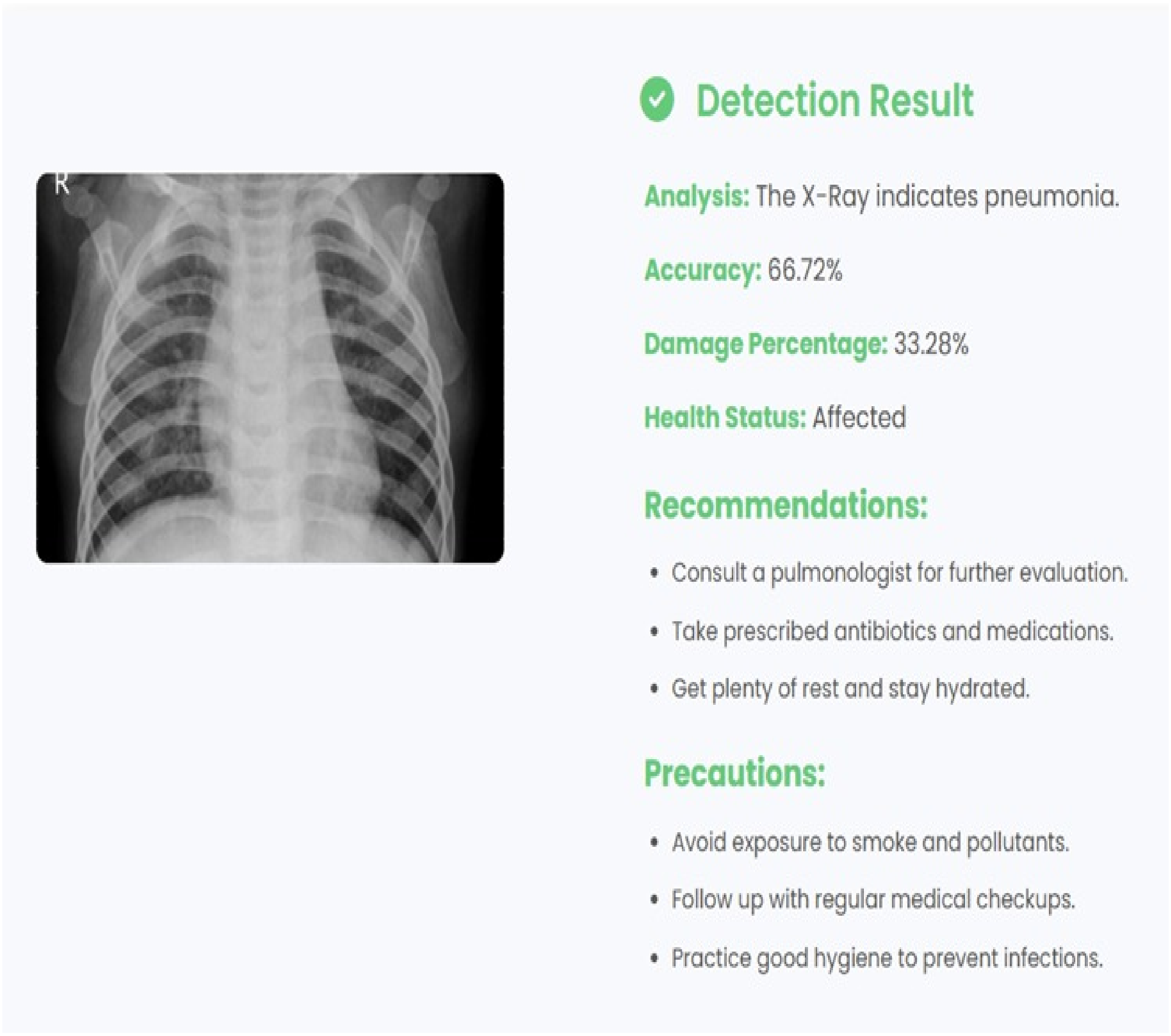
In order to surpass the shortcomings of the current system, the MediXpert application implements the Random Forest algorithm, which provides enhanced accuracy and generalization. Random Forest constructs an ensemble of many decision trees and combines their outputs, thus decreasing overfitting and variance. It allows the system to analyze various subsets of features and samples, enhancing the robustness of predictions for diverse types of medical imaging data. While we can't completely govern the randomness during tree building, this heterogeneity translates into improved generalization. In the MediXpert system, this technique yields much greater accuracy in detecting complicated patterns involving brain tumors, pneumonia, and fractures. Additionally, the ensemble approach of Random Forest provides more dependability in clinical decision support, making the system much more powerful than the previous decision tree-based implementation.

```python
from flask import Flask, render_template, request, flash
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import os
import numpy as np
import uuid
import imghdr
app = Flask(_name_)
app.secret_key = 'your_secret_key_here'  # Required for flash messages
# Path to save uploaded files
UPLOAD_FOLDER = 'static/uploads'
app.config['UPLOAD_FOLDER'] = UPLOAD_FOLDER
```

```
# Allowed image extensions
ALLOWED_EXTENSIONS = {'png', 'jpg', 'jpeg'}
# Load your models
BRAIN_MODEL_PATH = 'brain_tumor_detection_model.keras'
brain_model = load_model(BRAIN_MODEL_PATH)
PNEUMONIA_MODEL_PATH = 'pneumonia_detection_model_v2.keras'
pneumonia_model = load_model(PNEUMONIA_MODEL_PATH)
BONE_FRACTURE_MODEL_PATH = 'bone_fracture_model.h5'
bone_fracture_model = load_model(BONE_FRACTURE_MODEL_PATH)
def allowed_file(filename):
    return '.' in filename and \
        filename.rsplit('.', 1)[1].lower() in ALLOWED_EXTENSIONS
def validate_image_type(file_stream):
    image_type = imghdr.what(file_stream)
    file_stream.seek(0)  # Reset file pointer after checking
    return image_type in ALLOWED_EXTENSIONS
# Route for homepage (upload form)
@app.route('/')
def index():
    return render_template('index.html')
# Route to handle brain tumor detection
@app.route('/upload_brain', methods=['POST'])
def upload_brain_file():
    if 'file' not in request.files:
        flash('No file part in the request', 'error')
        return render_template('index.html', active_tab='brain')
    file = request.files['file']
    if file.filename == '':
        flash('No selected file', 'error')
        return render_template('index.html', active_tab='brain')
    if file and allowed_file(file.filename):
        if not validate_image_type(file.stream):
            flash('Invalid image type. Please upload a valid brain scan image.', 'error')
            return render_template('index.html', active_tab='brain')
        # Generate a unique filename
        unique_filename = str(uuid.uuid4()) + os.path.splitext(file.filename)[-1]
        file_path = os.path.join(app.config['UPLOAD_FOLDER'], unique_filename)
        file.save(file_path)
        try:
            # Process the uploaded image
            img = load_img(file_path, target_size=(150, 150))
            img_array = img_to_array(img) / 255.0
            img_array = np.expand_dims(img_array, axis=0)
            # Predict using the brain tumor model
            prediction = brain_model.predict(img_array)[0][0]
            is_affected = prediction > 0.5
            accuracy = round(prediction * 100, 2) if is_affected else round((1 - prediction) * 100,
                2)
            damage_percentage = round((1 - prediction) * 100, 2) if is_affected else round(
                prediction * 100, 2)
            health_status = "Affected" if is_affected else "Healthy"
            if is_affected:
                message = "The MRI scan indicates presence of a brain tumor."
                recommendations = [
                    "Immediate consultation with a neurologist is recommended.",
                    "Advanced imaging (CT/MRI) may be needed for confirmation.",
                    "Discuss treatment options including surgery, radiation, or chemotherapy."
                ]
                precautions = [
                    "Avoid strenuous activities that may increase intracranial pressure.",
                    "Monitor for symptoms like severe headaches, nausea, or vision changes.",
                    "Follow all prescribed medications strictly."
                ]
            else:
                message = "The MRI scan shows no signs of brain tumor."
                recommendations = [
                    "Regular check-ups are still recommended.",
                    "Maintain a healthy lifestyle with proper diet and exercise.",
                    "Be aware of potential symptoms like persistent headaches."
                ]
                precautions = [
                    "Protect your head from injuries by wearing helmets when needed.",
                    "Manage stress through meditation or other relaxation techniques.",
                    "Get adequate sleep (7-9 hours per night)."
                ]
            return render_template('index.html',
                                   message=message,
                                   image_url=file_path,
                                   accuracy=accuracy,
                                   damage_percentage=damage_percentage,
                                   health_status=health_status,
                                   recommendations=recommendations,
                                   precautions=precautions,
                                   active_tab='brain')
        except Exception as e:
            flash(f'Error processing image: {str(e)}', 'error')
            return render_template('index.html', active_tab='brain')
    flash('Allowed file types are png, jpg, jpeg', 'error')
    return render_template('index.html', active_tab='brain')
# Route to handle pneumonia detection
@app.route('/upload_lungs', methods=['POST'])
def upload_lungs_file():
    if 'file' not in request.files:
        flash('No file part in the request', 'error')
        return render_template('index.html', active_tab='lungs')
    file = request.files['file']
    if file.filename == '':
        flash('No selected file', 'error')
        return render_template('index.html', active_tab='lungs')
    if file and allowed_file(file.filename):
        if not validate_image_type(file.stream):
            flash('Invalid image type. Please upload a valid chest X-ray image.', 'error')
            return render_template('index.html', active_tab='lungs')
        # Generate a unique filename
        unique_filename = str(uuid.uuid4()) + os.path.splitext(file.filename)[-1]
        file_path = os.path.join(app.config['UPLOAD_FOLDER'], unique_filename)
        file.save(file_path)
        try:
            # Process the uploaded image
            img = load_img(file_path, target_size=(150, 150))
            img_array = img_to_array(img) / 255.0
            img_array = np.expand_dims(img_array, axis=0)
            # Predict using the pneumonia model
            prediction = pneumonia_model.predict(img_array)[0][0]
            is_affected = prediction > 0.5
            accuracy = round(prediction * 100, 2) if is_affected else round((1 - prediction) * 100,
                2)
            damage_percentage = round((1 - prediction) * 100, 2) if is_affected else round(
                prediction * 100, 2)
            health_status = "Affected" if is_affected else "Healthy"
            if is_affected:
                message = "The chest X-ray indicates presence of pneumonia."
                recommendations = [
                    "Immediate consultation with a pulmonologist is recommended.",
                    "Antibiotics may be prescribed if bacterial pneumonia is suspected.",
                    "Get plenty of rest and stay hydrated."
                ]
                precautions = [
                    "Complete the full course of prescribed antibiotics.",
                    "Use a humidifier to ease breathing.",
                    "Avoid smoking and exposure to air pollutants."
                ]
            else:
                message = "The chest X-ray shows no signs of pneumonia."
                recommendations = [
                    "Maintain good respiratory health through regular exercise.",
                    "Get annual flu shots to prevent respiratory infections.",
                    "Practice good hygiene to prevent infections."
                ]
                precautions = [
                    "Avoid close contact with people who have respiratory infections.",
                    "Wash hands frequently to prevent infection spread.",
                    "Wear masks in crowded places during flu season."
                ]
            return render_template('index.html',
                                   message=message,
                                   image_url=file_path,
                                   accuracy=accuracy,
                                   damage_percentage=damage_percentage,
                                   health_status=health_status,
                                    recommendations=recommendations,
                                    precautions=precautions,
                                    active_tab='lungs')
        except Exception as e:
            flash(f'Error processing image: {str(e)}', 'error')
            return render_template('index.html', active_tab='lungs')
    flash('Allowed file types are png, jpg, jpeg', 'error')
    return render_template('index.html', active_tab='lungs')
# Route to handle bone fracture detection
@app.route('/upload_bone', methods=['POST'])
def upload_bone_file():
    if 'file' not in request.files:
        flash('No file part in the request', 'error')
        return render_template('index.html', active_tab='bone')
    file = request.files['file']
    if file.filename == '':
        flash('No selected file', 'error')
        return render_template('index.html', active_tab='bone')

    if file and allowed_file(file.filename):
        if not validate_image_type(file.stream):
            flash('Invalid image type. Please upload a valid bone X-ray image.', 'error')
            return render_template('index.html', active_tab='bone')

        # Generate a unique filename
        unique_filename = str(uuid.uuid4()) + os.path.splitext(file.filename)[-1]
        file_path = os.path.join(app.config['UPLOAD_FOLDER'], unique_filename)
        file.save(file_path)
        try:
            # Process the uploaded image
            img = load_img(file_path, target_size=(150, 150))
            img_array = img_to_array(img) / 255.0
            img_array = np.expand_dims(img_array, axis=0)

            # Predict using the bone fracture model
            prediction = bone_fracture_model.predict(img_array)[0][0]
            is_affected = prediction > 0.5
            accuracy = round(prediction * 100, 2) if is_affected else round((1 - prediction) * 100,
                2)
            damage_percentage = round((1 - prediction) * 100, 2) if is_affected else round(
                prediction * 100, 2)
            health_status = "Affected" if is_affected else "Healthy"
            if is_affected:
                message = "The X-ray indicates presence of a bone fracture."
                recommendations = [
                    "Immediate consultation with an orthopedic specialist is required.",
                    "The affected area should be immobilized immediately.",
                    "Follow-up imaging may be needed to monitor healing."
                ]
                precautions = [
```

```python
                    "Avoid putting weight on the affected area.",
                    "Use casts or splints as directed by your doctor.",
                    "Attend all follow-up appointments."
                ]
            else:
                message = "The X-ray shows no signs of bone fracture."
                recommendations = [
                    "If pain persists, consider consulting a doctor.",
                    "Maintain bone health through calcium-rich diet and exercise.",
                    "Use proper protective gear during sports activities."
                ]
                precautions = [
                    "Practice fall prevention measures, especially for elderly.",
                    "Wear appropriate safety equipment during physical activities.",
                    "Get regular exercise to maintain bone density."
                ]
            return render_template('index.html',
                                   message=message,
                                   image_url=file_path,
                                   accuracy=accuracy,
                                   damage_percentage=damage_percentage,
                                   health_status=health_status,
                                   recommendations=recommendations,
                                   precautions=precautions,
                                   active_tab='bone')
        except Exception as e:
            flash(f'Error processing image: {str(e)}', 'error')
            return render_template('index.html', active_tab='bone')

    flash('Allowed file types are png, jpg, jpeg', 'error')
    return render_template('index.html', active_tab='bone')
if _name_ == '_main_':
    if not os.path.exists(UPLOAD_FOLDER):
        os.makedirs(UPLOAD_FOLDER)
    app.run(host='0.0.0.0', port=5000, debug=True)
```

Output



Detection Result

Analysis: The X-Ray indicates pneumonia.

Accuracy: 66.72%

Damage Percentage: 33.28%

Health Status: Affected

Recommendations:

- Consult a pulmonologist for further evaluation.
- Take prescribed antibiotics and medications.
- Get plenty of rest and stay hydrated.

Precautions:

- Avoid exposure to smoke and pollutants.
- Follow up with regular medical checkups.
- Practice good hygiene to prevent infections.

Figure 6.1: **Output of MediXpert application**

Figure 6.1 Represents the The picture illustrates the outcome of an X-ray test showing that pneumonia exists. The detection system gives an accuracy of 66.72 and calculates the percentage of lung damage to be 33.28, thereby resulting in a health status labeled as ”Affected.” From this outcome, the analysis suggests referring to a pulmonologist for further examination, taking prescribed medicines and antibiotics, and obtaining sufficient rest and fluids. Also, precautions involve staying away from smoke and pollutants, regular medical checkups, and good hygiene to avoid further infections. A chest X-ray image is provided on the left side of the report to substantiate the findings.

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

The mediXpert application marks a major breakthrough in medical imaging analysis, empowering healthcare professionals with a reliable and efficient tool for the detection and management of critical conditions such as brain tumors,pneumonia, and bone fractures. By leveraging the power of Convolutional Neural Networks, the application provides accurate and consistent results, enhancing the decision-making capabilities of clinicians and radiologists.The seamless integration of image upload, preprocessing,CNN-based detection models, result interpretation, and customizable report generation streamlines the medical imaging analysis workflow, saving valuable time and resources. The user-friendly interface and accessibility across desktop and mobile platforms further ensure that the mediXpert application can be seamlessly integrated into existing healthcare systems and workflows. The mediXpert application is poised to remain at the fore front of innovation, with regular updates and enhancements to its detection models and features. By combining cutting edge technology with a focus on user experience and clinical relevance, the mediXpert application stands as a transformative solution that it can greatly enhance patient outcomes and streamline the overall efficiency of healthcare delivery.

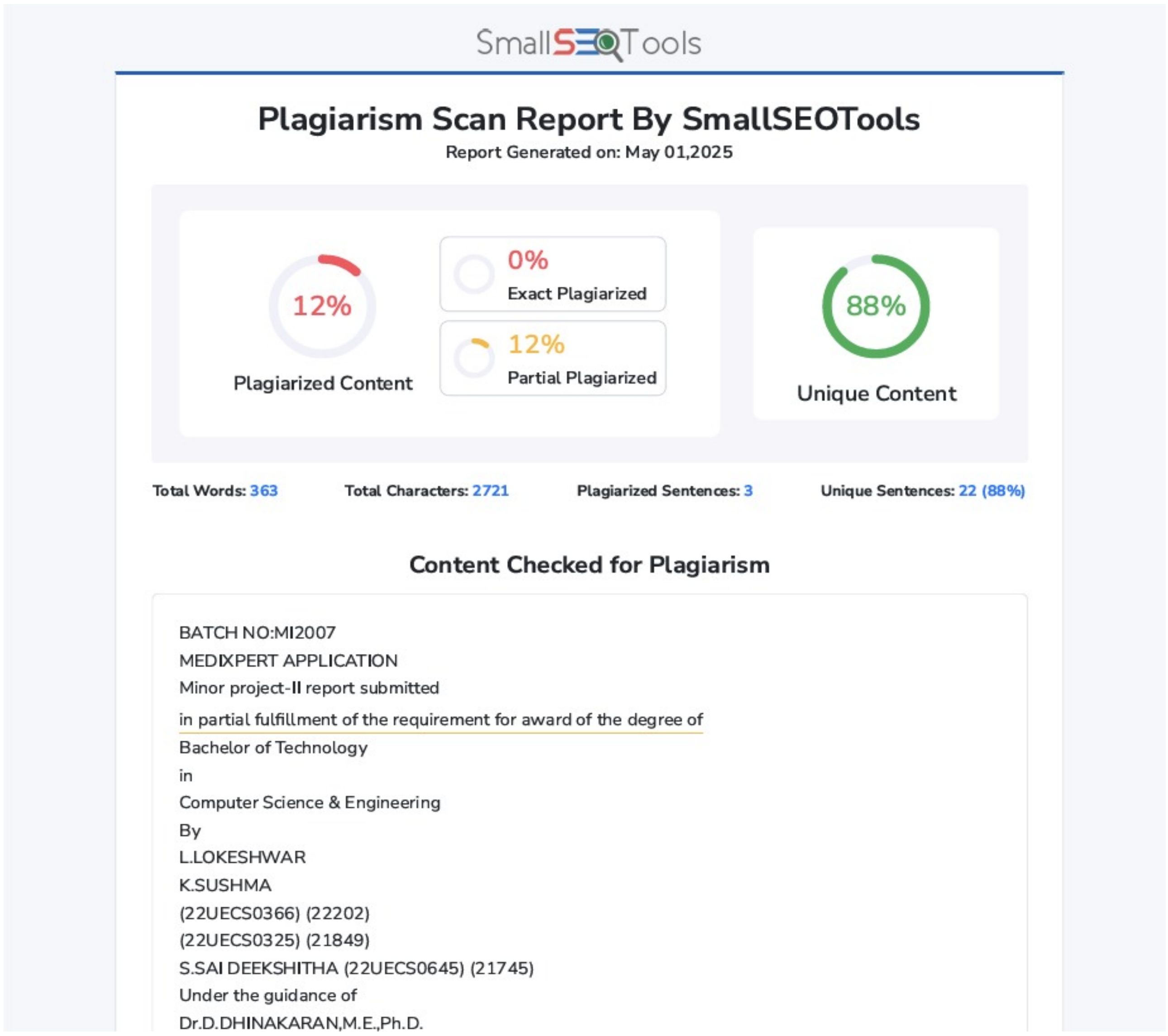
7.2 Future Enhancements

In the future, MediXpert can be improved by broadening its diagnostic capabilities to cover a broader spectrum of medical conditions like diabetic retinopathy, tuberculosis, lung cancer, and skin diseases. Through the integration of more datasets and training of specialized deep learning models, the platform can be made a more complete diagnostic tool. Adding 3D image analysis (e.g., for CT scans and MRI images) would enable the app to handle volumetric data, producing even more precise and nuanced diagnoses. In addition, real-time image capture from mobile phone cameras or connected imaging devices would enable streamlined workflow and greater accessibility, particularly in low-resource or rural environments.

Yet another significant upgrade can be integrating Electronic Health Records (EHR) and patient history to offer context-aware diagnosis. AI models might utilize not just imaging data but also laboratory test results, symptoms, and medical history for more tailored predictions. Moreover, the app might include explainable AI (XAI) methods to render the model's choices interpretable to physicians, increasing physicians' confidence in AI-enabled diagnostics. Cloud-based deployment and multi-language support could further enhance worldwide scalability and user access.

Chapter 8

PLAGIARISM REPORT


SmallSEOTools

Plagiarism Scan Report By SmallSEOTools

Report Generated on: May 01,2025

12% Plagiarized Content

0% Exact Plagiarized

12% Partial Plagiarized

88% Unique Content

Total Words: 363 Total Characters: 2721 Plagiarized Sentences: 3 Unique Sentences: 22 (88%)

Content Checked for Plagiarism

BATCH NO:MI2007
MEDIXPERT APPLICATION
Minor project-II report submitted
in partial fulfillment of the requirement for award of the degree of
Bachelor of Technology
in
Computer Science & Engineering
By
L.LOKESHWAR
K.SUSHMA
(22UECS0366) (22202)
(22UECS0325) (21849)
S.SAI DEEKSHITHA (22UECS0645) (21745)
Under the guidance of
Dr.D.DHINAKARAN,M.E.,Ph.D.

Figure 8.1: **Plagiarism Report**

Appendices

Appendix A

Source Code

```
from flask import Flask, render_template, request, flash
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import os
import numpy as np
import uuid
import imghdr
app = Flask(_name_)
app.secret_key = 'your_secret_key_here'  # Required for flash messages
# Path to save uploaded files
UPLOAD_FOLDER = 'static/uploads'
app.config['UPLOAD_FOLDER'] = UPLOAD_FOLDER
# Allowed image extensions
ALLOWED_EXTENSIONS = {'png', 'jpg', 'jpeg'}
# Load your models
BRAIN_MODEL_PATH = 'brain_tumor_detection_model.keras'
brain_model = load_model(BRAIN_MODEL_PATH)
PNEUMONIA_MODEL_PATH = 'pneumonia_detection_model_v2.keras'
pneumonia_model = load_model(PNEUMONIA_MODEL_PATH)
BONE_FRACTURE_MODEL_PATH = 'bone_fracture_model.h5'
bone_fracture_model = load_model(BONE_FRACTURE_MODEL_PATH)
def allowed_file(filename):
    return '.' in filename and \
        filename.rsplit('.', 1)[1].lower() in ALLOWED_EXTENSIONS
def validate_image_type(file_stream):
    image_type = imghdr.what(file_stream)
    file_stream.seek(0)  # Reset file pointer after checking
    return image_type in ALLOWED_EXTENSIONS
# Route for homepage (upload form)
@app.route('/')
def index():
    return render_template('index.html')
# Route to handle brain tumor detection
@app.route('/upload_brain', methods=['POST'])
def upload_brain_file():
    if 'file' not in request.files:
        flash('No file part in the request', 'error')
        return render_template('index.html', active_tab='brain')
    file = request.files['file']
    if file.filename == '':
        flash('No selected file', 'error')
```

```python
        return render_template('index.html', active_tab='brain')
    if file and allowed_file(file.filename):
        if not validate_image_type(file.stream):
            flash('Invalid image type. Please upload a valid brain scan image.', 'error')
            return render_template('index.html', active_tab='brain')
        # Generate a unique filename
        unique_filename = str(uuid.uuid4()) + os.path.splitext(file.filename)[-1]
        file_path = os.path.join(app.config['UPLOAD_FOLDER'], unique_filename)
        file.save(file_path)
        try:
            # Process the uploaded image
            img = load_img(file_path, target_size=(150, 150))
            img_array = img_to_array(img) / 255.0
            img_array = np.expand_dims(img_array, axis=0)
            # Predict using the brain tumor model
            prediction = brain_model.predict(img_array)[0][0]
            is_affected = prediction > 0.5
            accuracy = round(prediction * 100, 2) if is_affected else round((1 - prediction) * 100, 2)
            damage_percentage = round((1 - prediction) * 100, 2) if is_affected else round(prediction * 100, 2)
            health_status = "Affected" if is_affected else "Healthy"
            if is_affected:
                message = "The MRI scan indicates presence of a brain tumor."
                recommendations = [
                    "Immediate consultation with a neurologist is recommended.",
                    "Advanced imaging (CT/MRI) may be needed for confirmation.",
                    "Discuss treatment options including surgery, radiation, or chemotherapy."
                ]
                precautions = [
                    "Avoid strenuous activities that may increase intracranial pressure.",
                    "Monitor for symptoms like severe headaches, nausea, or vision changes.",
                    "Follow all prescribed medications strictly."
                ]
            else:
                message = "The MRI scan shows no signs of brain tumor."
                recommendations = [
                    "Regular check-ups are still recommended.",
                    "Maintain a healthy lifestyle with proper diet and exercise.",
                    "Be aware of potential symptoms like persistent headaches."
                ]
                precautions = [
                    "Protect your head from injuries by wearing helmets when needed.",
                    "Manage stress through meditation or other relaxation techniques.",
                    "Get adequate sleep (7-9 hours per night)."
                ]
            return render_template('index.html',
                                   message=message,
                                   image_url=file_path,
                                   accuracy=accuracy,
                                   damage_percentage=damage_percentage,
                                   health_status=health_status,
                                   recommendations=recommendations,
                                   precautions=precautions,
                                   active_tab='brain')
        except Exception as e:
            flash(f'Error processing image: {str(e)}', 'error')
            return render_template('index.html', active_tab='brain')
    flash('Allowed file types are png, jpg, jpeg', 'error')
    return render_template('index.html', active_tab='brain')
# Route to handle pneumonia detection
@app.route('/upload_lungs', methods=['POST'])
def upload_lungs_file():
    if 'file' not in request.files:
        flash('No file part in the request', 'error')
        return render_template('index.html', active_tab='lungs')
    file = request.files['file']
    if file.filename == '':
        flash('No selected file', 'error')
        return render_template('index.html', active_tab='lungs')
    if file and allowed_file(file.filename):
        if not validate_image_type(file.stream):
            flash('Invalid image type. Please upload a valid chest X-ray image.', 'error')
            return render_template('index.html', active_tab='lungs')
        # Generate a unique filename
        unique_filename = str(uuid.uuid4()) + os.path.splitext(file.filename)[-1]
        file_path = os.path.join(app.config['UPLOAD_FOLDER'], unique_filename)
        file.save(file_path)
        try:
            # Process the uploaded image
            img = load_img(file_path, target_size=(150, 150))
            img_array = img_to_array(img) / 255.0
            img_array = np.expand_dims(img_array, axis=0)
            # Predict using the pneumonia model
            prediction = pneumonia_model.predict(img_array)[0][0]
            is_affected = prediction > 0.5
            accuracy = round(prediction * 100, 2) if is_affected else round((1 - prediction) * 100, 2)
            damage_percentage = round((1 - prediction) * 100, 2) if is_affected else round(prediction * 100, 2)
            health_status = "Affected" if is_affected else "Healthy"
```

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