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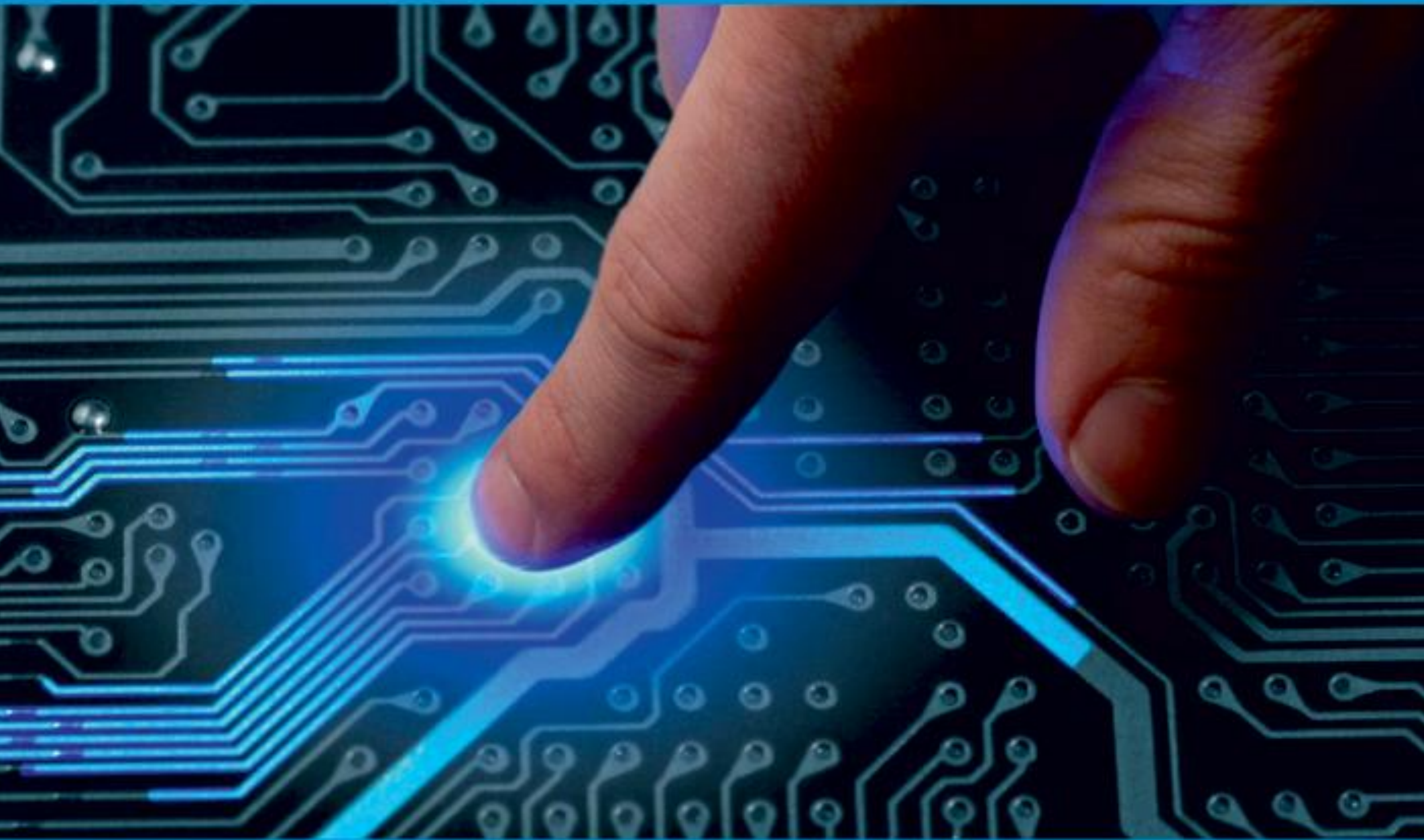

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Bone Fracture Detection and Classification Through Deep Learning Techniques

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ABSTRACT: Improving Bone Fracture Assessment and Classification is crucial for enhancing the precision and efficiency of diagnosing fractures in clinical settings. Conventional approaches, reliant on manual analysis, tend to be time-consuming and susceptible to inconsistencies. This study advocates for a revolutionary approach utilizing cutting-edge deep learning methodologies, such as TensorFlow or PyTorch, and leveraging computer vision libraries like OpenCV. The objective is to automate the identification, categorization, and measurement of bone fractures from medical images. This automation aims to substantially minimize interobserver discrepancies and elevate the accuracy of diagnoses.

KEYWORDS: Bone fracture · Deep learning · Medical imaging · Diagnostic precision

I. INTRODUCTION

Accurate assessment and classification of bone fracture displacement are pivotal in determining optimal treatment strategies, be it non-invasive approaches like immobilization and casting or surgical interventions aimed at realignment and stabilization. Fractures of the human skeleton, resulting from various causes including accidents, falls, or underlying medical conditions, represent a prevalent occurrence that significantly impacts patient care and recovery. The precise evaluation of fractures not only serves as a cornerstone for medical decision-making but also profoundly influences patient outcomes. However, conventional assessment methods, often reliant on manual interpretation of medical imaging, are susceptible to subjectivity and can be time-consuming, potentially delaying crucial treatment decisions.

Recognizing the pressing need for more efficient and accurate fracture assessment, this project delves into the innovative application of AI-driven deep learning techniques. By harnessing the power of artificial intelligence, this initiative aims to revolutionize the assessment and classification of bone fracture displacement, with the overarching goal of enhancing diagnostic precision and expediting treatment planning.

The project's scope encompasses the comprehensive development, meticulous implementation, and rigorous evaluation of an AI-enhanced system tailored specifically for bone fracture assessment. Leveraging sophisticated deep

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learning algorithms trained on diverse datasets of medical images, the system endeavours to achieve unparalleled accuracy in the detection, classification, and quantification of bone fracture displacement. One of the primary challenges addressed by this project involves the inherent subjectivity and variability associated with manual assessment methods. Through the automation of fracture classification using AI and deep learning, the project aims to mitigate these challenges by training machine learning models on extensive datasets comprising varied fracture types and corresponding displacement measurements. The process entails training the AI model to discern intricate patterns and relationships between fracture characteristics and their respective displacement measurements. Once trained, the AI-driven system becomes adept at automatically categorizing new fractures into appropriate classes based on their displacement characteristics, streamlining the diagnostic process, and minimizing reliance on subjective human interpretation.

Moreover, this initiative seeks to establish a standardized framework for fracture assessment that promotes greater consistency, objectivity, and efficiency in clinical practice. Ultimately, the integration of AI-driven technologies in fracture assessment holds promise for significantly improving patient care by facilitating more accurate diagnoses and expediting treatment interventions.

II. LITERATURE SURVEY

In order to get required knowledge about various concepts related to the present application, existing literature was studied. Some of the important conclusions were made through those are listed below. Below table is literature review summary for bone fracture detection

Johari and Singh[1]: Analysis and of Bone Fractures Using Machine Learning Techniques. This survey proposed the Canny Edge Detection method for bone fracture detection. According to the results, Canny's algorithm is the best method for identifying edges with impulsive thresholds and low error rates. Thanks to this framework, doctors were able to get more accurate results in less time and with less effort. Real-world data has been used to test out the system's capabilities.

Basha et al[2]: Computer Aided Fracture Detection System. This study outlines a sequence of steps for fracture detection, including methods for adaptive histogram equalization, statistical feature extraction, and the utilization of an artificial neural network. Additionally, the classification of radiographs through the employment of probabilistic neural networks and back propagation neural networks is emphasized as a significant aspect of X-ray image interpretation. The system described in this research achieved a notable accuracy rate of 72.3% in the detection of fractures.

Basha et al[3]: An Effective and Reliable Computer Automated Technique for Bone Fracture Detection. This technique stated an effective automated bone fracture identification system based on the improved Haar Wavelet Transform, Scale-Invariant Feature Transform (SIFT), and NN. Fracture images can be classified using the first two methods, which extract features. SIFT and enhanced Haar Wavelet Transforms work together to enhance the X-ray image. In the following work, 'Bag of Words' methods based on K-means clustering is used to extract improved SIFT features. A classical Back Propagation neural network with 1024 neurons in three layers was used for in the proposed technique. Using approximately 300 different x-ray images of bone fractures, this proposed system achieved a rate of 73.4 percent. Traditional SIFT-facilitated detection outperformed the proposed computer aided technique in our experiments.

Ern et al[4]: Convolutional Neural Networks for Automated Fracture Detection and Localization on Wrist Radiographs. This group proposed a Convolutional neural network for object detection that is capable of detecting and locating fractures on wrist radiographs. Total wrist radiography scans from 7356 patients were obtained using an image archiving and transmission system from a hospital. The bounding boxes of all radius and ulna fractures were marked by radiologists. The dataset was separated into training (90%) and validation (10) sets to create fracture localization models for frontal and lateral images. The study used a deep learning model identified as Inception-ResNet faster R-CNN architecture. Each fracture, image (or view), and study had a sensitivity and specificity value that was determined.

Abbas et al[5]: Lower Leg Bone Fracture Detection and Using Faster RCNN for X-Rays Images. The group conducted out R-CNN deep learning model to locate lower leg bone fractures. Traditional methods of fracture detection have struggled to locate lower leg bone fractures. With the help of the R-CNN deep learning model, these issues can be addressed more quickly. Using 50 x-ray images, the model's top layer was also retrained using an inception v2 (version2) network architecture. After 40k steps, the model was completed when the loss remained at just 0.0005

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percentage points. To see if the proposed model could identify and classify anomalies, it was tested. The method was used to classify X-ray images of bone fractures into two categories: fracture and non-fracture. This method has a 94 percent overall accuracy rate for and detection.

III. LITERATURE REVIEW SUMMARY

The studies mentioned explore different machine learning methods to detect bone fractures in X-ray images. Techniques such as edge detection and various neural networks, including convolutional and probabilistic networks, are used to improve the accuracy and efficiency of fracture detection. These approaches have achieved moderate accuracy rates, demonstrating significant improvements over traditional methods, making the detection process quicker and more reliable for medical practitioners.

IV. PROPOSED SYSTEM

To address the limitations of the existing fracture method, the proposed system automates the process of fracture detection and classification. This is achieved by identifying the location of the broken fragment of the fracture using an AI model. The model is trained with advanced deep learning techniques and is fed with a diverse set of medical reports and radiological images, such as X-rays. This enables the AI to accurately detect and classify various types of fractures. The results obtained from the AI model are then utilized to classify the fracture. This information is presented on a user-friendly graphical user interface (GUI).

V. METHODOLOGY

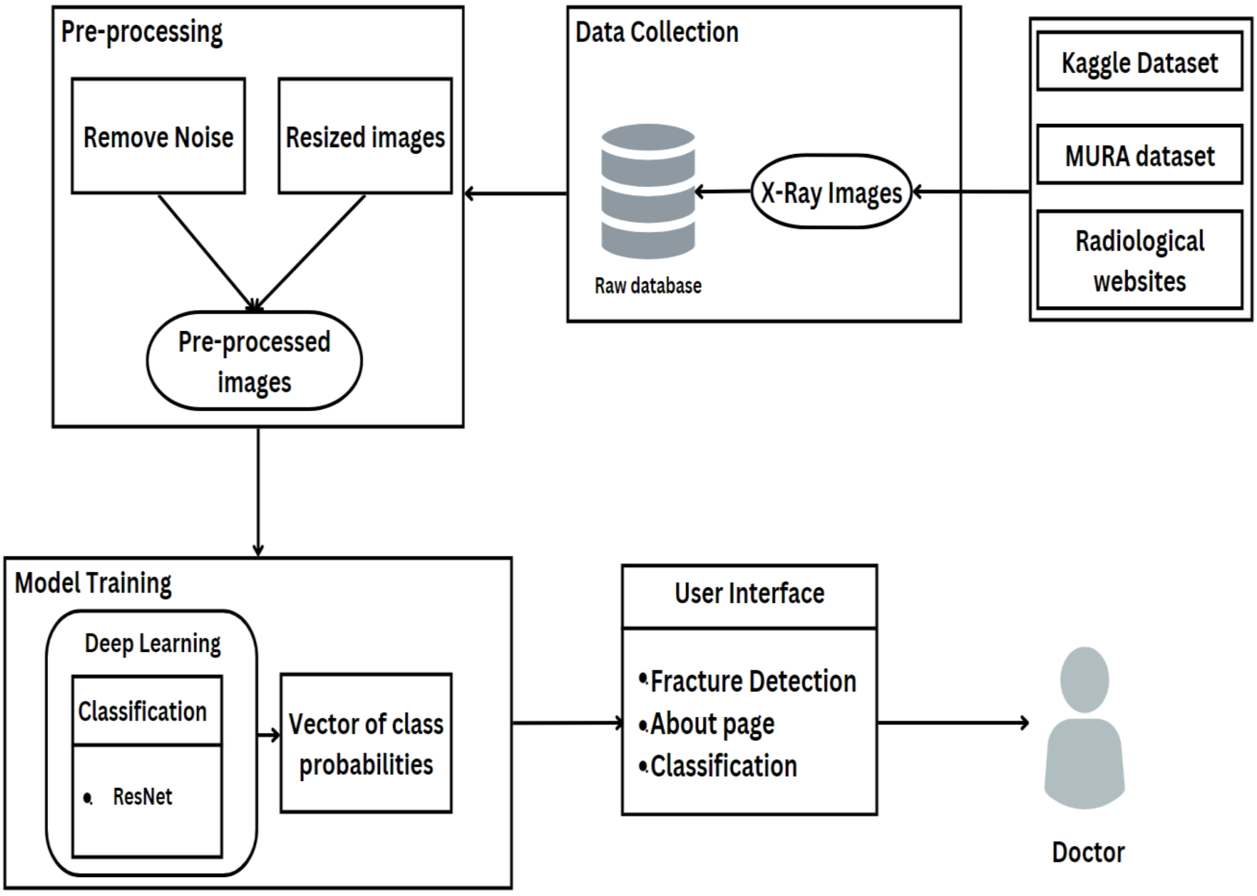

Fig 4.1 : Methodology diagram

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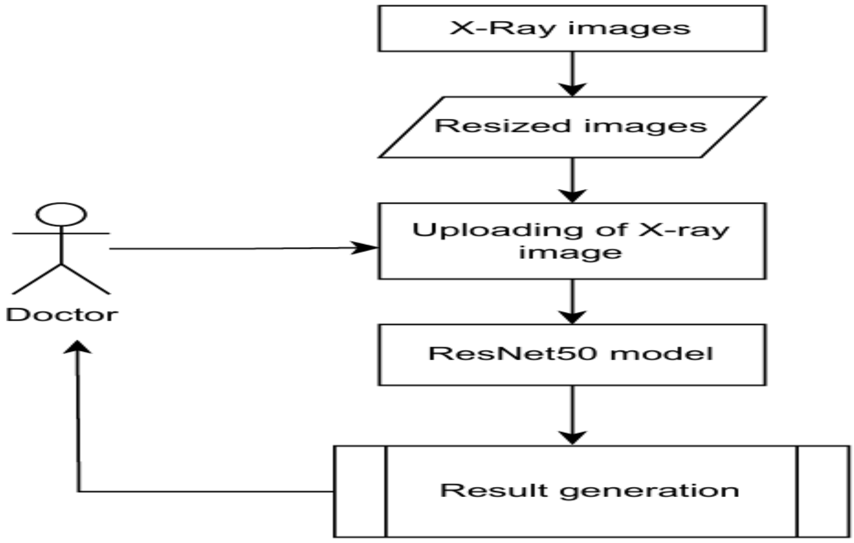

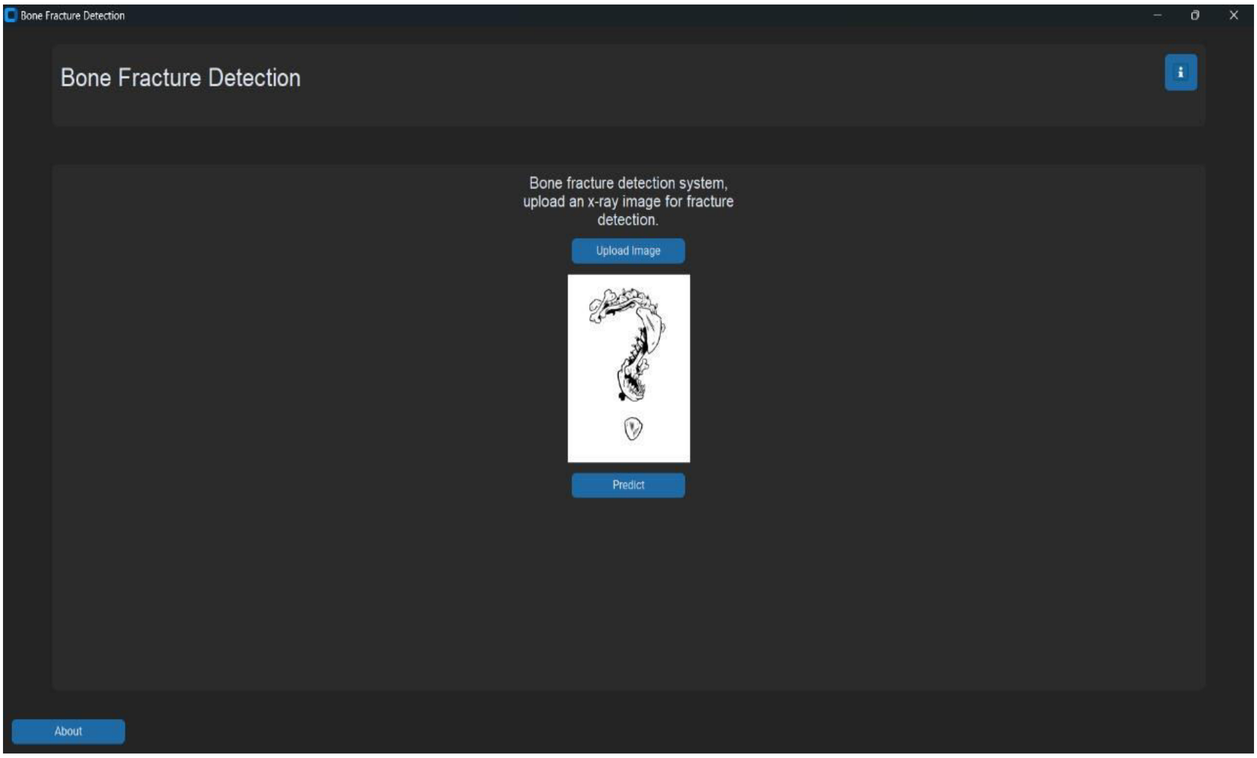

FIG 6.1: HOME PAGE

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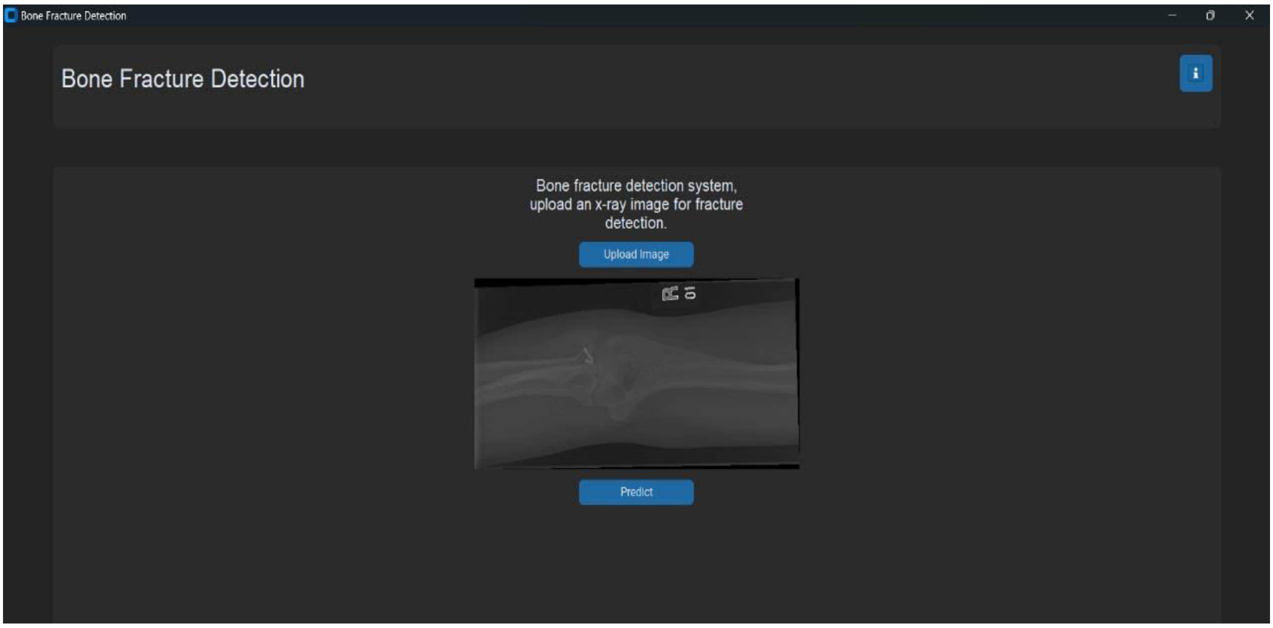

FIG 6.2: UPLOAD IMAGE

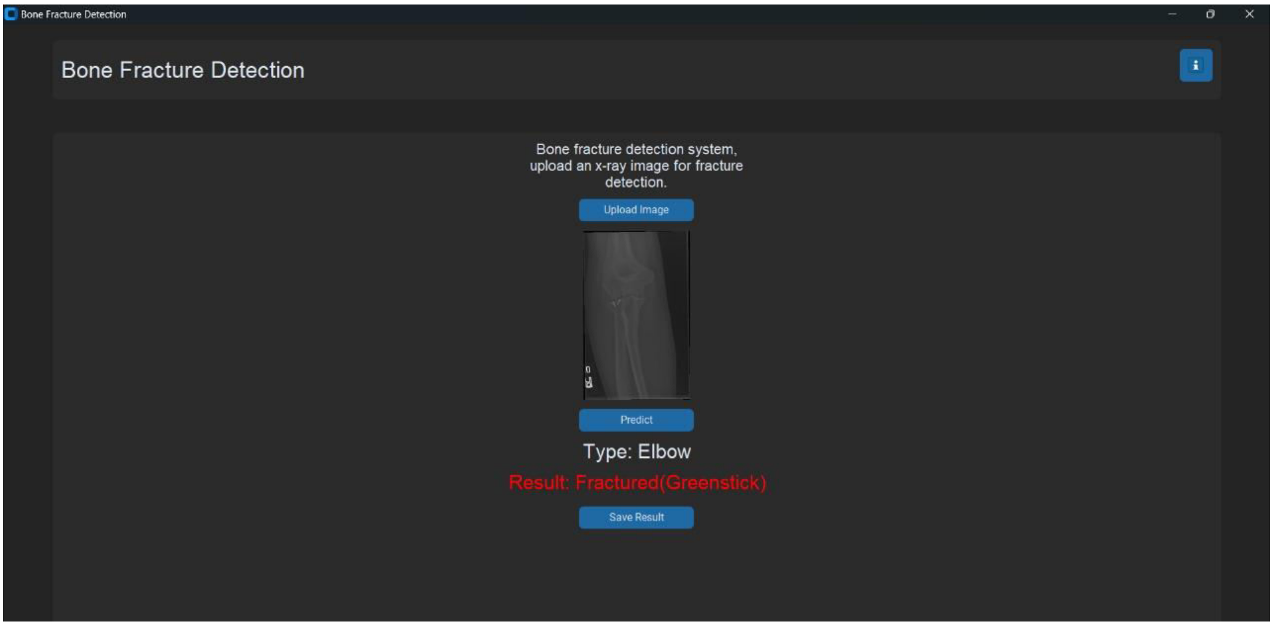

FIG 6.3: RESULT PAGE

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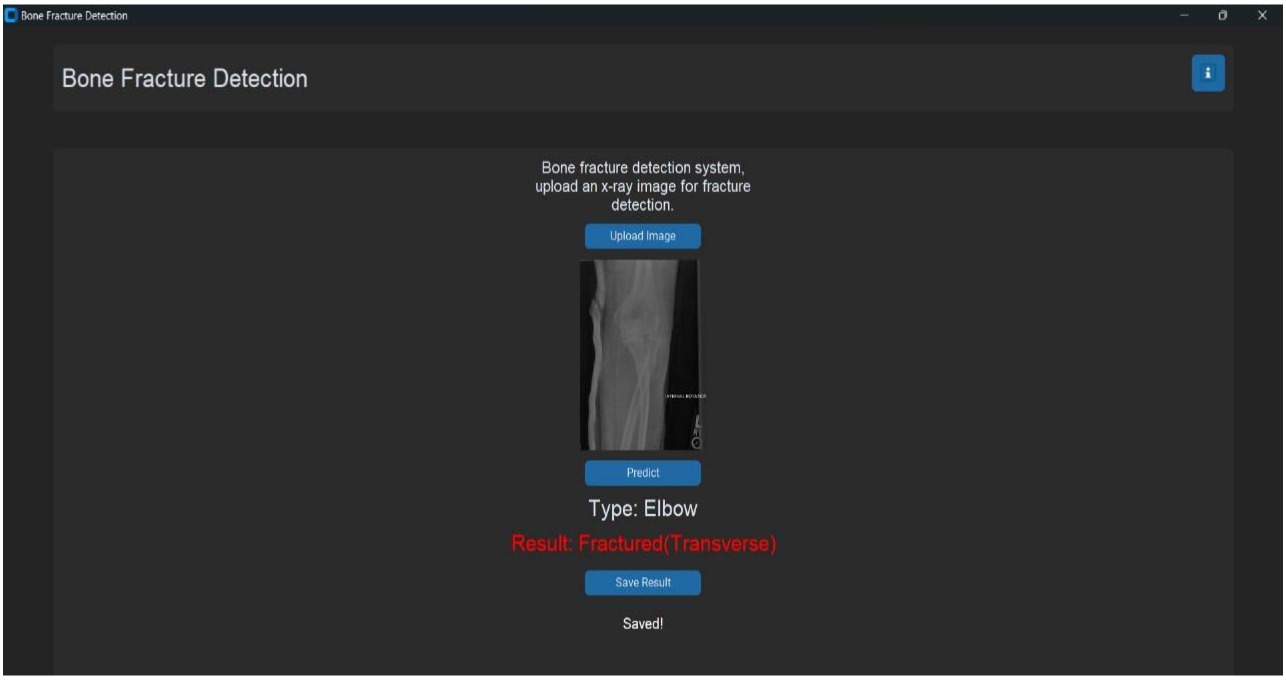

FIG 6.4: REPORT GENERATION PAGE

VI. CONCLUSION

The project "Bone Fracture Detection and Classification through Deep Learning techniques" represents a significant stride towards revolutionizing the domain of bone fracture assessment in healthcare. Traditional manual approaches, while effective, are often time-consuming and subject to variations in interpretation. By harnessing the power of cutting-edge deep learning techniques, this project introduces a transformative solution that automates the detection, classification, and quantification of bone fractures from medical images. As this project continues to evolve, it holds the promise of not only improving patient care through enhanced diagnostic accuracy but also setting a precedent for the utilization of AI in healthcare. With the capabilities of automation, consistency, and scalability, the system is poised to make a substantial impact on bone fracture assessment and classification, ultimately leading to better treatment outcomes and a brighter future for healthcare diagnostics.

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