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Automated Bone Fracture Detection in X-ray Imaging to Improve Orthopaedic Diagnostics in Healthcare

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Abstract

The healthcare system in India faces an acute shortage of medical staff, significantly impacting the nation's ability to provide sufficient healthcare services. X-ray reports are paramount to orthopaedic surgeons for making critical patient care decisions. Implementing automated systems for detecting bone fractures offers a potentially efficient solution to supplement the limited workforce. However, these systems encounter substantial hurdles, such as inconsistent image quality and the risk of incorrect diagnosis due to the limitations of current technology. The research provides a specialised tool for identifying bone fractures with high precision (97% accuracy) and an excellent overall rating (F1 score of 0.98), showing it can reliably detect fractures. The assessment of this model is augmented by visual tools like heatmaps and performance graphs, providing an in-depth analysis of its operational effectiveness. Furthermore, creating a user-friendly interface is intended to streamline the adoption of this tool in clinical settings. Notwithstanding its demonstrated precision, the model must navigate data-related challenges, precisely data complexity and the representation of different categories, to prevent skewed outcomes. Clarifying the model's decision-making process and adaptability to various clinical situations are also critical. The study emphasises the need for thorough testing to ensure the model's dependability in diagnosing fractures before being deployed effectively in the medical field.

Keywords: Bone Fracture ; X-ray Imae; Healthcare ; Machine Learning ;

1. Introduction

India's healthcare infrastructure is facing a severe crisis due to a shortage of trained healthcare workers, affecting all levels, from doctors and specialists to nurses and lab technicians[1]. This issue is particularly acute in rural areas and less affluent urban neighbourhoods, exacerbating the divide in access to healthcare services[2]. This shortfall is impeding the effectiveness of the healthcare system, delaying the provision of essential medical care to India's vast

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