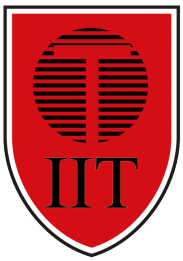

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OsteoGuard: Multimodal Approach for Predicting Osteoporosis: Integrating X-ray Imaging and Clinical Data.

A dissertation by

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ABSTRACT

Osteoporosis poses a significant global health challenge, particularly in affluent nations, where it leads to weakened bones and an increased risk of fractures. With over 200 million people affected worldwide, the economic burden of osteoporosis is substantial, costing healthcare systems billions annually. Early diagnosis is crucial for effective management, yet current diagnostic methods often rely solely on Bone Mineral Density measurements or X-ray imaging, limiting their accuracy and reliability. This over-reliance on single data sources often results in delayed or missed diagnoses, underscoring the need for more comprehensive diagnostic tools.

This research introduces a sophisticated multichannel approach for osteoporosis prediction, integrating clinical healthcare data with X-ray diagnostic images using advanced machine learning algorithms. Unlike existing methods that depend on individual data types, this approach combines clinical data, analysed via a Random Forest classifier, with X-ray image analysis performed by a deep learning model. This fusion of data sources enhances predictive accuracy by leveraging the strengths of both clinical and imaging data. By addressing the limitations of single-method diagnostics, this project aims to improve the detection and management of osteoporosis in clinical settings.

Testing and evaluation of the proposed deep learning X-ray image classification model resulted in a 99.55% accuracy rating which surpassed existing work. The clinical data classification model based on machine learning achieved 94.34% success rate. The accuracy of detecting osteoporosis should increase through a prediction combination technique that utilizes data fusion technology. Diagnostic precision advances through data integration which creates both a scalable solution with interpretability. The upcoming research will concentrate on optimizing both data fusion techniques and growing the available dataset to enhance predictive determination precision. The study creates fundamental knowledge that improves osteoporosis treatment by allowing health professionals to make diagnostic decisions more quickly and precisely.

Subject Description

Medical Informatics → Diagnostic Imaging → Healthcare Technology → Data Fusion →Predictive Modelling

Keywords: Osteoporosis, Multichannel Diagnostics, Machine Learning, Clinical Data Integration, X-ray Image Analysis, Early Diagnosis