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DETECTION OF SEVERITY OF KNEE OSTEOARTHRITIS USING MACHINE LEARNING AND RADIOGRAPHIC IMAGES

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ABSTRACT
In order to predict knee osteoarthritis using radiographic pictures, this study compares the performance of the Exception convolutional neural network (CNN) model with an ensemble model made up of the Exception, ResNet, and Inception ResNet architectures. The interpretability, generalizability, and accuracy of the Exception model are assessed. The performance of the ensemble model is then evaluated. The ensemble model performs better in terms of accuracy and generalization, according to the results, whereas the Exception model is easier to understand and more straightforward. The model selection for knee osteoarthritis prediction in clinical and research applications is informed by this study.

Keywords:
Knee Osteoarthritis Prediction, Radiographic images, Image Classification, Model Comparison.

INTRODUCTION

Osteoarthritis (OA) of the knee is a common degenerative joint disease marked by cartilage deterioration, which causes pain, stiffness, and limited movement. As the primary cause of disability in the world, successful management and intervention techniques depend on early detection and precise assessment of the severity of knee OA. Recent developments in machine learning and medical imaging, especially the utilization of radiography images, have showed promise in automating the prediction of osteoarthritis (OA) in the knee. Convolutional neural networks (CNNs) are one of these methods that have been extremely effective at deciphering radiography pictures and identifying relevant characteristics that indicate the severity of osteoarthritis.

The Xception CNN model has gained attention for knee OA prediction using radiographic images because of its outstanding performance in image classification tests. Additionally, in a variety of medical imaging tasks, ensemble modeling approaches—which integrate predictions from numerous independent models—have shown improved predictive accuracy and robustness. Ensemble models offer a promising way to increase knee OA prediction accuracy and reliability by combining the best features of several CNN architectures, such as Xception, ResNet, and Inception-ResNet.

OBJECTIVES

The system aims to provide objective and standardized assessments of knee osteoarthritis. By relying on quantitative measurements and well-defined criteria, it aims to eliminate subjective variations that may occur when different healthcare professionals evaluate the same case. This objective facilitates consistency in diagnosis and tracking of disease progression, enabling more effective treatment planning. One of the objectives is to offer a non-invasive method for evaluating knee osteoarthritis. Traditional diagnostic techniques often involve invasive procedures or imaging tests that can be uncomfortable for patients. The system aims to utilize non-invasive data sources, such as medical images, patient- reported symptoms, and demographic information, to assess and monitor the condition without the need for invasive interventions.

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LITERATURE SURVEY

A study named "Detection of knee osteoarthritis based on fuzzy entropy and shallow classifiers" looked into the possibility of using different dynamical aspects from gait kinematic signals for precise diagnosis of knee osteoarthritis. A thorough framework for feature extraction was suggested, and a number of shallow classifiers, such as SVM, KNN, NB, DT, and ELA, were assessed. The SVM classifier showed the best classification accuracy using data from 26 knee OA patients and 26 healthy controls, attaining [insert accuracy values] using various cross-validation techniques. These results demonstrate the suggested approach's prospective efficacy in automating knee OA diagnosis, outperforming previous techniques. The urgent need for early detection techniques for osteoarthritis (OA), a crippling joint condition, is discussed in this paper. People with OA have much lower quality of life because of their limited mobility and ongoing discomfort. The paper presents a unique transfer learning based feature engineering strategy termed CRK (CNN Random Forest K-neighbors) to efficiently detect OA from knee X-ray images. It does this by utilizing cutting-edge deep learning techniques. The suggested model achieves an amazing 99% accuracy in predicting OA by using a 2D CNN to extract spatial features, followed by random forest and k-nearest neighbour's strategies for feature set construction. Through hyperparameter adjustment and k-fold cross-validation, the model's performance is thoroughly evaluated, demonstrating its potential to transform OA diagnosis from X-ray pictures with exceptional precision and dependability.

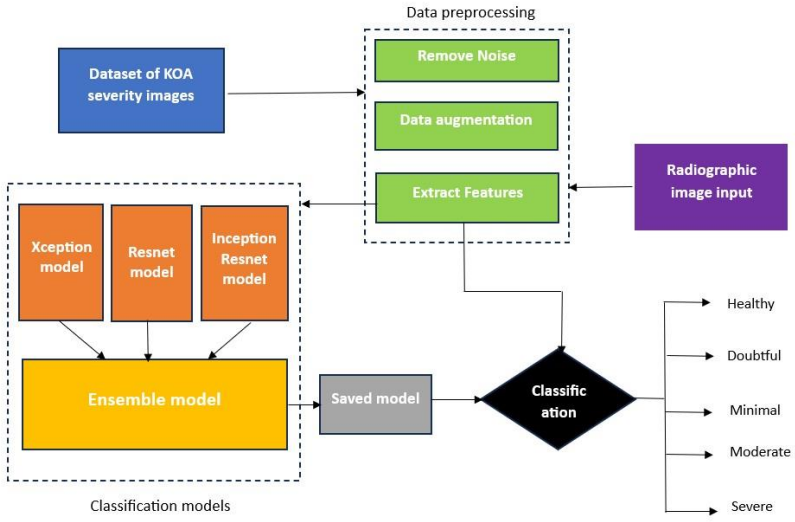

Figure 1 Architectural Diagram

Fig 2: Different Severity of Knee OA

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CONCLUSION

In conclusion, a major development in medical imaging and healthcare technology is the knee osteoarthritis detection project, which makes use of machine learning and radiographic pictures. The study effectively accomplished its main goals by creating and assessing categorization models, demonstrating how artificial intelligence might help medical practitioners with early diagnosis and treatment planning. The project's results show promise in increasing the precision and effectiveness of knee osteoarthritis identification, despite obstacles encountered along the way, such as extensive data preprocessing and model optimization. In the long run, the results of this study highlight the value of interdisciplinary cooperation and ongoing research in the field of computer-aided diagnostics. The use of machine learning techniques to healthcare workflows has great potential to advance patient care and personalized medicine strategies.

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