

Chapter 6

Osteoarthritis Disease Prediction Based on Machine Learning Techniques

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ABSTRACT

The most typical type of arthritis is osteoarthritis. Osteoarthritis is a degenerative joint disease affecting millions of people worldwide. It usually affects the hands, hips, and knees. People with osteoarthritis struggle to perform simple tasks such as walking, standing, or climbing stairs. In osteoarthritis, a joint's cartilage starts to degrade, and the underlying bone starts to alter. One of the main causes of disability and a prevalent disease of the elderly population is osteoarthritis. Moreover, because of the persistent pain and impairment brought on by the condition, osteoarthritis can also result in psychological distress, such as sorrow and anxiety. The advanced deep learning-based convolutional neural network and several machine learning-based techniques are applied in comparison. Using the random forest method, this chapter divides osteoarthritis disease into four categories of severity: Grade-0, Grade-1, Grade-2, Grade-3, Grade-4. Extensive experiments demonstrate that the proposed model outperformed with a 99% accuracy score for predicting osteoarthritis.

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INTRODUCTION

Osteoarthritis (OA) is a degenerative, non-inflammatory disorder of the joints characterised by articular cartilage degradation (Kumar & Saxena, 2019). A common technique that produces clear images of the joint is Magnetic Resonance Imaging (MRI), but it is expensive and unable to record the knee in use. The same restriction applies to X-ray imaging, which is also troublesome owing to radiation exposure (Yiallourides & Moore, 2018). When the exact condition appears, serious issues occur. The key effects are poor quality of life because of excruciating pain and stiffness, Poor psychological health and apathy towards life (Kokkotis et al., 2020). Previous studies have shown no strong correlation between pain severity and imaging findings. Several researchers support that the dynamic assessment of knee function is necessary. Meanwhile, the fast development of electrical computer engines allows people to use intelligent algorithms as auxiliary tools to process and assess the data generated from the dynamic examinations. In this paper use of Machine learning algorithms have been used to predict diseases, and researchers have proposed methods to recognize patients with Knee OA based on different physiological signals, ML is a subfield of artificial intelligence (AI) focuses on using data and algorithms to imitate how humans learn, gradually increasing the accuracy of the system. Machine learning techniques has various algorithm like Convolutional Neural Network (CNN), K-Nearest Neighbours (KNN), Support Vector Machine (SVM), K-Means, Random Forest Algorithm. In these algorithms CNN performs well and produce the best accuracy. In image processing it has an effective recognition method, is frequently employed. It offers several attributes, including adaptability, a straightforward structure, and fewer training requirements. Here we are using the Osteoarthritis dataset which was collected from Kaggle website. It consists of 9000 images of both left and right knee to achieve the best accuracy.

RELATED WORKS

Hassan A. Alshamrani (2023) discovered that knee osteoarthritis is a difficult problem that affects many individuals throughout the world. There are presently no drugs that can treat knee osteoarthritis. Early identification is the only method to prevent the development of knee osteoarthritis. X-ray imaging is now the most often utilized tool for predicting osteoarthritis. However, mistakes are common with manual X-ray techniques due to radiologists' lack of competence. They also noted that recent research have detailed the use of automated machine learning methods for the effective prediction of osteoarthritis from X-ray images. However, most of these approaches require greater prediction accuracy to diagnose osteoarthritis at an early stage. In their work, they proposed a strategy with improved prediction accuracy that might be used in the actual world for the early identification of knee osteoarthritis. In addition, transfer learning models based on sequential convolutional neural networks (CNNs), Visual Geometry Group 16 (VGG-16), and Residual Neural Network 50 (ResNet-50) have been proposed for the early diagnosis of osteoarthritis from knee X-ray images. The authors' investigation revealed that all of the recommended models had a better degree of prediction accuracy, greater than 90%, in identifying osteoarthritis. However, the best-performing model was assigned to the pre-trained VGG-16 model, which obtained 99% training accuracy and 92% testing accuracy.

According to Taghi Ramazanian et al. (2023), knee osteoarthritis (OA) is a common joint condition. Clinical prediction algorithms take into account a wide variety of risk variables for knee osteoarthritis. The authors examined the assessed and published prediction models for knee OA and identified potential

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