Automated Detection and Severity Grading of Osteoarthritis: A Machine Learning Approach

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Abstract:

Osteoarthritis (OA) is one of the most common joint disorders worldwide, affecting millions of people and leading to pain, reduced mobility, and a lower quality of life. Early detection is crucial for effective treatment and improved patient outcomes. However, traditional diagnostic approaches, such as X-rays and physical examinations, often struggle to identify OA in its initial stages, delaying timely intervention. This study introduces an advanced diagnostic framework that combines image processing techniques with machine learning algorithms to enhance early osteoarthritis detection. Utilizing high-resolution X-ray and ultrasound images, the system employs data normalization, augmentation, and deep learning models to analyze joint structures for early degenerative changes. The model's effectiveness was assessed using a dataset of X-ray images, showing notable improvements in diagnostic accuracy and sensitivity over conventional methods. The findings indicate that this approach can enable earlier diagnosis and treatment, potentially minimizing the long-term effects of OA. Furthermore, the system is designed for easy integration into clinical settings, offering healthcare professionals an efficient and user-friendly diagnostic solution. This research underscores the transformative potential of machine learning and image processing in advancing osteoarthritis detection and management.

Keywords:

Osteoarthritis (OA), Early Detection, Machine Learning, Image Processing, Diagnostic Precision.