ABSTRACT

In the developing world of technology, computers can accurately detect Osteoarthritis (OA) in the early knee, which is crucial for patients. Conventional diagnostic methods that rely on subjective interpretation of X-ray images lead to variability and inconsistency. Along with advances in Deep Learning and object detection, the potential to improve the efficiency and accuracy of medical diagnosis is opening up. This study presents YOLOV8 and RT-DETR models to compare the detection and classification of knee OA severity on a comprehensive dataset consisting of normal, doubtful, mild, moderate, and severe X-ray images. Through this training process, the models understand the characteristics and identify patterns and features in Osteoarthritis, thereby improving diagnostic accuracy. The experimental results show that both models achieve very high detection performance with an overall mAP50 value above 97%. However, a more in-depth analysis through F1-Score hypothesis testing reveals statistically significant differences. With a p-value of 0.0235, the paired t-test demonstrates that the RT-DETR model exhibits superior balance between Precision and Recall (average F1-Score 0.9731) compared to YOLOv8 (average F1-Score 0.9607). Class-based analysis indicates strong performance in the Normal and Severe classes, but faces some challenges in the Mild class. These findings highlight that RT-DETR is more reliable in producing balanced detection, minimising both false positives and false negatives. This advantage makes RT-DETR a more optimal choice for diagnostic applications where accuracy and reliability are critical. Future work will focus on optimising the model for minority classes and exploring more advanced Deep Learning architectures.

Keywords: *knee osteoarthritis, medical, object detection , YOLOV8 , RF-DETR*