AUTOMATIC KNEE OSTEOARTHRITIS DETECTION AND SEVERITY GRADING USING DEEP LEARNING

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Abstract

Knee Osteoarthritis is a crippling condition that can limit the physical movement of individuals by mainly affecting the joints that bear majority of the body weight such as the hips, hands and most frequently, the knee joints. While diagnosis methods include assessing symptoms, investigating medical history, using MRIs, and inspecting radiographs using the Kellgren-Lawrence grading system by medical professionals, it is highly reliant on their level of experience and how skilful they are at proper diagnosis. Therefore, a better approach is needed to reduce the rates of misclassifying the severity of the condition and diagnosing the patient inaccurately.

Research uncovered the best approach to the problem stated would be to explore suitable radiographic image processing techniques and to explore object detection algorithms that can jointly detect a knee joint and classify to the relevant grade simultaneously. To overcome issues of misclassifications of the severity of Knee Osteoarthritis, a novel deep learning model that makes use of radiograph processing methods such as CLAHE to allow better detection of knee joints and better bounding box prediction via an improved version of the YOLO algorithm with the most accurate KL grade classification is achieved as a part of the research carried out.

The OAI dataset was used to detect and categorize knee joints, and the Jaccard Index and mean Average Precision were found to be 61.50% and 79.51%, respectively. Although the outcomes are encouraging, this dissertation is just an initial effort to identify and classify Knee Osteoarthritis using knee x-rays. As a result, constraints and potential enhancements are evaluated, leaving space for additional exploration in the future.

Keywords: Deep Learning, Object Detection, Multi-Class Classification, Knee Osteoarthritis, KL Grade