UNDERGRADUATE THESIS

DETECTION AND CLASSIFICATION OF OSTEOARTHRITIS SEVERITY ON KNEE JOINT X-RAY USING MSTHGR AND VGG-19

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ABSTRACT

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Characterized by joint cartilage degradation, Osteoarthritis (OA) is a progressive disease that triggers substantial deformity, stiffness, chronic pain, and limited movement. Epidemiological reports indicate a massive 113.25% expansion in worldwide cases, which grew from 247.51 million to 527.81 million between 1990 and 2019. Standard severity grading by experienced practitioners is not only time-consuming but also exhibits only moderate agreement among observers.

Consequently, deploying computerized approaches is crucial for accelerating and refining the diagnostic assessment of osteoarthritis. The primary objective of this paper is to classify five levels of knee osteoarthritis severity from X-ray scans utilizing a pre-trained VGG-19 deep learning model. To refine structural bone clarity, a Multi-Scale Top-Hat Transform powered by Geodesic Reconstruction (MSTHGR) algorithm is integrated into the preprocessing pipeline. Evaluation of the network's predictive quality relies on accuracy, precision, recall, and macro F1-score indicators.

The experimental data confirms that applying the MSTHGR technique improves classification accuracy for several disease cohorts. On the evaluation dataset, the hybrid VGG-19 and MSTHGR pipeline yields an accuracy of 61.85% and a macro F1-score of 66.52%. Ultimately, these findings indicate that merging digital image refinement tools with deep learning methodologies offers promising support for classifying knee osteoarthritis progression.

Keywords: Knee Osteoarthritis, MSTHGR, VGG-19, X-Ray.

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Surabaya, June 2nd 2026

Agus Bisana Putra

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