UNDERGRADUATE THESIS

APPLICATION OF SOFT VOTING ENSEMBLE LEARNING IN THE CLASSIFICATION OF THE TINEA CAPITIS SKIN DISEASE USING RESNET-50 AND EFFICIENTNET-B2

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APPROVAL SHEET

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Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

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ABSTRACT

Student Name / NPM	:	Sandy Nicholas / 22081010237
Thesis Title	:	Application of Soft Voting Ensemble Learning in the Classification of the Tinea Capitis Skin Disease using ResNet-50 and EfficientNet-B2
Supervisor	:	1. Dr. Ir. I Gede Susrama Mas Diyasa, ST. MT. IPU 2. Hendra Maulana, S.Kom., M.Kom.

Tinea Capitis skin disease (scalp ringworm) is a dermatophyte fungal infection with a high prevalence of disease distribution, particularly among the pediatric age group, male gender, and rural communities, characterized by a rapid transmission risk. Diagnosing Tinea Capitis faces challenges involving high dermoscopy equipment costs and the subjectivity of medical image interpretation, exacerbated by visual similarities between inflammatory and non-inflammatory subtypes (Kerion, Pustular Diffuse, Black Dot, and Gray Patch). This study aims to address these issues by proposing a Tinea Capitis subtype classification system based on Deep Learning using the Soft Voting Ensemble Learning paradigm, which combines the predictive strengths of Convolutional Neural Network (CNN) architectures, specifically the ResNet-50 and EfficientNet-B2 models. ResNet-50 architecture was selected for deep textural image feature extraction capabilities via Residual Blocks that mitigate the vanishing gradient problem, while the EfficientNet-B2 architecture was chosen for parameter efficiency and Compound Scaling mechanism, offering a balance between depth, width, and resolution. To maximize the performance of Soft Voting Ensemble Learning, contribution weight combination optimization is applied by comparing the deterministic Grid Search method and the stochastic Random Search method across three dataset splitting scenarios. System testing results indicate that Scenario 1 (70% training : 20% validation : 10% testing) yielded the most robust performance with the highest testing accuracy reaching 89.47%, where the Grid Search optimization proved consistent compared to Random Search in finding the optimal ensemble weight configuration (w1 = 0.45 for ResNet-50 architecture model and w2 = 0.55 for EfficientNet-B2 architecture model), and successfully corrected classification errors in the Pustular Diffuse class. The best architectural model results are subsequently implemented into a web-based interface system utilizing Laravel 12 and Tailwind CSS frameworks to facilitate direct use by medical personnel in the field. Performance evaluation using Accuracy, Precision, Recall, F1-Score, Specificity, and False Positive Rate evaluation metrics concludes that the integration of the optimized Soft Voting Ensemble Learning applied within a medical information system is capable of providing an accurate, efficient, and accessible diagnostic solution for medical personnel.

Keywords : Confusion Matrix, EfficientNet-B2, Grid Search, Random Search, ResNet-50, Ringworm, Soft Voting Ensemble Learning Paradigm, Tinea Capitis.

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Through this thesis, the author hopes that readers will gain valuable knowledge and insights from the report. The author is fully aware that this thesis still has many shortcomings. Therefore, the author highly expects constructive criticism and suggestions from readers to further improve this thesis report.

Surabaya, April 1st 2026
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