



UNDERGRADUATE THESIS

**CLASSIFICATION OF MALARIA USING
MICROSCOPIC IMAGES OF BLOOD CELLS
WITH A HYBRID CNN-SWIN TRANSFORMER
ARCHITECTURE**

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INFORMATICS STUDY PROGRAM
SURABAYA
2026**

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CLASSIFICATION OF MALARIA USING MICROSCOPIC IMAGES OF BLOOD CELLS WITH A HYBRID CNN-SWIN TRANSFORMER ARCHITECTURE

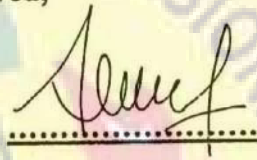
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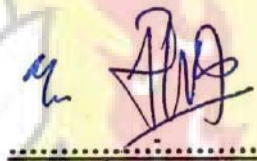
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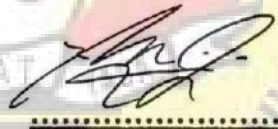
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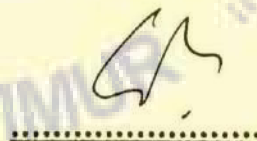
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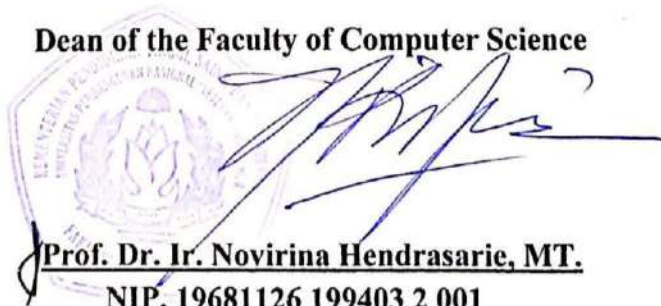
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ABSTRACT

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Thesis Title : Malaria Disease Classification on Blood Cell Microscopic Images Using Hybrid CNN–Swin Transformer Architecture

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Malaria remains a significant public health threat in endemic regions, including Indonesia, while manual microscopic diagnosis remains prone to subjectivity and is time-consuming. This study applies binary classification of malaria (infected vs. uninfected) on microscopic blood cell images using a Hybrid CNN–Swin Transformer architecture, which combines CNN's local feature extraction with Swin Transformer's global context modeling. The images underwent preprocessing consisting of resizing to 224×224 pixels, Z-Score normalization, and on-the-fly augmentation, with performance optimized through hyperparameter tuning using Grid Search. Evaluation results on the best configuration for each model show that the Swin Transformer achieved an accuracy of 96.57% and F1-score of 96.54% (70:15:15), the CNN achieved an accuracy of 96.01% and F1-score of 96.01% (70:15:15), while the Hybrid model achieved an accuracy of 96.06% and F1-score of 96.01% (70:15:15). The slightly lower performance of the Hybrid model is attributed to spatial information reduction at the bridge layer, the architecture's sensitivity to hyperparameter combinations, and the characteristics of the single-cell dataset, in which the Swin Transformer's global context alone is already sufficient for classification. Interpretability was analyzed using Grad-CAM, which showed the model's focus consistently on the morphology of the Plasmodium parasite as the biologically relevant region. The system was implemented as a web-based prototype using Streamlit to support fast and interactive malaria detection.

Keywords : Malaria, Binary Classification, Microscopic Images, Convolutional Neural Network, Swin Transformer, Hybrid, Grad-CAM, Explainable AI

ACKNOWLEDGEMENTS

All praise and gratitude are due to Allah SWT for His infinite blessings, guidance, and mercy, which have enabled the author to successfully complete this undergraduate thesis entitled " **CLASSIFICATION OF MALARIA USING MICROSCOPIC IMAGES OF BLOOD CELLS WITH A HYBRID CNN–SWIN TRANSFORMER ARCHITECTURE.**"

This thesis is submitted as one of the requirements for obtaining the Bachelor of Computer Science degree in the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur. Throughout the preparation of this thesis, the author received invaluable assistance, guidance, encouragement, and support from many individuals and institutions. Therefore, the author would like to express sincere gratitude and appreciation to everyone who has contributed to the successful completion of this thesis. In particular, the author would like to extend heartfelt thanks to:

1. My beloved parents, **Harti Hanifah** and **Djoko Soerjadi**, as well as my beloved siblings, for their unconditional love, endless support, and sincere prayers throughout every stage of my life. Their unwavering dedication, sacrifices, and care have been the greatest source of strength that has enabled me to persevere and successfully complete this thesis.
2. Muhammad Muharrom Al Haromainy, S.Kom., M.Kom. and Henni Endah Wahanani, S.T., M.Kom., my thesis supervisors, for their patience, invaluable guidance, constructive feedback, and continuous support throughout the research and writing process. Their time, expertise, and encouragement have been instrumental in the successful completion of this study.
3. My fellow seminar and thesis colleagues, Ken Narendra Ekamartha, Abraham Danar Jovian, Dimas Aji Primadiansyah, M. Maulana Falihuddin, and Ryan Bagus Bimantoro, for their constant encouragement, friendship, and support throughout my academic journey. The experiences, discussions, and assistance we shared have created unforgettable memories and made this challenging journey significantly more meaningful.

4. Awidya Chandradewi, for always being by my side through every step of this journey, in moments of joy and hardship alike. Thank you for being a source of comfort during the most demanding times, for believing in me even when I doubted myself, and for your unwavering patience, encouragement, and prayers. Your presence and support have been an invaluable source of strength that enabled me to persevere and successfully complete this thesis.
5. My friends at **Mamino, Kupluk, Basroil, Fadika, Rizki, Alip, Nanta, Yasir, Kepin, Ojan, Wahyu, Leon, Erlang, Irfan, and Slotong**, for filling my university years with laughter, memorable moments, and unwavering camaraderie. I am sincerely grateful for the academic advice, information, and support you generously shared throughout my studies and graduation process, as well as for the companionship that made every challenge easier to overcome.
6. Finally, I would like to express my sincere gratitude to everyone who has contributed to and supported my academic journey and the completion of this thesis, whether directly or indirectly, and whose names cannot all be mentioned individually. Thank you for your kindness, assistance, encouragement, and prayers. May God Almighty bless you abundantly and reward your generosity with greater blessings.

Surabaya, July 10th 2026



Muhammad Nabil Ramadhani

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