

**AN AUTOMATED MALARIA DIAGNOSIS SYSTEM FOR  
DETECTING LIFE CYCLE STAGES OF PLASMODIUM IN THIN  
BLOOD SMEAR IMAGES**

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**AUGUST, 2024**

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**BY**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF  
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SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA,  
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**AUGUST, 2024**

## **ACCEPTANCE**

This is to attest that this dissertation is accepted in partial fulfillment of the requirements for the award of the Master of Sciences in Bio-informatics degree in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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## **DECLARATION**

**I, OBA, EMMANUEL BABATUNDE, (22PBF02396)**, declare that the research entitled **“AN AUTOMATED MALARIA DIAGNOSIS SYSTEM FOR DETECTING LIFE CYCLE STAGES OF PLASMODIUM IN THIN BLOOD SMEAR IMAGES.”** Was carried out by me under the supervision of Dr. Itunuoluwa M. Isewon of the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been submitted anywhere else, in whole or in part, for the purpose of receiving a degree. This dissertation includes complete acknowledgments for all data and scholarly information sources.

**OBA, EMMANUEL BABATUNDE**

**Signature and Date**

## **CERTIFICATION**

This is to certify that this dissertation titled “**AN AUTOMATED MALARIA DIAGNOSIS SYSTEM FOR DETECTING LIFE CYCLE STAGES OF PLASMODIUM IN THIN BLOOD SMEAR IMAGES**” is an original research work carried out by **OBA, EMMANUEL BABATUNDE, (22PBF02396)** in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria under the supervision of Dr. Itunuoluwa M. Isewon. We have examined and found this work acceptable as part of the requirements for the award of Master of Science (M.Sc.) in Bioinformatics.

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## **DEDICATION**

I present this work as a tribute to the Almighty God, whose boundless wisdom, grace, and love have been the beacon illuminating my path through life. Furthermore, I devote this work to my dear parents, who have exhibited steadfast commitment and extraordinary efforts in preparing me for achievement.

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## ABSTRACT

The worldwide influence of malaria has hastened the creation and execution of innovative diagnostic approaches aimed at combating the disease. Several attempts have been made to develop an automated malaria diagnosis system (AMDS), but most of these systems are trained to perform binary classification to distinguish between infected and uninfected Plasmodium falciparum parasites. This study investigates the application of deep learning techniques in developing an Automated Malaria Diagnosis System (AMDS) to enhance the accuracy and efficiency of malaria life cycle stage detection from thin blood smear images. The main objectives are to curate a novel dataset of thin blood smear images with the lifecycle stages of Plasmodium and to leverage pre-trained convolutional neural networks (CNNs) to identify the life cycle stages of Plasmodium, which are responsible for malaria. The study specifically focuses on evaluating the performance of different CNN architectures, including VGG16, VGG19, ResNet50, and MobileNet. The methodology involved curating a dataset of annotated thin blood smear images representing various life stages of the Plasmodium parasite. This dataset was then used to fine-tune the selected CNN models. The models were evaluated based on metrics such as accuracy, precision, recall, F1-score, and support. The results showed that VGG16 achieved the highest accuracy of 0.72, but its precision (0.47) and F1-score (0.49) indicated room for improvement in classification performance. VGG19, while slightly lower in accuracy at 0.71, demonstrated better precision (0.55) and recall (0.64), resulting in a higher F1-score (0.56). ResNet50, commonly recognized for its robustness in other domains, underperformed with an accuracy of 0.61 and a notably lower recall of 0.26. MobileNet displayed moderate results, with an accuracy of 0.68 and balanced precision and recall values. The findings suggest that VGG19 offers a more balanced performance for malaria stage classification, making it a promising candidate for deployment in a clinical setting. However, further optimization and refinement of these models are necessary to improve diagnostic precision and reliability. The study concludes that deep learning models, particularly VGG19, hold significant potential in supporting malaria diagnosis and contributing to more effective disease management and control strategies.

***Keywords: Automated Malaria Diagnosis System, Convolutional Neural Networks, Deep Learning, Plasmodium, Thin Blood Smear Images, Web Application***