

**DEVELOPMENT OF AN AUTOMATED MALARIA DETECTION  
SYSTEM USING DEEP LEARNING MODELS**

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**AUGUST, 2023**

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**BY**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF  
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COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT  
UNIVERSITY, OTA, OGUN STATE, NIGERIA**

**AUGUST, 2023**

## **ACCEPTANCE**

This is to attest that this dissertation has been accepted in partial fulfilment of the requirements for the award of the degree of Master of Science in Bioinformatics in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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## **DECLARATION**

I, **ADEGOKE, FAITH OMOLARA (21PBF02258)** declare that this dissertation is a representation of my work and is written and implemented by me under the supervision of Professor Jelili O. Oyelade of the Department of Computer and Information Sciences, Covenant University, Ota, Nigeria. I attest that this dissertation has in no way been submitted either wholly or partially to any other university or institution of higher learning for the award of a master's degree. All information cited from published and unpublished literature has been duly referenced.

**ADEGOKE, FAITH OMOLARA**

**Signature and Date**

## **CERTIFICATION**

This is to certify that the research work titled “**DEVELOPMENT OF AN AUTOMATED MALARIA DETECTION SYSTEM USING DEEP LEARNING MODELS**” is an original research work carried out by **ADEGOKE, FAITH OMOLARA, (21PBF02258)** meets the requirements and regulations governing the award of Master of Science (M.Sc.) degree in Bioinformatics from the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, and is approved for its contribution to knowledge and literary presentation.

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## **DEDICATION**

This research work is dedicated to God Almighty, the custodian of all wisdom, knowledge, and understanding, for His grace and favour throughout the execution of this research.

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# TABLE OF CONTENTS

<b>CONTENTS</b>	<b>PAGES</b>
<b>COVER PAGE</b>	<b>i</b>
<b>TITLE PAGE</b>	<b>ii</b>
<b>ACCEPTANCE</b>	<b>iii</b>
<b>DECLARATION</b>	<b>iv</b>
<b>CERTIFICATION</b>	<b>v</b>
<b>DEDICATION</b>	<b>vi</b>
<b>ACKNOWLEDGMENTS</b>	<b>vii</b>
<b>TABLE OF CONTENTS</b>	<b>ix</b>
<b>LIST OF FIGURES</b>	<b>xii</b>
<b>LIST OF TABLES</b>	<b>xiii</b>
<b>ABSTRACT</b>	<b>xiv</b>
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
1.1 Background to the study	1
1.2 Statement of the Problem	4
1.3 Aim and Objectives of the Study	5
1.4 Research Methodology	5
1.5 Significance of the Study	6
1.6 Scope of the Study	7
1.7 Limitation of the Study	7
1.8 Organization of the Study	7
<b>CHAPTER TWO: LITERATURE REVIEW</b>	<b>8</b>
2.1 Preamble	8
2.2 Malaria	8
2.3 Malaria Diagnosis	9
2.4 Parasite density (Parasitaemia)	11
2.5 Image Classification	12
2.5.1 Binary and Multiclass Classification	12
2.6 Machine Learning	13
2.7 Deep Learning	14
2.8 Convolutional Neural Networks	15
2.8.1 AlexNet	17
2.8.2 VGG16	17

2.8.3	Deep Residual Network (ResNet)	18
2.9	Related Works	19
2.10	Summary of Literature Review	24
<b>CHAPTER THREE: RESEARCH METHODOLOGY</b>		<b>25</b>
3.1	Preamble	25
3.2	Curation of all available malaria image datasets	26
3.2.1	Systematic Review Methodology	26
3.2.2	Datasets Retrieved	27
3.3	Building the deep learning classifiers	30
3.3.1	Datasets Pre-processing	30
3.3.2	Data Augmentation	30
3.3.3	Synthetic Minority Oversampling Technique (SMOTE)	30
3.3.3	Building the classification models	31
3.3.4	Performance Evaluation	34
3.4	Development of the Web Application Prototype	35
<b>CHAPTER FOUR: RESULTS AND DISCUSSION</b>		<b>37</b>
4.1	Preamble	37
4.2	Curation of available datasets	37
4.3	Evaluation of Deep Learning Classifiers	45
4.3.1	Performance Evaluation for Infection Status Classification	45
4.3.2	<i>Plasmodium</i> Species ( <i>falciparum</i> & <i>vivax</i> ) Classification	47
4.3.3	Smear Classification	48
4.3.4	Optical Train Classification	49
4.3.5	Type of Stain classification	50
4.4	Web Application Prototype	51
<b>CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION</b>		<b>55</b>
5.1	Summary	55
5.2	Conclusion	56
5.3	Contribution to knowledge	56
5.4	Recommendation	56
<b>REFERENCES</b>		<b>57</b>
<b>APPENDIX A</b>		<b>75</b>



## LIST OF FIGURES

<b>FIGURES</b>	<b>TITLE OF THE FIGURES</b>	<b>PAGES</b>
2.1	Malaria endemicity globally	9
2.2	Thick and thin blood smears and the microscopic view	11
2.3	Binary and Multi-class classification	12
2.4	Basic architecture of Convolutional Neural Network	15
2.5	Architecture of AlexNet network	17
2.6	The Architecture of VGG16 network	18
2.7	The Architecture of Res-Net	18
3.1	The Study Workflow	25
3.2	PRISMA Flowchart for the selection of the study	29
3.3	The SMOTE algorithm	31
3.4	VGG16 Architecture	32
3.5	VGG19 Architecture	33
3.6	RESNET50 architecture	34
4.1	Summary of all publications included in the study by year of publication	37
4.2	Proportion of staining reagent used in this study	43
4.3	The number of images per datasets	43
4.4	The type of blood smears used in the study	44
4.5	The Optical Train used for the datasets	44
4.6	Performance of deep learning for infection status classification	46
4.7	Performance of deep learning algorithms for Species classification	48
4.8	Performance of deep learning algorithms for Smear classification	49
4.9	Performance of deep learning algorithms for Optical Train classification	50
4.10	Performance of deep learning for Stain classification	51
4.11	The landing page of the web application prototype for the upload of image by the user	52
4.12	The prompt that is seen when an image is not uploaded by the user.	53
4.13	The prompt shown when the Image placeholder has been clicked.	53
4.14	The uploading of the image by the user.	54
4.15	The result of the Image prediction	54

## LIST OF TABLES

<b>TABLES</b>	<b>TITLE OF THE TABLES</b>	<b>PAGES</b>
3.1	The Eligibility Criteria for the study	26
3.2	Datasets Retrieved	28
4.1	Retrieved datasets and their identifiers in the study	41
4.2	Summary of available malaria image datasets	41
4.3	The combined and single set for Classification categories	45
4.4	Best-performing models saved to the web application prototype	52

## ABSTRACT

Malaria remains a public health concern, prompting intensive research into computer-aided diagnosis using machine learning models. However, the effectiveness of these models is hindered by the presence of variabilities in clinical practices, especially in medical imaging. These issues, such as demographic differences among patients, diverse staining methods, and variations in devices, coupled with the absence of standardized medical protocols, present considerable obstacles in achieving optimal model performance. This study aims to develop a malaria detection system using deep learning models. Existing malaria image datasets were curated by doing a systematic literature review of papers published in this domain from 2015-2023. Thirteen (13) datasets were retrieved following this process. The key artifacts classified are the infection status, parasite species, type of stain, type of smear, and optical train. Python programming was used in implementing the deep learning models for the classification of the identified artifacts. Getting this information about an image dataset will ensure standardized approaches to diagnosis and research, leading to more reliable and comparable data across different settings and studies. The performance evaluation metrics used include recall (sensitivity), accuracy, precision, and F1-score. A ten-fold cross validation was also done. The models were evaluated on single set and combined sets (to increase statistical power) to compare their performance. The best performing model for infection status is VGG19 on the single set, RESNET50 performed best on the single set for Species classification, for classifying smears, VGG19 performed best on the combined set, RESNET50 performed best on the single set for classifying stains and for classifying optical train, VGG19 had the best performance on the combined set. A prototype web application for the prediction of these artifacts was developed using the Python Flask micro-framework. The best performing models were loaded to the web application. When deployed, it will provide a user-friendly platform for medical professionals and researchers alike.

***Keywords: Malaria, Image classification, Deep Learning, Computer-aided Diagnosis, Blood Smear Images***