CNN-Based Culex Mosquito Identification System

Emir Fenina

20220859

SWE491:Final Project 1

Artificial Intelligence and informatics Department

Table of content

Introduction

Culex mosquitoes are common in both towns and rural areas. They can spread illnesses like West Nile virus, making them a serious concern for public health. Knowing how to spot them helps support early detection, strong monitoring, and timely steps to slow the spread of mosquito-borne diseases.

Traditional mosquito checks depend on expert eyes, but the process is slow, demanding, and prone to mix-ups because many species look very similar. It also struggles to handle big or real-time data. These issues show why automated methods are becoming essential.

Culex_Dataset

Aedes

anopheles

Bees

horsefly

2642

```
C:\Users\amirf\Downloads\dataset\culex>dir /b *.
jpg *.jpeg *.png | find /c /v ""
2617

C:\Users\amirf\Downloads\dataset\culex>cd ..

C:\Users\amirf\Downloads\dataset>cd non-culex

C:\Users\amirf\Downloads\dataset\non-culex>dir /
b *.jpg *.jpeg *.png | find /c /v ""
2642
```

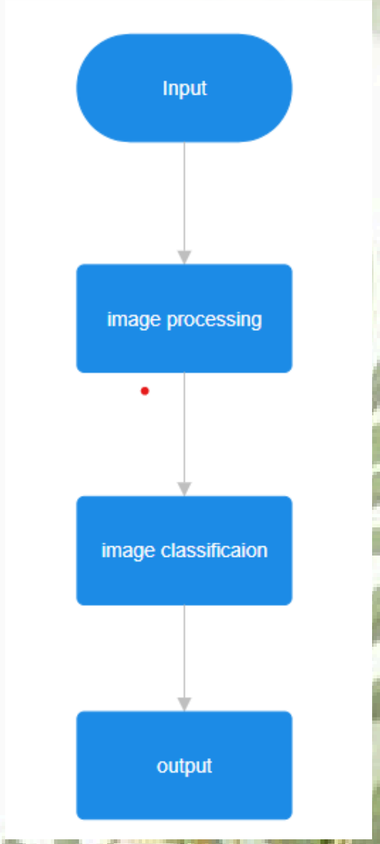
Culex Mosquito

2617

Literature Survey

Research on mosquito identification has evolved from simple feature-based methods to robust deep learning models. CNNs and transfer learning tools learn patterns directly from images and deliver better results than older techniques. Even so, problems such as unbalanced data and species that look alike underscore the need for smarter models and better training.

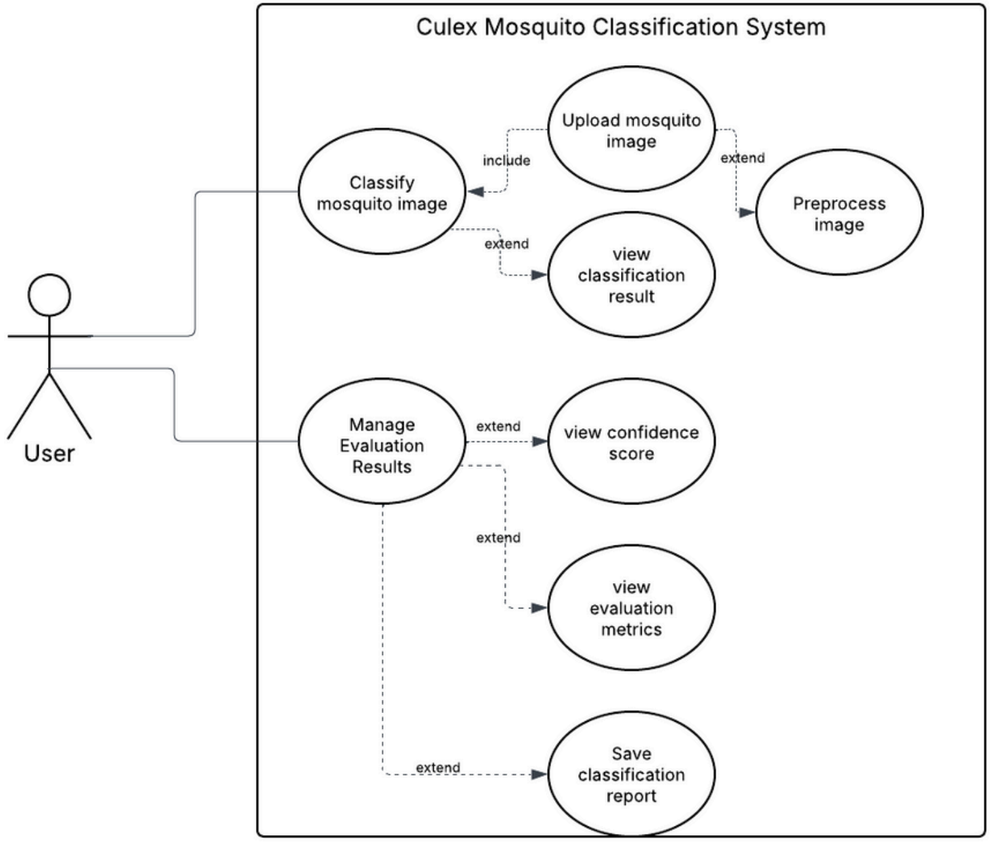
This study builds on these advances by applying a CNN-based approach to achieve accurate and scalable Culex mosquito identification.



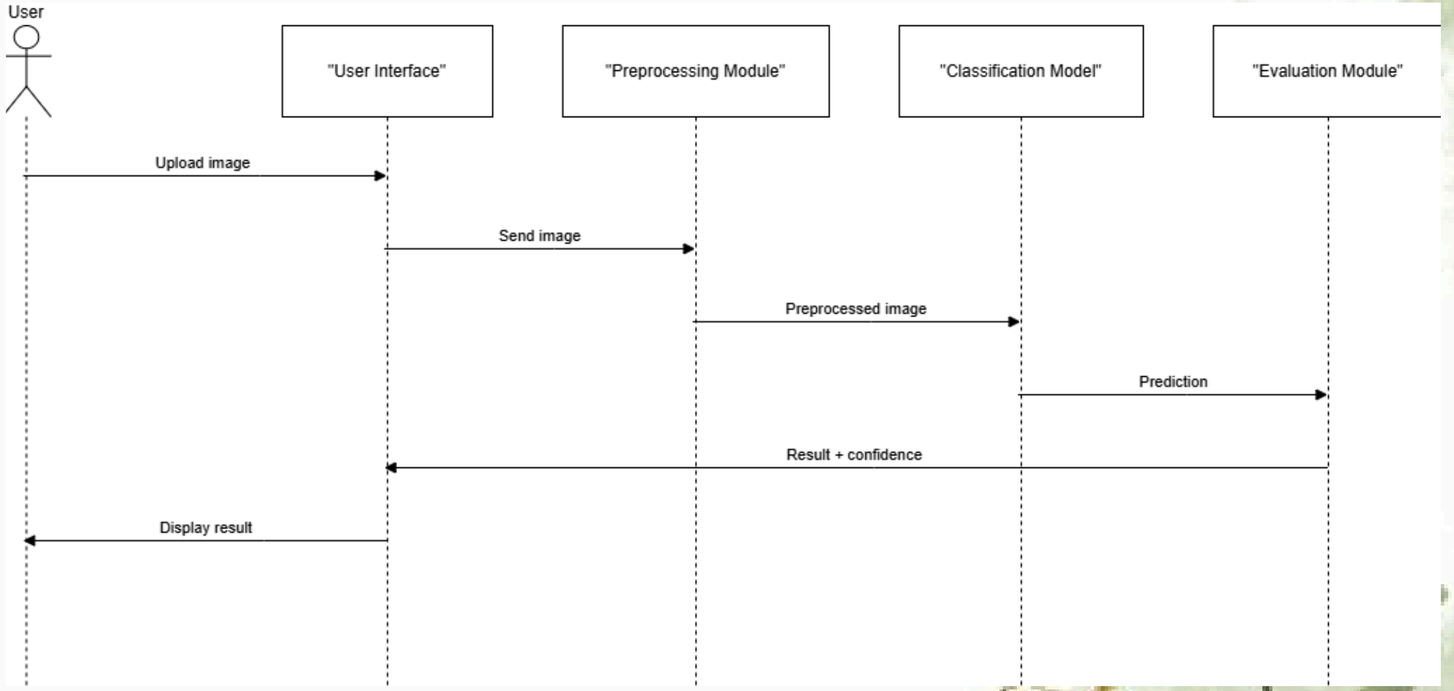
Research gaps

- Dataset imbalance and limited diversity
- Difficulty distinguishing visually similar species
- Weak generalization to real-world data
- Lack of lightweight and explainable models
- Few end-to-end, deployable systems
- High computational cost and long training time
- Poor image quality requires extensive data cleaning

Methadology

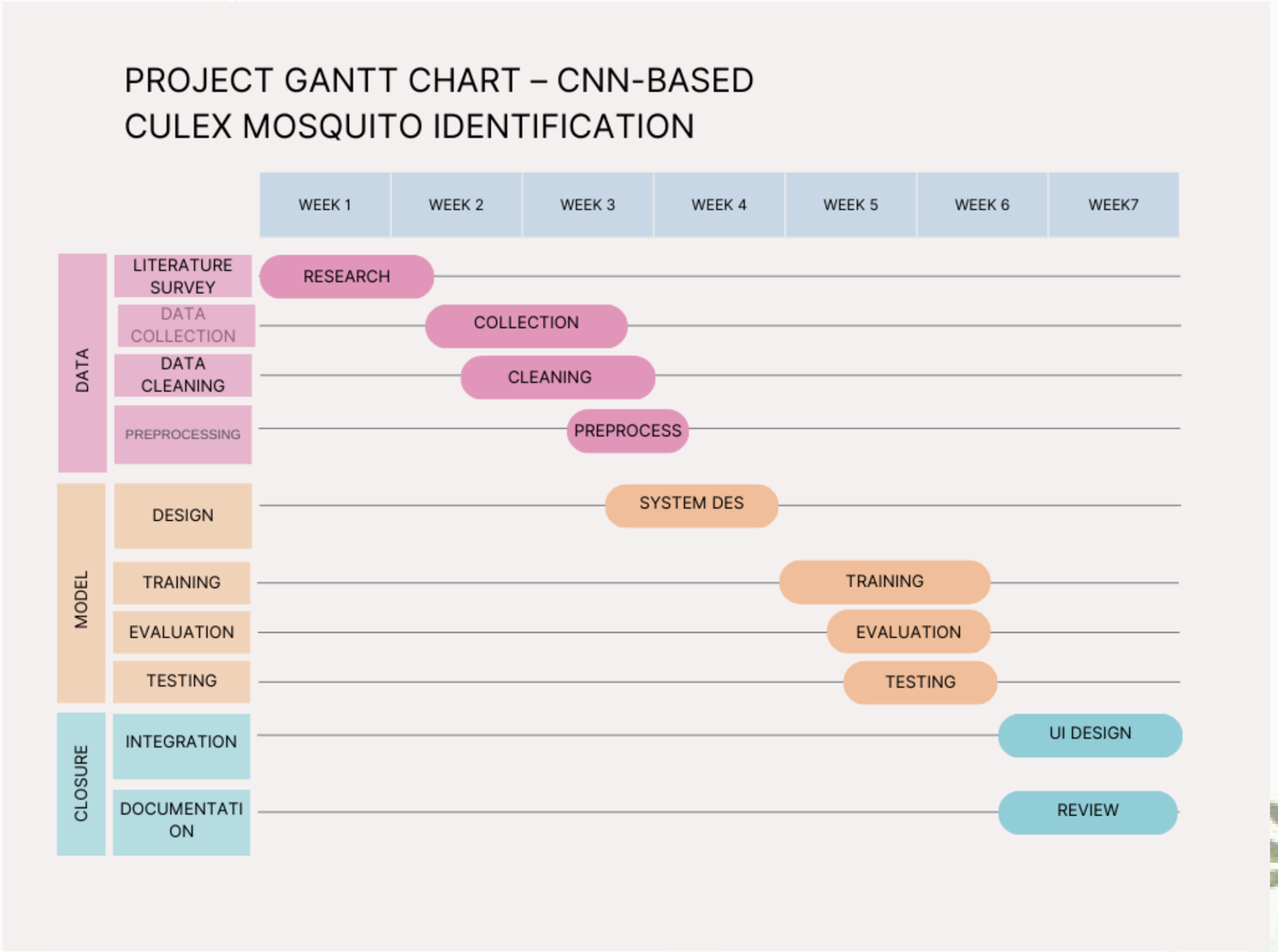


UseCase Diagram



Sequence Diagram

Timeline


PROJECT GANTT CHART – CNN-BASED
CULEX MOSQUITO IDENTIFICATION
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 6
WEEK7
DATA
LITERATURE SURVEY
DATA COLLECTION
DATA CLEANING
PREPROCESSING
RESEARCH
COLLECTION
CLEANING
PREPROCESS
MODEL
DESIGN
TRAINING
EVALUATION
TESTING
SYSTEM DES
TRAINING
EVALUATION
TESTING
CLOSURE
INTEGRATION
DOCUMENTATION
UI DESIGN
REVIEW

Technologies Used

UI Design

Programming & Core Development: Python 3.10

Frontend: React.js and CSS: used to develop an interactive web-based interface for image upload and result visualization.

Backend: FastAPI: Used to serve the trained CNN model through RESTful APIs.

Database: SQLite: Lightweight relational database used to store prediction results, image metadata, and system logs

Model Training

Model :

- TensorFlow: Framework used for building, training, and deploying deep learning models.
- Keras: High-level API built on TensorFlow for efficient CNN model development.
- EfficientNet-B3: Pre-trained CNN architecture used for transfer learning

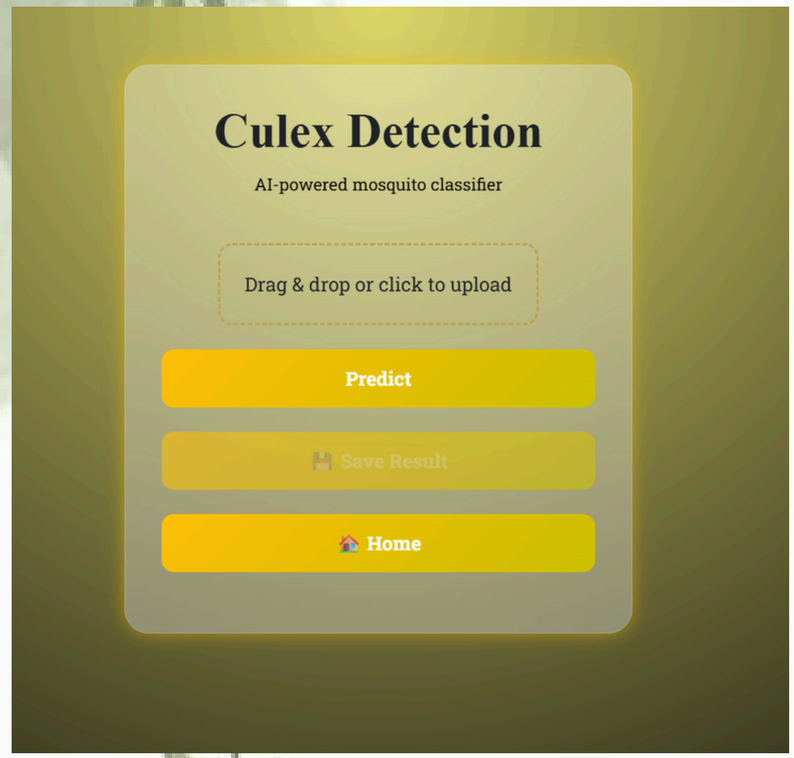
Data Processing & Visualization:

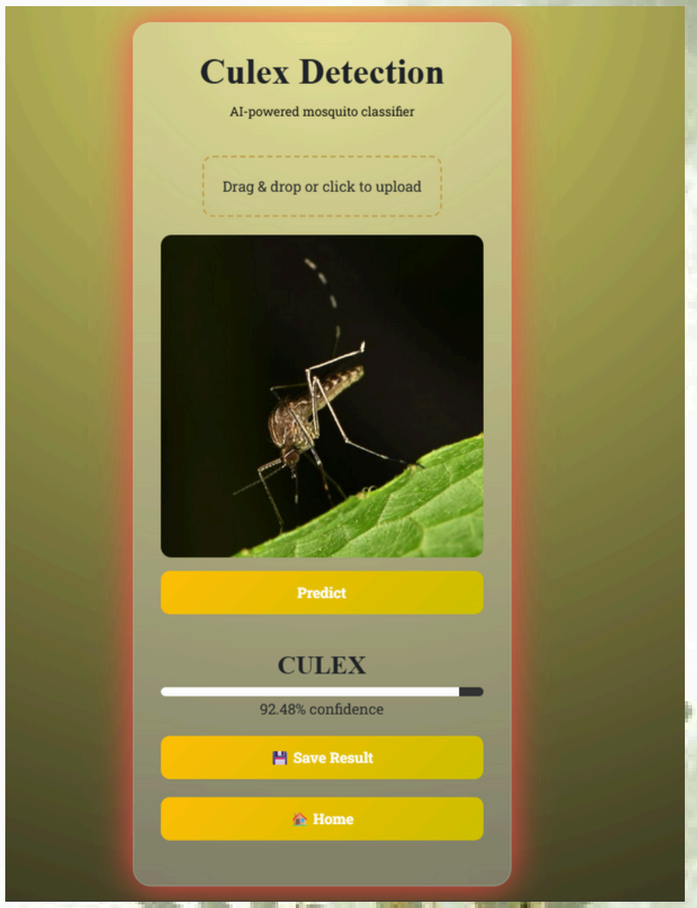
- NumPy – Numerical computations and array manipulation.
- Matplotlib – Visualization of training history, evaluation metrics, and confusion matrices.

Evaluation Tools

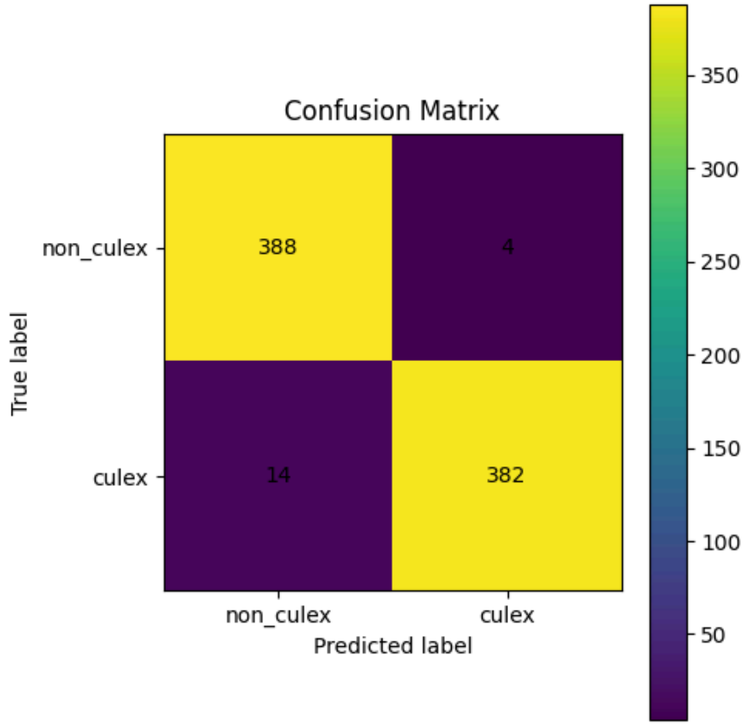
- Scikit-learn: Compute performance metrics.

Expected Outcome



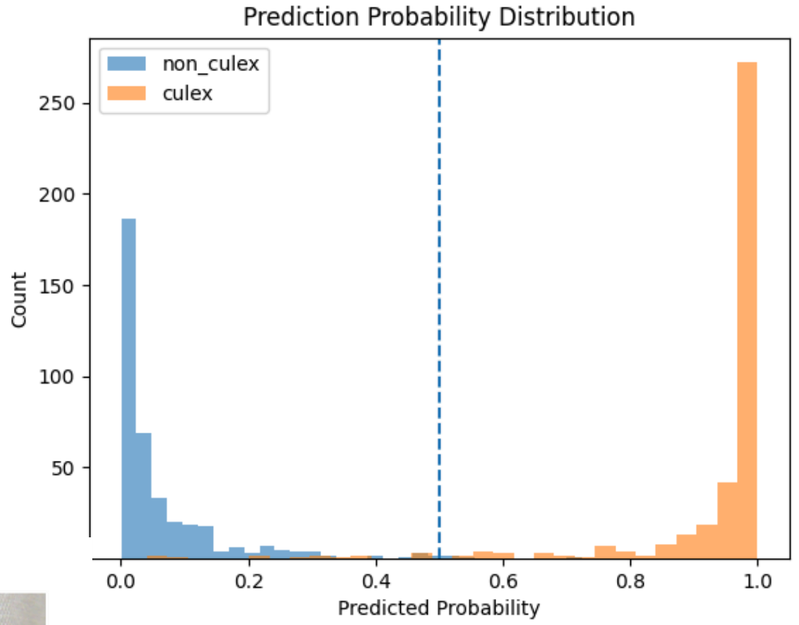


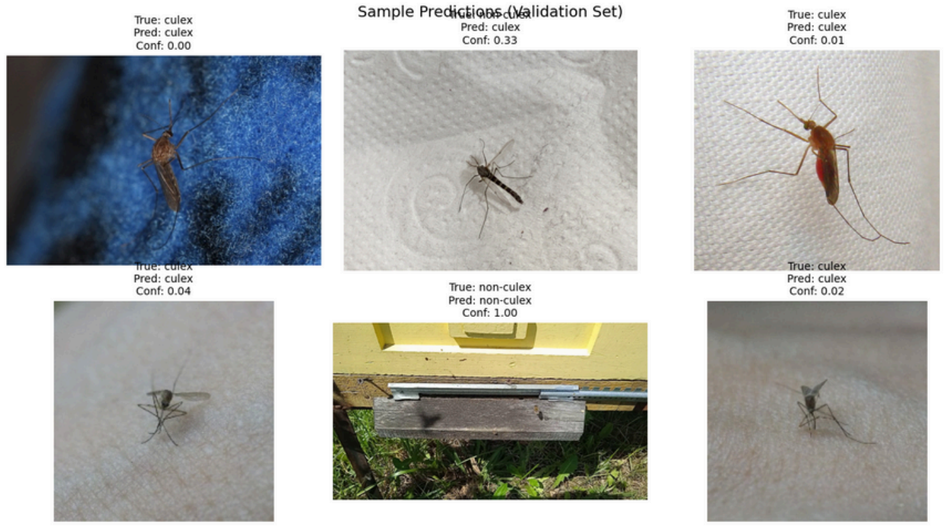
Results & Discussion



Last try confusion metrics

	precision	recall	f1-score	support
Non_culex	0.97	0.99	0.98	392
culex	0.99	0.96	0.98	396
Accuracy			0.98	788
macro avg	0.98	0.98	0.98	788
weighted avg	0.98	0.98	0.98	788





References

Tan, M., & Le, Q. (2019). EfficientNet: Rethinking model scaling for convolutional neural networks. Proceedings of ICML.

Krizhevsky, A., Sutskever, I., & Hinton, G. (2012). ImageNet classification with deep convolutional neural networks. NIPS.

Chollet, F. (2017). Deep Learning with Python. Manning Publications.

TensorFlow Documentation. https://www.tensorflow.org

World Health Organization (WHO). Mosquito-borne diseases and vector control.

Aknowledgement

I would like to express my sincere gratitude to my project supervisor for their valuable guidance, support, and constructive feedback throughout this work.

I also thank my department and faculty members for providing the necessary resources and learning environment.

Finally, I am grateful to my family and friends for their continuous encouragement and support during the completion of this project.

THANK YOU