

April 20th



Detecting Malaria Using Convolutional Neural Networks

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Presentation Agenda



✦	1.	Background on Malaria	
	2.	Stakeholder	
	3.	Data	
	4.	Models	
	5.	Conclusions	
			

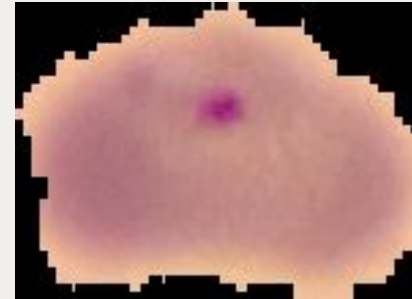
Quick Facts on Malaria

- Malaria is a parasite that can be transmitted to humans through mosquito saliva
- Once in the body, the malaria parasite lives in and destroy red blood cells
- This disease can cause flu like symptoms in most hosts and potentially death if untreated, especially in vulnerable populations
- The best method for malaria detection is to use microscopy to look at infected cells under a microscope.

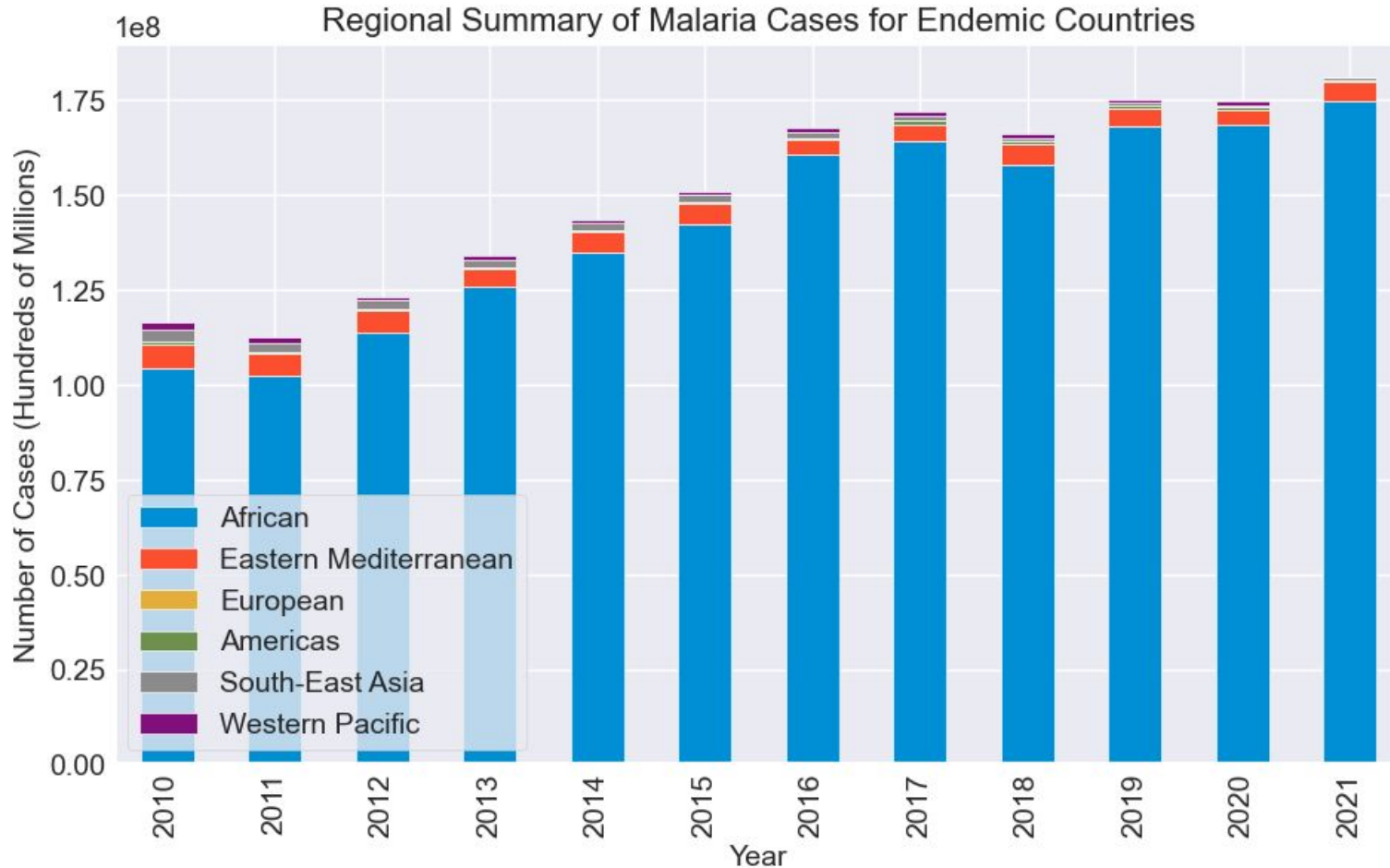
Uninfected



Parasitized



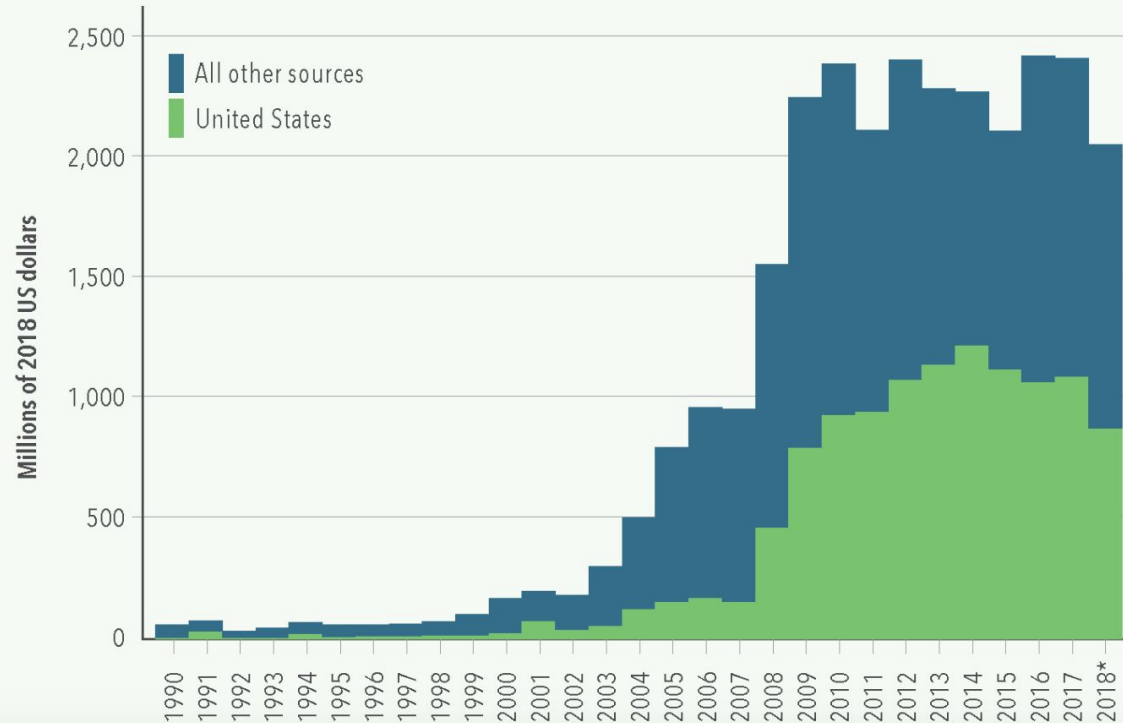
Regional Summary of Malaria Cases for Endemic Countries



The number of worldwide malaria cases has increased in recent years with most cases occurring in Africa

Donor funding for malaria was **flat** from 2010 to 2018.

Development assistance for malaria, 1990-2018



In their 2022 report on Malaria, the World Health Organization said that a lack of consistent, sufficient funding was one of the greatest challenges in the effort to eradicate Malaria.



Stakeholder: World Health Organization (WHO)

The Problem

The WHO wants to reduce global malaria incidence by at least 90% by 2030, however inadequate global malaria funding has left the WHO's current malaria **monitoring** system understaffed and under resourced



My Solution

Launched a CNN model through Streamlit that :

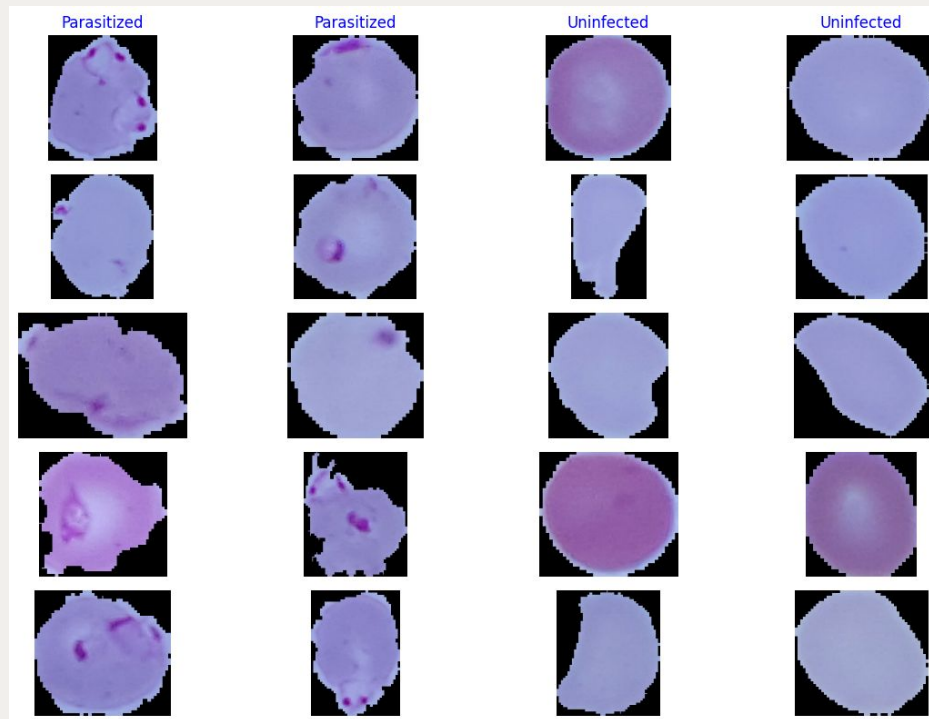
1. Stream lines malaria detection efforts in these understaffed and under resourced areas
2. Allows the WHO to more accurately and intentionally distribute malaria aid in areas impacted the most by malaria outbreaks

My Dataset

My dataset contains 27,558 blood cell samples photographed through a light microscope at 100X zoom from the National Library of Medicine

There are equal instances of parasitized (infected) and uninfected cells with diverse staining techniques

The parasitized cell samples show various stages of malaria infections



Model Timeline

Baseline Model: one
input layer & Dense
Layer. Test Accuracy
of **74%**

Model 2

Adding
additional
dense layers

**Models
4 -9**

Transfer
learning:
EfficientNetB3

Model 11

Model 1

Five layers,
three dense
layers, and
callback

Model 3

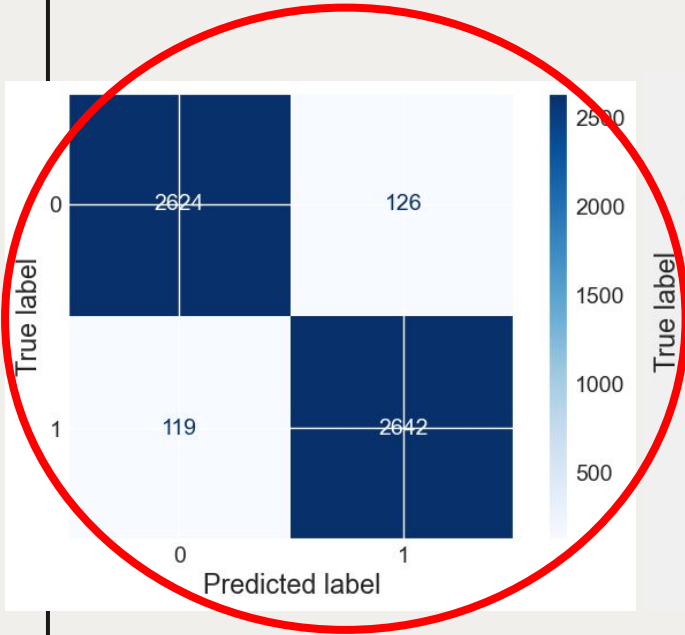
Rearranging
layers and
adding
additional
layers

Model 10

Transfer
learning:
VGG19 Model

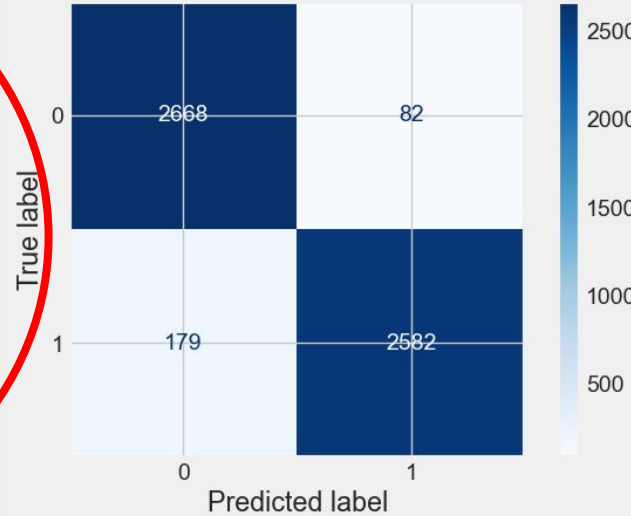
Model Performance

Model 3



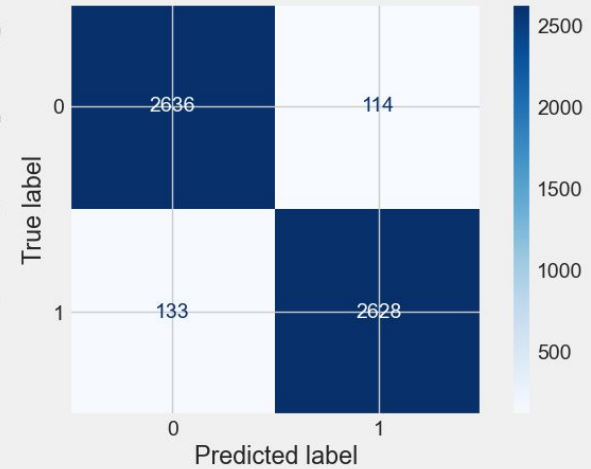
Test Accuracy: 0.96
Train Accuracy: 0.94

Model 4



Test Accuracy: 0.95
Train Accuracy: 0.96

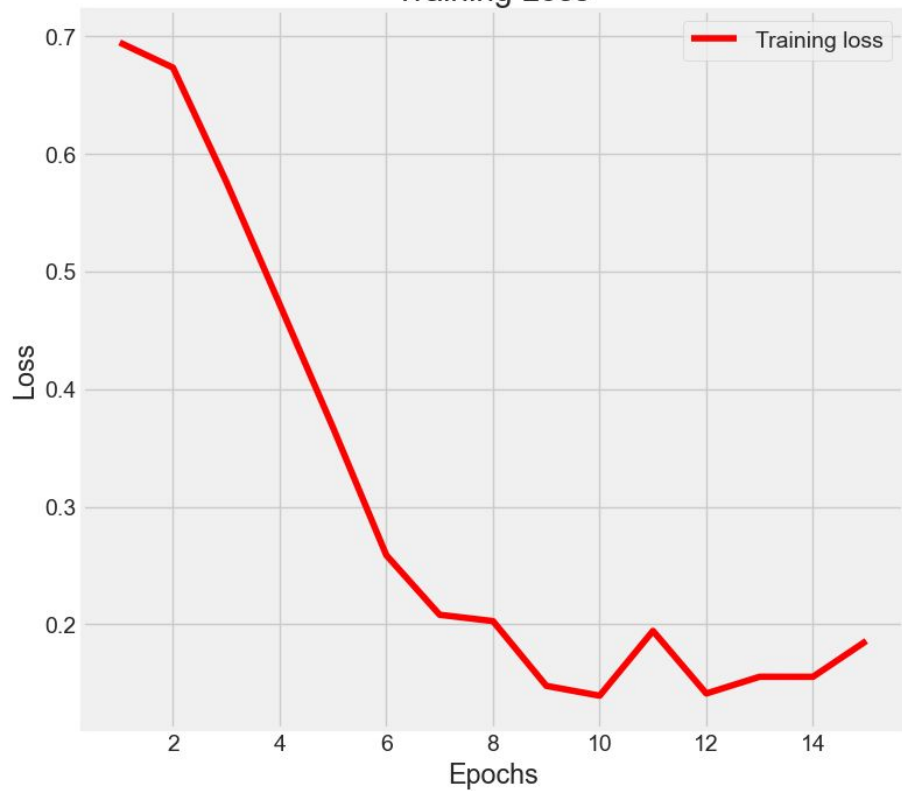
Model 7



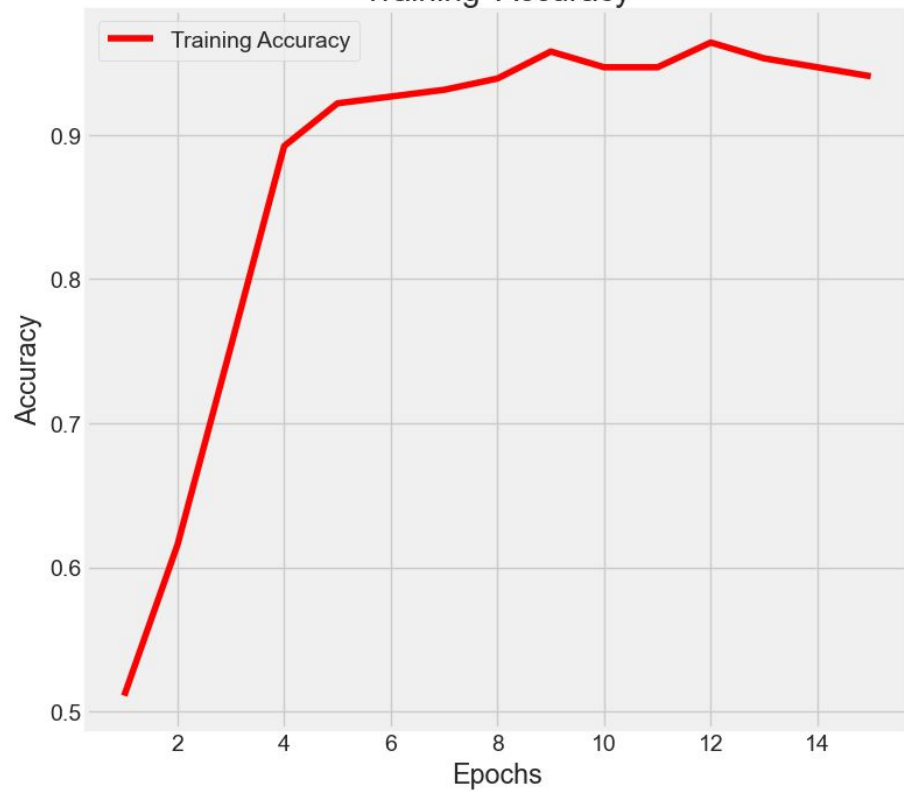
Test Accuracy: 0.96
Train Accuracy: 0.95

Model 3 Training Loss and Accuracy

Training Loss



Training Accuracy



Model: "sequential_2"

Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_2 (MaxPooling 2D)	(None, 63, 63, 32)	0
conv2d_3 (Conv2D)	(None, 61, 61, 64)	18496
max_pooling2d_3 (MaxPooling 2D)	(None, 30, 30, 64)	0
conv2d_4 (Conv2D)	(None, 28, 28, 128)	73856
max_pooling2d_4 (MaxPooling 2D)	(None, 14, 14, 128)	0
conv2d_5 (Conv2D)	(None, 12, 12, 256)	295168
max_pooling2d_5 (MaxPooling 2D)	(None, 6, 6, 256)	0
conv2d_6 (Conv2D)	(None, 4, 4, 512)	1180160
max_pooling2d_6 (MaxPooling 2D)	(None, 2, 2, 512)	0
flatten_2 (Flatten)	(None, 2048)	0
dense_4 (Dense)	(None, 128)	262272
dense_5 (Dense)	(None, 64)	8256
dense_6 (Dense)	(None, 32)	2080
dense_7 (Dense)	(None, 1)	33
Total params: 1,841,217		
Trainable params: 1,841,217		
Non-trainable params: 0		

Conclusions and Next Steps

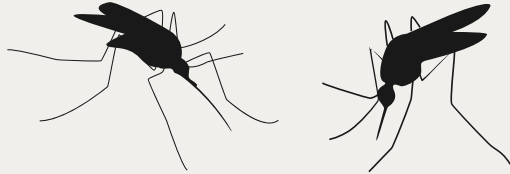
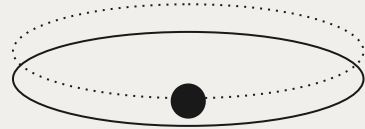
Recommendations

1. Given that my model is categorizing blood samples as being infected/uninfected with malaria with 96% accuracy, I would recommend the WHO use my Streamlit app.
2. Next, I would recommend the WHO train field works, local doctors, and microscopists in high needs areas on how to use the Streamlit app.

Next Steps

1. Continue to run models with the goal of reducing false negatives (improve recall)
2. Update streamlit app to intake patients information
3. Connect Streamlit website to mongoDB in order to save results in a database to improve the WHO's malaria surveillance system

Thanks!



Do you have any questions?

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