Deep Learning Mobile Application Towards Malaria Diagnosis

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Introduction

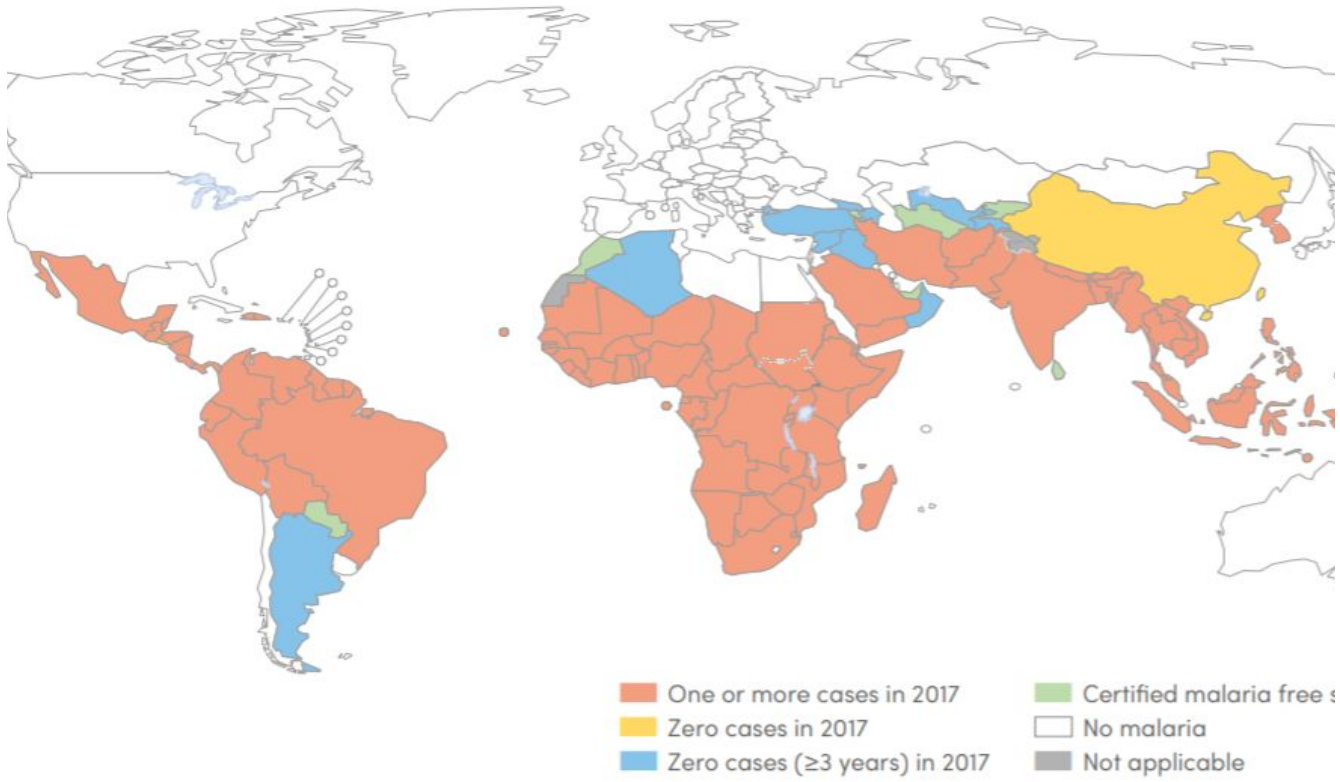
- Malaria is a life threatening disease transmitted by a bite of an infected **female anopheles mosquito.**

Who is at Risk?

- In 2017 nearly half of the world was at risk of malaria being the poorest and marginalized communities with the highest risk;

Death Burden

- 93% of the deaths caused by malaria was reported in Africa in 2017;
- 60% of the reported cases of death were children under 5 years;
- Malaria kills a child every 2 minutes!



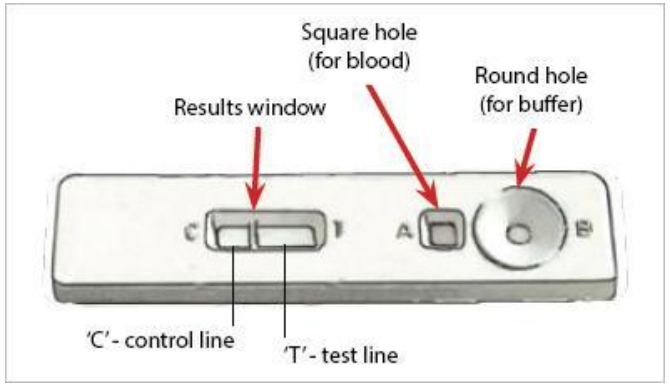
Source: WHO malaria report 2018 showcasing malaria cases globally

The goal of this project is to reduce mortality rate related to malaria disease, particularly in marginalised communities.

Existing Strategies

- **Malaria is curable** and with a prompt diagnose and treatment can reduce death.

Common diagnosis tools for malaria



Microscope

Pros: accurate.

Cons: takes time (15-30 mins), requires expert and labour in count of parasites.

RDT

Pros: fast, portable, no need of expert, cheap.

Cons: can't diagnose malaria at early stage, no quantitative analysis.

- Existing rapid diagnosis tests can't identify the stage or count the number of parasites (quantitative diagnosis) .
- But we can do so with object detection in Computer Vision.

Why Quantitative Diagnosis matters?

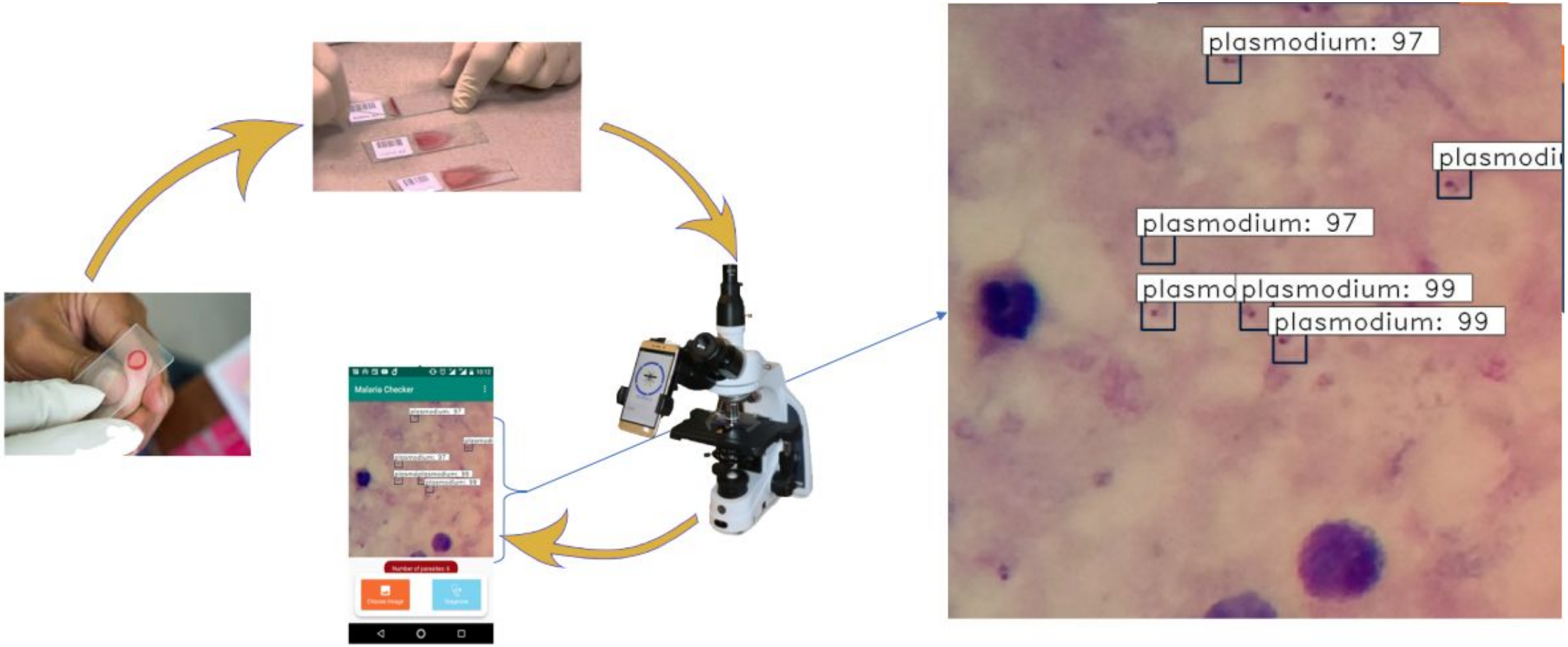
- Uncomplicated malaria patient receives oral antimalarial.

- Severe malaria patient receives parenteral antimalarial.

- In this study we have used computer vision to solve the challenges posed in these existing strategies.

Our Solution

A malaria diagnosis test using a mobile phone that is fast, can detect early stage of malaria, provides quantification of parasites and not expert dependent.



Methodology

Data Set

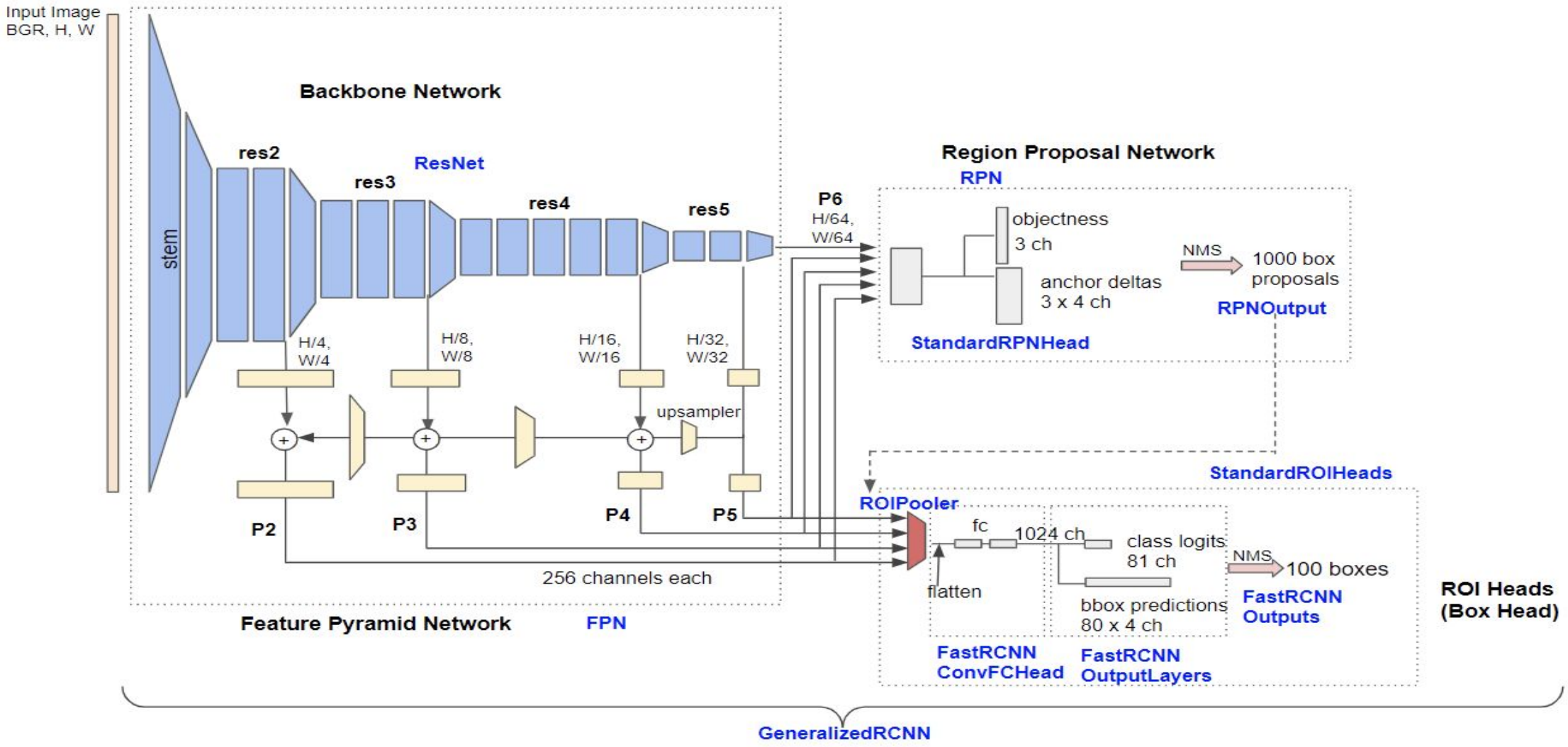
Datasets	Number of patients	Number of thick blood smear images	Number of a bounded box of parasites
Uganda	n/a	1182	7245
Tanzania	28	100	600

- The dataset was split into 80:10:10 ratio.
- We had a total of approximately 7800 bounded box of parasites
- Model used: Facebook Detectron 2

Methodology

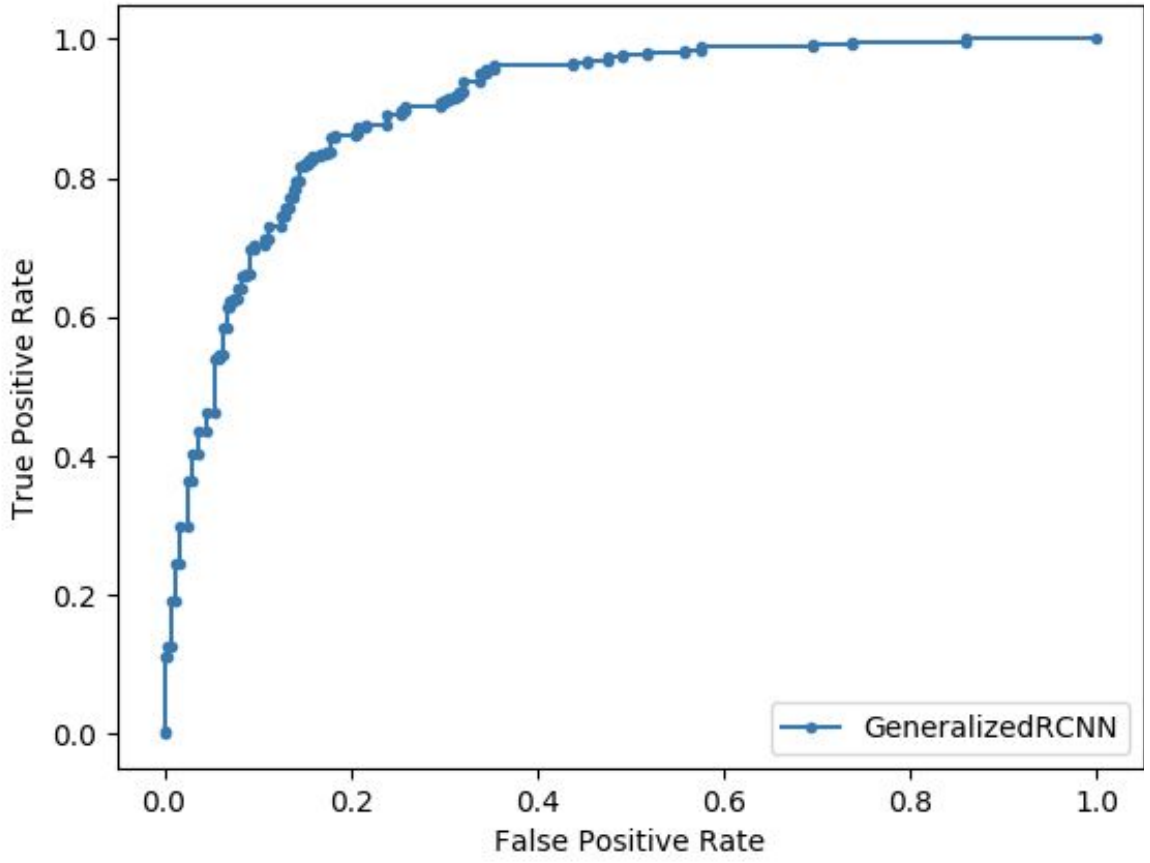
Our Model

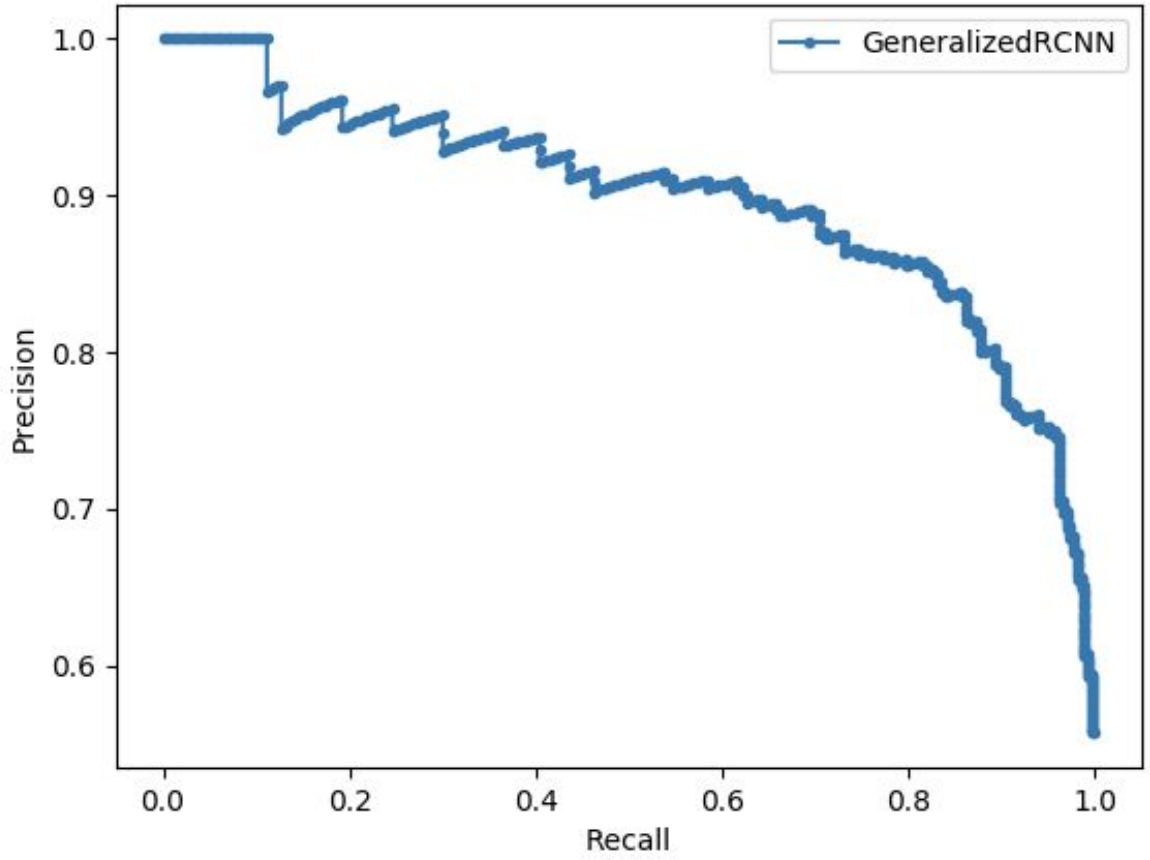
- We fine-tuned a coco-pretrained R50-FPN Mask R-CNN from our custom malaria dataset.



Results

- F1- score =0.841
- AUC=0.898





ROC and Precision-recall for malaria

Future Work

- Collect more data set (5000 Images) with both parasite and white blood cells labelled to improve the performance of the model and have a fully automated malaria diagnosis.
- To understand why the model made certain predictions such as false positive and false negative could also be valuable to improve the model performance
- Training of a smaller network that can easily be deployed in a limited resource area such as a mobile phone will eliminate the need to deploy the model in a computer server.

Reference

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