Machine Learning Engineer Nanodegree

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I Definition

Project Overview

According to the World malaria report [1] , in 2017, an estimated 219 million cases of malaria occurred worldwide (95% confidence interval [CI]: 203262 million), compared with 239 million cases in 2010 (95% CI: 219285 million) and 217 million cases in 2016 (95% CI: 200259 million).

In 2017, there were an estimated 435 000 deaths from malaria globally, compared with 451000 estimated deaths in 2016, and 607000 in 2010. Nearly 80% of global malaria deaths in 2017 were concentrated in 17 countries in the WHO African Region and India; 7 of these countries accounted for 53% of all global malaria deaths.

Problem Statement

In order to reduce the burden for microscopists in resource-constrained regions and improve diagnostic accuracy, the *National Library of Medicine*[2] provide us with a dataset[3] with which I will create a model to detect malaria parasite in thin blood smear images.

A common approach to create similar models consist in resize the images to a common size in order to train the model, then use this model to predict and classify new images. In this project I will apply a technique called **Progressive resizing** which consist of training different models for different size of images.

The idea behind this technique is to create different models for different image sizes. First I need to decide which sizes could be good to train the model based on the data exploration, then I'll create and train a model with the images resized to the lower size I chose. Once the first model is trained, I will apply transfer learning to create and train the second model with the next size for the images, and so on with all Once the first model is trained, I will apply transfer learning to create and train the second model with the next size for the images, and so on with all chosen sizes.

For each model I will get different metrics in order to know which model performs better and also to know if this technique is useful for this dataset.

Metrics

This project is based on the research article *"Pre-trained convolutional neural networks as feature extractors toward improved malaria parasite detection in thin blood smear images"*[4] where r Rajaraman S and his team shown a table[5] with

[1] https://www.who.int/malaria/media/world-malaria-report-2018/en/
[2] https://www.nlm.nih.gov/
[3] https://ceb.nlm.nih.gov/proj/malaria/cell_images.zip
[4] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5907772/
[5] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5907772/table/table-6/

the performance metrics results obtained during their experiments, comparing their custom model against other well-known models like AlexNet, VGG-16, ResNet-50, Xception and DenseNet-121.

For this project I will use the same metrics and then compare the results against the values of their custom model.

Table 1: Metrics

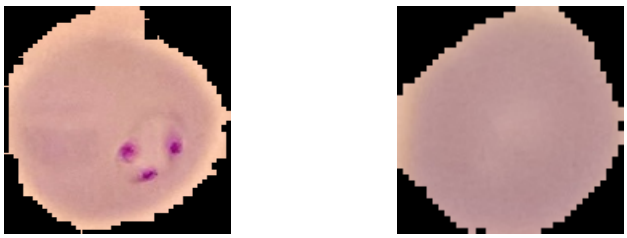
Name	**Formula**
Accuracy	$\frac{TP+TN}{TP+TN+FP+FN}$
AUC	formula
Sensitivity	$\frac{TP}{TP+FN}$
Specificity	$\frac{TN}{TN+FP}$
F1-score	$\frac{2TP}{2TP+FP+FN}$
MCC	$\frac{TP \times TN - FP \times FN}{\sqrt{(TP+FP)(TP+FN)(TN+FP)(TN+FN)}}$

II Analysis

Data Exploration

The dataset contains a total of 27560 images separated in two folders, Parasitized folder and Uninfected folder with 13780 images each.

The image sizes varies between 49x58 and 349x241 pixels.



(a) Parasitized cell (b) Uninfected cell

Figure 1: Dataset sample

Exploratory Visualization

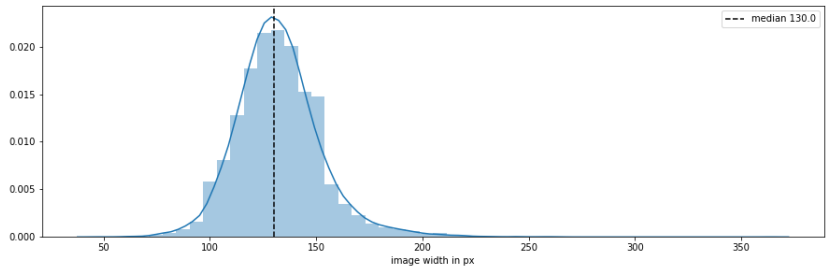


Figure 2: Distribution based on the image width

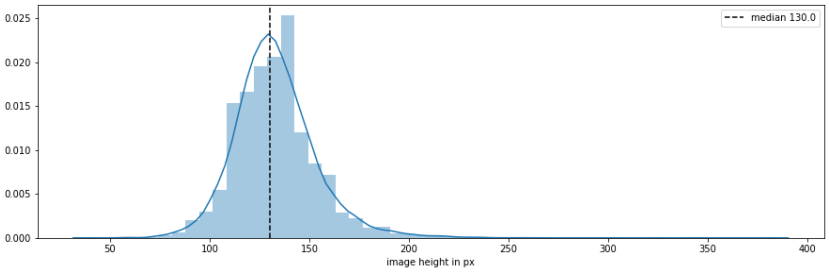


Figure 3: Distribution based on the image height