



Trypanosome Detection

AUTOMATIC DETECTION OF TRYPANOSOME IN THE BLOOD STREAM

Motivation

Trypanosome infect a variety of hosts and are responsible for many diseases that affected humans and animals alike, two of the most dangerous diseases to humans: chagas disease and sleeping sickness, are caused by the *Trypanosoma cruzi* and *Trypanosoma brucei*, two sub-species of *Trypanosome*.

According to data from the World Health Organization and Centers for Disease Control and Prevention:

- Chagas disease is a potentially life-threatening illness, being found mainly in Latin America. Per year there are 41,200 new cases of *T. cruzi* infection, 14.400 infants are born with congenital chagas disease and 12,000 die from it. The cost of treatment for chagas disease remains substantial. In Colombia alone, the annual cost of medical care for all patients with the disease was estimated to be about US\$ 267 million in 2008.
- The sleeping sickness cases are generally prevalent in Africa, in 1998, 40,000 cases were reported, but more than 300,000 cases were

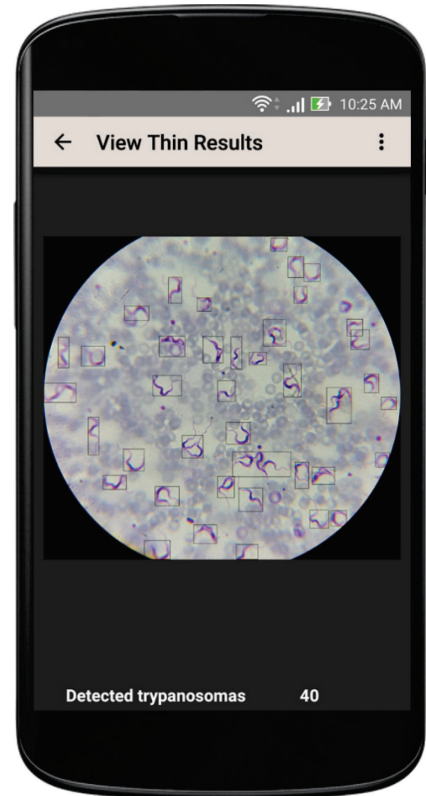


Fig1. Resulting analysed image.

undiagnosed and untreated this number was reduced to 3,796 in 2014 due to control efforts. The estimated population at risk for this disease is 65 million people.

Objectives

This project has two objectives:

- The creation of an object recognition methodology that can detect the parasite in thin blood samples efficiently;
- The creation of an android application that uses the

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Features

- Offline analysis of blood sample images
- Saves the results in organized samples associated with patients
- Counts and marks the parasites in the images for easy visualization
- Image acquisition using either the skylight adapter or the MalariaScope prototype

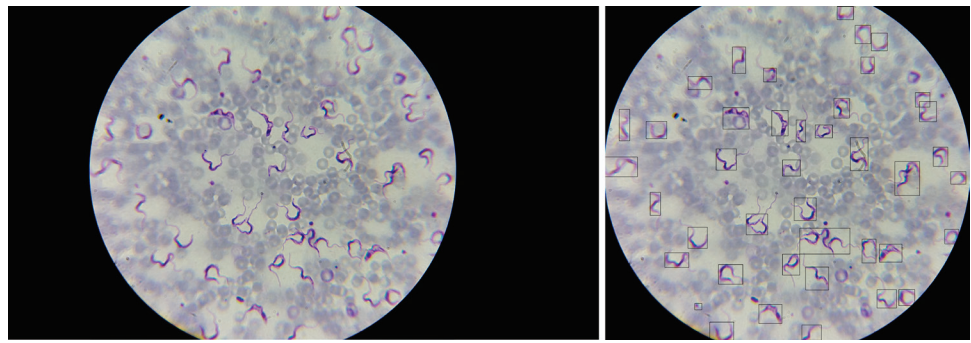


Fig2. Original and resulting images (with all the detected trypanosome marked).

methodology previously created to detect the parasites in the blood samples and, consequently, if the patient is infected.

Image processing and analyses

This project was focused in the automatic detection of the *Trypanosomes* parasites in their early stage in the blood samples images.

This object recognition problem has divided in four phases: preprocessing, segmentation, features extraction and classification.

In the preprocessing phase the image is cropped to a smaller size making the process faster and improving the image visualization.

Later, in the segmentation phase the parasites and similar components are separated from the rest of the image using colour and size features.

In the end the feature extraction and classification algorithms work together to decide if any of the previously detected components is one of the wanted parasites. In this process are used both Texture-Color-Geometry Feature Extraction (TCGFE) and k-Nearest Neighbour (KNN) libraries.

Android App

The android application was created using the MalariaScope as template.

After installing the app, it is possible to acquire a set of images from blood samples using the smartphone camera and analyse them without the need of internet connection (offline).

The mobile app can also use the microstage prototype to acquire a group of images ready to be analysed.

This mobile application is fast and reliable due to its analysis sensibility of 97.37% and its short execution time of approximately 32 seconds on high-spec android devices.



Fig3. Microscope with skylight adapter.