



CervCancer Screening

CERVICAL CANCER AUTOMATED SCREENING MODULE

Introduction

Cervical cancer remains one of the leading causes of death all over the world, especially in developing countries. This cancer is deadly only when diagnosed in later stages, therefore the problem is that there is not enough gynecological surveillance in these countries.

Considering all these facts, this project attempts to fulfil these needs by creating an innovative and low-cost solution. This tool would automatically process and identify all the relevant aspects within the samples which could provide information about the existence of cervical cancer. By using this tool, the clinicians can have their time-consuming work eased up and at the same time provide a solution for cervical cancer screening in developing countries.

Objectives

The purpose is to combine image processing and machine learning into a single tool capable of screening cervical cancer. Evidence of this type of cancer lies upon the cell's nuclei characteristics. Considering this, the tool uses image processing in order to

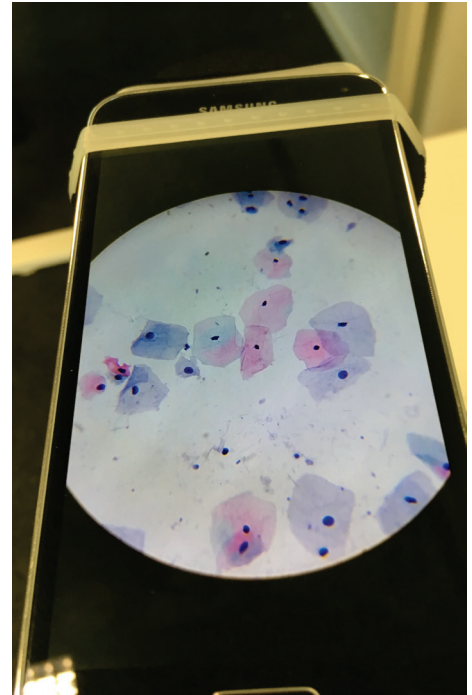


Fig1. Cervical Cancer Screening tool working along with MalariaScope.

identify and highlight all the nuclei, so their information is extracted. The machine learning module uses these features to classify the nuclei regarding their nature, namely if they manifest the presence of cervical cancer.

Application

This tool, in order to fulfill the low-cost goal, will be deployed into an Android application. This solution has one great advantage, which the other marketed solutions do not have: mobility. As we can see in Fig1., associated with the low-cost MalariaScope, this application can gather images from the samples and screen them at the same time.

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Screening Results

As seen in the Fig2., red contours represent abnormal nuclei and green the normal ones. Even though there are some non-nuclei objects identified, the results of the first classifier are above 70%, filtering most of them. Regarding the Abnormal/Normal classification, the results are above 75%, classifying most of the nuclei correctly.

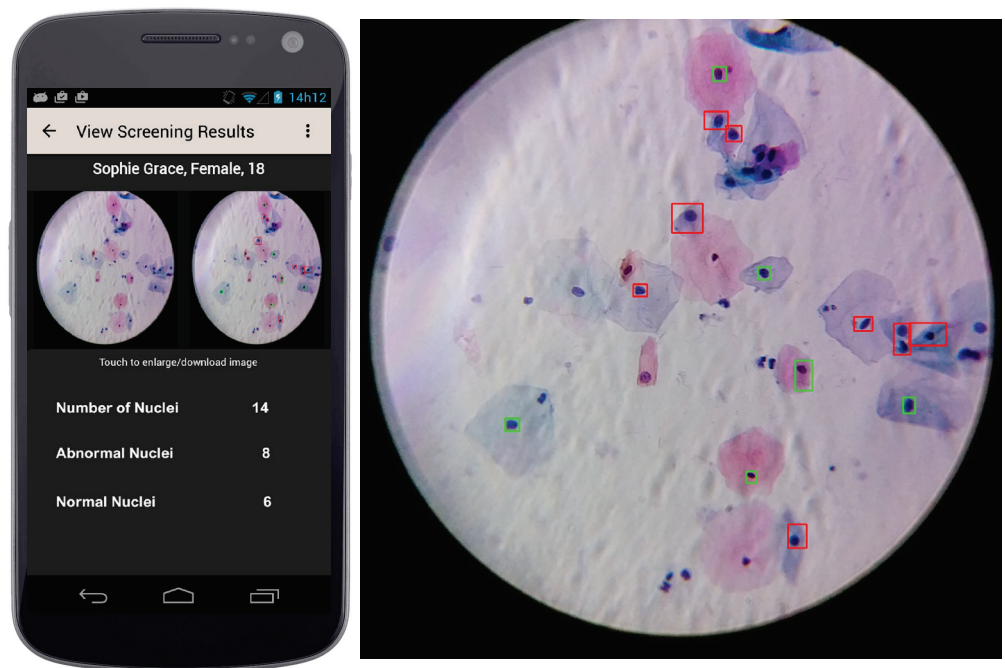


Fig2. Application's screenshot.

Nuclei Detection

Processing the sample's images is the first stage of this tool. In order to extract the nuclei information, it is necessary to identify them by applying image enhancement techniques throughout the image processing module. This makes them easier to be identified and at the same time undesired objects are removed from the images. Then, it is possible to extract their information. This step is done extracting 152 texture, colour and geometry characteristics from each and every identified nuclei. This will provide enough information for the machine learning module to determine if the identified object is an actual nucleus and whether presents evidence of cervical cancer.

Machine Learning

This module portrays how successful this tool is. Firstly, this module implements a classifier which filters the objects that are an actual nuclei from those that are not. This is done to exclude objects, identified during the image processing module that do not represent a nuclei. The second classifier identifies if each nuclei is either normal or abnormal. The latter, is the one which represents cervical cancer. This separation is done according to their morphology. Either the object is too irregular, and represents an abnormal nuclei, or it is too circular and does not have an anomalous morphology, representing a normal one. The result of this whole screening can be seen in Fig2. The red contours represent abnormal nuclei and the green the normal ones.