# Information Extraction from Uterine Cervical Images

**According to report of International Agency for Research on Cancer of World Health Organization uterine cervical cancer is the third most common cancer among women worldwide as of 2008 [1] The poor quality of cervical images can be sourced by several factors like incorrect instrumental settings, glare (reflection), blur due to poor focus, and physical contaminants.This study aims increasing image quality for diagnosing uterine cervical cancer easily and extracting as much information as possible from uterine cervical images.**

**Keywords; image processing; cervical image analysis; colposcopy; ROI detection**

## I. INTRODUCTION

According to report of International Agency for Research on Cancer of World Health Organization uterine cervical cancer is the third most common cancer among women worldwide as of 2008 [1]. If early detection is available, its death rate can be dramatically reduced by appropriate treatment. This project aims increasing image quality for diagnosing cancer easily and extracting as much information as possible from uterine cervical images. Various image analysis techniques was studied and implemented.

## II. LITERATURE SURVEY

A limited number of studies in very preliminary stages, address the task of automated cervical image analysis. However they generally lack of detailed approach and make many assumptions like perfect input images. For example many of the researched studies does not consider glare removal. However, glare in the imagery presents major problems for automated image analysis.

Proposed solution[2] in that study offers a detailed approach for information extraction from uterine cervical images. The detection of cervical region of interest is fully automatic and parameter free.

## III. METHODOLOGY

### A. *Development Methodology*

Agile Software Development methodology was being used for study. Agile is an iterative process and allows instant requirement changes within development period. It is a very suitable methodology for unclear projects.

### B. *Technologies*

Java 1.6 technology is being used. Main JDK libraries include many image processing functionalities. For further necessities ImageJ was selected to be used. ImageJ API is better documented than other rivals like JMagick (ImageMagick).

### C. *System Design*

A cross-platform Java desktop application is presented at the end of the project. Application have a clean and user friendly design. It takes an input image file in formats of JPG, GIF or PNG. After processing of input image, an output image can be saved for further use.

Application consists of 3 main components. Main component is the one executed when project executables are run. Main component generates a GUI component. GUI component creates an “Operation Definitions” component. Any user action on GUI component triggers related job in “Operation Definitions” component. Operation Definitions have access to image object seen on GUI component. Figure1 shows components of the application.


Figure 1. System components.

### D. *Project Phases*

After input image is given, processing of loaded image consists of 7 phases below:

- Glare Removal
- HSB transform
- Smoothing
- Blur Evaluation
- Binary Image
- Filling
- Region Assessment

Each phase can be executed separately and manually. Process command executes all steps in order and shows final image.

#### 1) *Glare Removal:*

Further study showed that glare removal is a huge job to be done among others. It consists of feature extraction, region detection, region extension and region removal parts [3]. Glare removal part caused a delay on time plan of study.

Glare removal algorithm is below:

i) Glare Pixel Detection: Glare pixels are detected with thresholding.
ii) Glare Pixel Value Calculation via Neighborhood Averaging: Glare pixels new value is calculated with respect to neighborhood values.
iii) Glare Pixel Neighborhood Smoothing: Glare pixel and close neighbors are smoothed and leveraged.
iv) Glare Region Extension: Glare region extended around glare pixel.

Figure below shows image before glare removal operation and after operation.

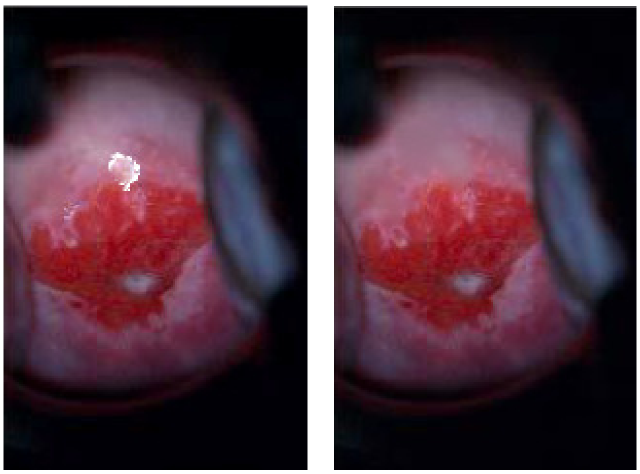


Figure 2. Glare removal.

*2) HSB Transformation:*

RGB image is transformed to HSB (Hue-Saturation-Brightness) image. This operation allows for further binary conversion and region detection techniques. Figure below shows this operation in action:

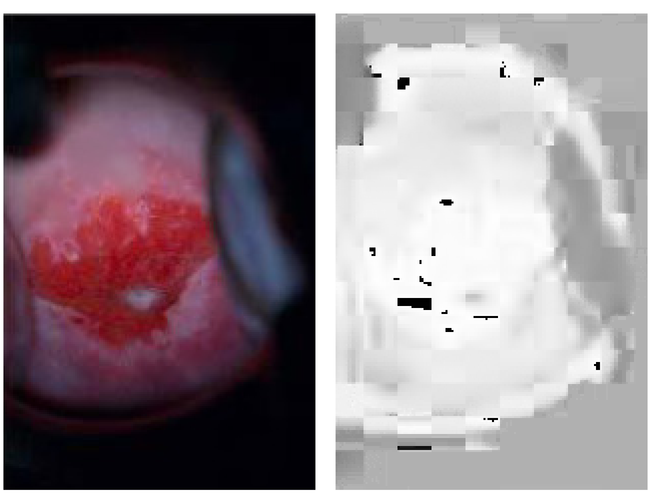


Figure 3. HSB transformation

*3) Smoothing And Blurring:*

Smoothing removes unnecessary noises with help of blurring. Both smoothing and blurring are done double times consequently. Figures below show smoothing and blurring:

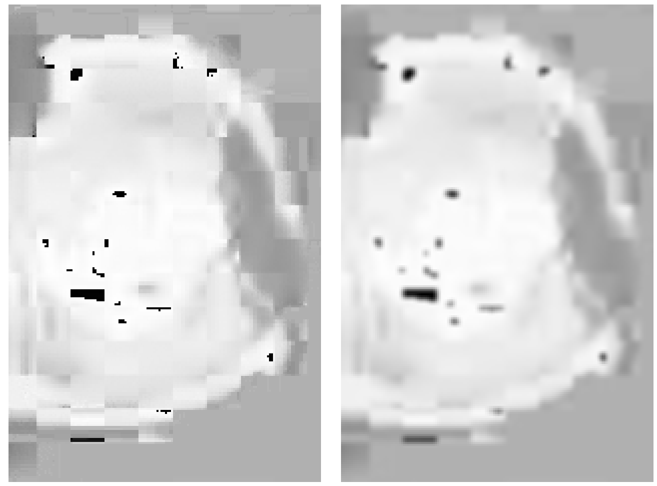


Figure 4. Smoothing

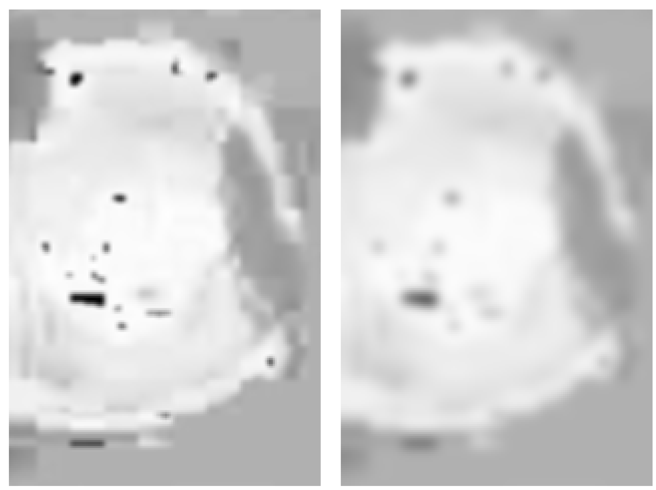


Figure 5. Blurring

*4) Binary Image:*

Converting HSB image to binary image enables filling and region detection. Operation samples are below:

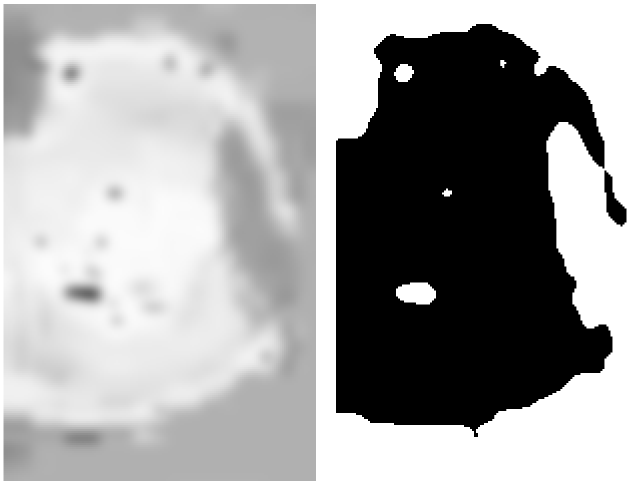


Figure 6. Binary Image

*5) Filling:*

Filling helps region assessment by closing holes within ROI (region of interest). Samples are below:

Figure 7. Filling

*6) Region Assessment:*

Region assessment consists of outlining image after filling and then applying outline to glare removed original image. Figure below shows region assessment:

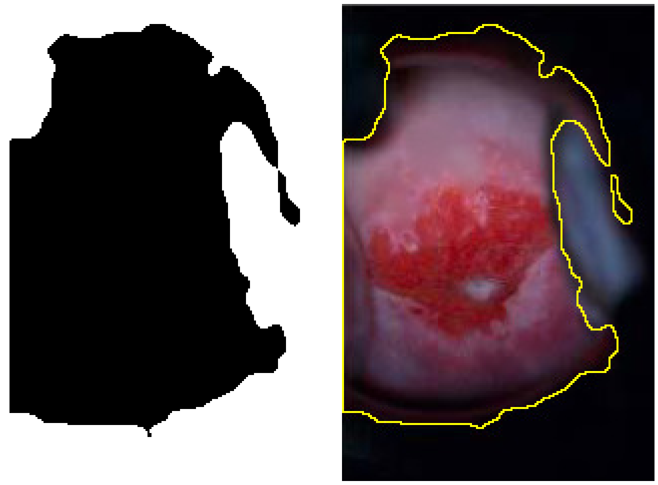
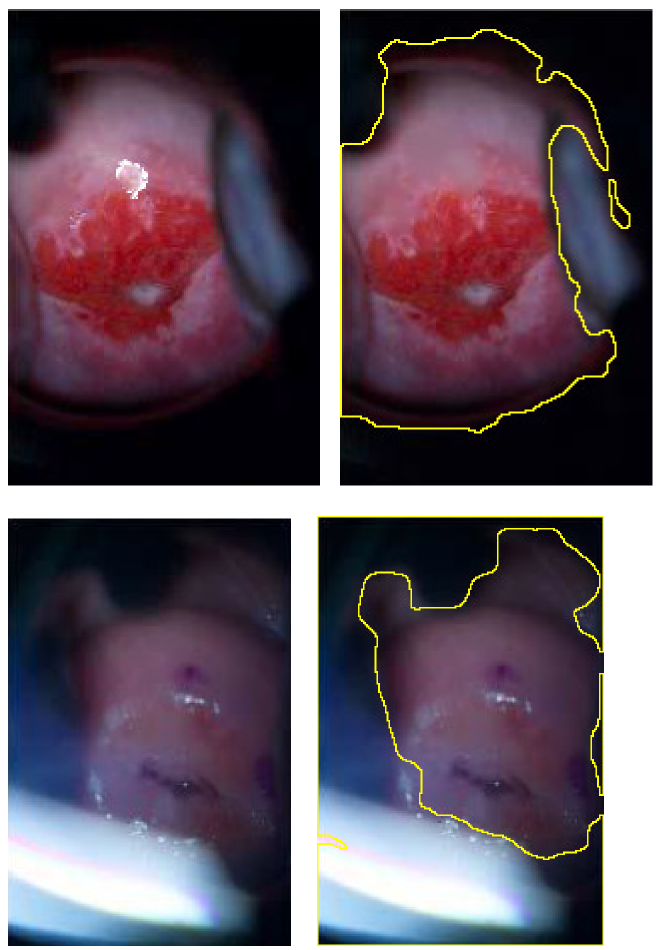
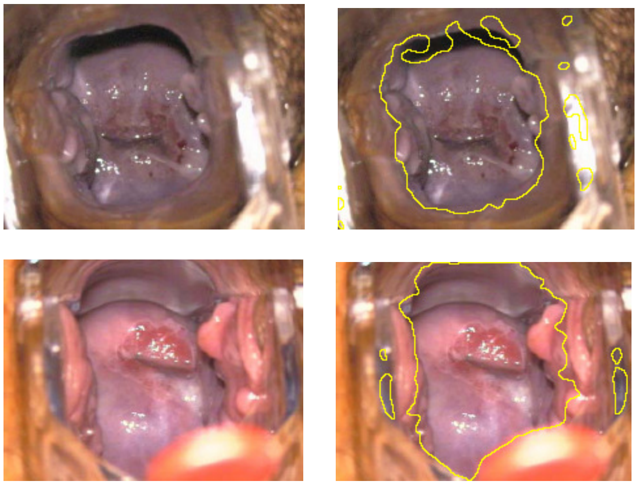


Figure 8. Region Assessment

## *E. RESULTS*

Some ROI detection results are below:





## IV. DISCUSSION AND CONCLUSIONS

This work introduces a series of methods for improving cervical image quality and automatically detection of region of interest. Samples show that even glared or bright images can be processed well with help of developed glare removal algorithm. Cervical region can be detected even if some diagnosis devices exist in the image.

ROI detection is first step before contamination detection and automated cancer detection. Further work can be done with help of some machine learning techniques after ROI is extracted. On the other hand image deficiencies can be overcome by the help of additional techniques such as image contrast enhancement or image debluring algorithm.

## REFERENCES


[1] http://globocan.iarc.fr/summary_table_pop.asp?selection=221900&title=World&age_from=1&age_to=10&sex=2&type=0&window=1&sort=0&submit=%A0Execute%A0

[2] Jia Gu, Wenjing Li; Automatic Image Quality Assessment for Uterine Cervical Imagery; SPIE Medical Imaging 2006; SPIE Proc.

[3] Lange H.; Automatic glare removal in reflectance imagery of the uterine cervix; SPIE Medical Imaging 2005; SPIE Proc. 5747, 2005

[4] http://rsbweb.nih.gov/ij/docs/index.html