## EFFECTIVE DETECTION OF CERVICAL CANCER DURING PAP SMEAR SCREENING TEST

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### Abstract

Mostly Woman are affected by cervical cancer in their different age groups. So, most of the Researchers, Pathologists prove more number of solutions to identify this cancer from the test images of pap smear screening test. But their results were given less accurate. Hence, I found the origin of the cancer formation. That is, basically a cancer is formed based on the nucleus abnormal growth. According to the existing report, I propose efficient detection method that is used for detecting the nucleus of cervical cell for finding its growth and the results are more useful for further analysis by the pathologists. The proposed work is based on cervical cell nuclei segmentation and its detection process.

### Keywords:
Cervical cancer, cervical nuclei segmentation, cervical nuclei detection.

### 1. INTRODUCTION

Cervical cancer is the most common malignancy in women in the developing countries. Cervical cancer develops over a prolonged period covering two to three decades [2]. Cervical cancer is the most common form of cancer in women under 35 years of age and the second most commonly occurring cancer in women of all ages, worldwide [1].

Cervical cancer disease is preventable by using many number of screening test methods. Among these methods, one of the most important and easy method is Pap Smear Screening test method. The procedure for this method is as follows: Using a small brush, a cotton wad stick, or a wooden stick, a specimen is taken from the uterine cervix, smeared onto a thin rectangular glass plate a slide, and colored, making it easier to examine the cells under a microscope. The persistence of the smear screening is finding the cell growth changes for before they develop to cancer.

Pap test is the most popular and effective screening test for cervical cancer. By extracting and observing morphology image of cervical cells, doctor will classify cervical cells based on Bethesda system; normal, Low Grade Squamous Intraepithelial Lesion (LSIL) or High Grade Squamous Intraepithelial Lesion (HSIL) cell [3].

Automation of diagnosis of cancer cell image has been studied for a few decades in the field of medical image processing technology. Most of the studies involved development of diagnosis support system solved problems of pathologist shortage [7]. Many techniques of image processing were proposed to handle the problems such as cell segmentation and classification in the development of these systems. Segmentation is one of the most important technique and it was used in al cell segmentation, each nucleus was segmented from its surrounding cytoplasm using a series of automated fast morphological transforms with octagonal structuring elements [8].

Color images provide more and richer information for visual perception than that of the gray images. Color image enhancement plays an important role in Digital Image Processing [6]. The purpose of image enhancement is to get finer details of an image and highlight the useful information. During poor illumination conditions, the images appear darker or with low contrast. Such low contrast images needs to be enhanced.

Contrast is one of the factors that influences the accuracy of interpretation of diseases based on medical images by pathologists or radiologists. To date, contrast enhancement process plays an important role in enhancing the quality and contrast of medical images [5]. Several previous studies have proven that contrast enhancement techniques are capable of removing unwanted noises and enhance the brightness and contrast of medical images [4].

The goal of this research was to develop a cervical cancer detection system that is able to detect the cervical nuclei of the cervical cell.

### 2. METHODOLOGY

The proposed methodology and the working process is explained briefly under the following sections.

#### 2.1 FLOW CHART

The following Flow chart represents the work flow of how to detect the cervical nucleus for finding cervical cancer from the test images of Pap smear screening test images as shown in figure.1.

##### 2.1.1 Input Image

This is the first process and it is used for converting cervical slides for the Pap smear Screening Test into Pap Smear Screening Test Images. But for explaining my proposed system I just used only one cervical image, is used.

##### 2.1.2. Noise Removal

Next process is the Noise Removal process. Basically any image not only cervical cell image initially contains some unwanted noise. Hence just median value based smoothing filter are applied to reduce the noise of the input image.
2.1.3. Nucleus Segmentation

Original noise is removed and cervical cell color Image is converted into respective Red, Green and Blue plane of the image.

Then Each R, G and B plane cell image is first locally thresholded by using given equations (1),(2) & (3) that is the mean value of the original input image is multiplied with the factors α, β & γ, by adjusting the value of these factors we get some segmentation of the nucleus. So cytoplasmic regions is removed by performing morphological closing operation morphological opening operation. The resulting segmented image for the respective R, G and B plane is used for identifying the nucleus with more details than the original image and it is given in equations (4), (5) & (6).

\[
\begin{align*}
M_{IR} &= \text{MEAN}(I_R) \cdot \alpha \\
M_{IG} &= \text{MEAN}(I_G) \cdot \beta \\
M_{IB} &= \text{MEAN}(I_B) \cdot \gamma \\
S_{IR} &= ((T_{IR} \bullet MC_R) \odot MO_R), \\
S_{IG} &= ((T_{IG} \bullet MC_G) \odot MO_G), \\
S_{IB} &= ((T_{IB} \bullet MC_B) \odot MO_B), 
\end{align*}
\]

Where \( S_{IR}, S_{IG}, S_{IB} \) is the resulting segmented image for the respective R,G and B plane. \( T_{IR}, T_{IG}, T_{IB} \) is the thresholded image for the respective R,G and B plane, \( MC_R, MC_G, MC_B, MO_R, MO_G, MO_B \) are structuring elements for the respective R,G and B plane. The symbols● and o denote morphological closing and opening, respectively.

Then by combining R, G and B Channel Segmented image \( S_{IR}, S_{IG}, S_{IB} \) we get the segmented cervical cell image equation 7.

\[
S_{RGB} = ((T_{RGB} \bullet MC_{RGB}) \odot MO_{RGB}) 
\]

Where \( S_{RGB} \) is the resulting segmented color image. \( J_{RGB} \) is the original thin prep Image, \( T_{RGB} \) is the thresholded image, \( MC_{RGB} \) and \( MO_{RGB} \) are structuring elements. The symbols● and o denote morphological closing and opening, respectively.

2.1.4. Cervical Cell Nucleus Detection

After the nucleus segmentation process is completed we get segmented nucleus of the image. But in that image we want to see the details of the nucleus very clearly means, First identify the boundary or edge of the nucleus or shape of the nucleus in a very clear manner.

For this reason I go for nucleus detection process. In this process I just apply a line scanning algorithm to detect the edges of all the cervical cell of the enhanced image. Before applying line scanning algorithm I first convert each and every one of the R,G,B plane of the enhanced image into binary image.

After converting into binary image then I apply all the line scanning directions that is horizontal, vertical, +45 degree & -45 degree to each and every one of the R,G,B plane of the binary images. Then by combining all the directions of the line scanning output to get the edge or boundary or shape of all the nucleus of the cervical cells that are present in each and every one of the R,G,B plane that exists in the binary image. But the result represents that all the edges of the nucleus and it’s color as white color, remaining all the pixels of an image are represented black color.

From these R,G,B Plane of the edge or boundary or shape of the images, I come to the conclusion that the green plane of an image can be used to find the exact edge of the nucleus and also apply this edges into the green plane of the enhanced image by using the following two conditions.

- If the pixel value of the green plane of an edge image is 1 means, there is no need to change the corresponding pixel value of the green plane of enhanced image.

- If the pixel value of the green plane of an edge image is 0 means, the corresponding pixel value of the green plane of enhanced image can be taken into the account.

Then, to view the exact shape of the nucleus in the color image, in addition to the green plane of the enhanced image by using the above two conditions, we must take the red and blue plane of the enhanced image.

The final image, thus arrived, will be clearer to detect the nucleus than the original image.
Table 1. Cervical Cell and Cancer Detection Process

<table>
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<tr>
<th>No</th>
<th>Image Names &amp; Important Factors</th>
<th>Images &amp; Resulting Factors</th>
<th>Results</th>
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<tbody>
<tr>
<td></td>
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<td>Fig. 1</td>
<td>Fig. 2</td>
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<tr>
<td>a)</td>
<td>Input Image</td>
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<tr>
<td>b)</td>
<td>Noise Removal</td>
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<td>c)</td>
<td>Segmentation</td>
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<td>d)</td>
<td>Detection</td>
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<th>Fig. 1</th>
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<tr>
<td>α</td>
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<tr>
<td>β</td>
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<td>0.65</td>
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<tr>
<td>γ</td>
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<td></td>
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<td>d)</td>
<td>Detection</td>
<td><img src="image" alt="Detection" /></td>
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3. RESULTS AND DISCUSSION

In this section a detailed explanation of digital image processing techniques with the corresponding image results are discussed based on the following two tables namely Table1 &Table2 for detecting the cervical cancer.

Each Table consists of noise removal, cervical cell nuclei segmentation with its thresholding factor values alpha, beta & gamma and cervical cell nucleus detection processes and its corresponding image results for identification of cervical cancer.

4. CONCLUSION

This work shows that the many number of image processing techniques like segmentation, detection, feature extraction and classification used for finding the details of the region of interest from the initial cervical cell image are seen by us very clearly with more accuracy than the original image. Also finding the nucleus with its edge is fine process.

REFERENCES


AUTHORS

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