Analysis of MGG stain images for detection of breast malignant cells in FNAC

Chayanika Sarmah
M.Tech Student
Department Of Information Technology
Gauhati University, India

Parismita Sarmah
Assistant Professor
Department Of Information Technology
Gauhati University, India

Abstract- In this paper, an effort is made to analyze MGG stain images of breast cell in FNAC which will help in early detection of malignant breast cancer cell. There are many morphological features based on which MGG stain test smear images can be categorized into normal and abnormal classes. Some of them are area, perimeter and presence of hyperchromatic crowded(HCG) group etc. So, in this approach a new expert system is being modeled for analyzing the malignancy present in the malignant breast cell (Images are examined). The proposed approach is implemented in matlab, a image processing tool to analyses the cancer cell images.

Keywords: breast cancer, HCG, FNAC.

I. INTRODUCTION

Cancer is potentially fatal disease caused by environmental factors which mutate genes encoding critical cell proteins [1]. One of the most common types of cancer in women is breast cancer. In western countries, there is one out of eight women who suffers from breast cancer and its highest percentage in terms of age is between 40 to 50 years. Cancers are divided into two types, benign and malignant and breast cancer has no exception. If the cancer is malignant under the conditions of early diagnosis, increasing age and treatment hope for patients will be very high. Studying patients and identifying all the factors influencing the disease, there are hopes to take useful steps toward this.

One the methods to identify breast cancer which is used more than the others, is Mammography. But it is frequently seen that different interpretation of radiologists about images is obtained from this way. Another method is Fine needle aspiration cytology [2] (FNAC) and its accuracy is 90%. Therefore, it is better to discover another accurate method.

May-Grünwald-Giemsa(MGG) [3] staining method is used for morphological Counting of blood cells. May-Grünwald test staining combines effect of acidic and alkaline methylene blue. The pH is important factor in staining, so any change will lead to a wrong staining reaction. The limits of most suitable pH are in between 6.5 and 6.8. In this paper an approach is made to develop an automated system for detection and segmentation of abnormal breast cells using the help of MGG stain images.

In our approach we try to classify the breast cells into normal and abnormal classes based on analysis of HCG features.

II. Overview of Breast Cancer

Breast cancer [4] originating from breast tissue, commonly from inner lining of milk ducts lobules that supply ducts with milk. Cancers originating from ducts known as ductal carcinomas. Breast cancer occurs in humans and it can also happen in other mammals. While the overwhelming majority of the human cases are observe in women, breast cancer of male can also observe.
The first symptom of breast cancer that can be noticed is a lump that feels different from the rest of breast tissue [5]. 80% of breast cancer cases are discovered when a woman feels a lump. Earliest breast cancers can be detected by a mammogram. Lumps found in the lymph located in armpits can also indicate breast cancer [6].

III. MORPHOLOGICAL DIFFERENCES

Normal cells are different from abnormal cells based on following morphological features.

a) Area of the nucleus – The nucleus area of a normal cell is small and nucleous area of abnormal cell is large.
b) Area of the cytoplasm – The cytoplasmic area of a normal cell is large and the cytoplasmic area of an abnormal cell is small.
c) Shape of nucleus – Shape is a very important feature to distinguish normal cell from an abnormal one. They are more elliptic and queerly deformed [7].
d) Perimeter of the nucleus – Perimeter of a normal nucleus is small and incase of abnormal cell it is large.
e) Presence of Hyperchromatic crowded groups (HCG) – It is nothing but the cluster of group of cells which contain at least 15 cells. HCG is common in abnormal cell images.

IV. PROPOSED METHOD

The input of the image is taken in .jpg format. The images Sample collected from Dr B. Barooh Cancer Institute, Guwahati –

Normal sample = 14
Abnormal sample = 34

Above MGG stain samples are categorized into two main classes Normal and Abnormal.

We analyzed 699 MGG stain samples and tried to draw a conclusion on how a threshold can be generated which will help in distinguishing the Normal Classes and Abnormal Classes. This identified threshold can be fitted in an automatic system to identify the percentage abnormality of a MGG stain test sample. But the quality of the Images matters in this approach. MGG stain images collected from liquid based technology is better for our approach.

The main steps involved are –

- Pre-processing
- Morphological operations
- Extraction of features.

A. Pre-Processing

The step is to perform preprocessing operations on the input MGG stain image. The input image is a colored image which is in RGB mode. As is known the color images are difficult to process so we convert the image to grayscale image using rgb2gray function in matlab. Then we adjust the size of the image using imresize function so that we can get uniform images. After that the histogram of the image is obtained using imhist function, which helps in finding a suitable threshold or grayscale image to binary conversion using im2bw function of the image so that we can perform the morphological operation for feature extraction.

B. Morphological Operations

The next step is the morphological operations for proper segmentation of the image. Firstly the opening is done using imopen function of matlab. This will remove the thin protrusions and help in finding two separate cell which are slightly connected. The complement operations are done using imcomplement function of matlab [8]. To extract different features we have to give a value of 1 to all the pixels corresponding to a cell. The main difficulty of proper segmentation is presence of unwanted components like WBC and other cells.

In our approach performed morphological erosion using imerode function of matlab which is followed by Median filter. Again all areas are cleared using bwareaopen function to remove the object having less than 100 pixels. This will remove the WBC’s present. Finally we have to fill up the holes using imfill function.

C. Extraction Of Required Feature: Influence of Hyperchromasia on Abnormality

Hyperchromasia is nothing but presence of a cluster of cells which contain more than 15 cells.

D. Proposed method for Hyperchromasia identification

For detecting the hyper chromatic Crowded Groups following measures are taken into consideration.

1. Select the image for which HCG to be identified.
2. Crop the particular region of interest (ROI), i.e. the portion which is dark and crowded.
3. Find the number of cells inside the ROI.
4. If number_of_cells > 15 then “Hyperchromasia is present” and if < 15 then “Hyperchromasia is absent”.

Presence of Hyperchromasia leads to abnormality in breast cells.

Above figure shows the presence of Hyperchromatic Crowded Group (HCG).

V. EXPERIMENTAL RESULTS

The experiment is performed using 699 images. In this paper 15 Normal images and 15 abnormal images results are.

Observation based on hyperchromasia

To explain the observation let us take the following 5 images, 2 of them are normal and 3 are abnormal.

Normal Case 1

No of cell found: 1
hyperchromatic group is not present
hence not malignant cell
Normal Case 2

No of cell found: 12
hyperchromatic group is not present
hence not malignant cell

Abnormal Case 1

No of cell found: 46
hyperchromatic group is present
hence malignant cell

Abnormal Case 2

No of cell found: 117
hyperchromatic group is present
hence malignant cell

Abnormal Case 3

No of cell found: 36
hyperchromatic group is present
hence malignant cell
VI. CONCLUSION

Medical images have various limitations such as low quality, presence of noise and human error in interpretation. Digital image processing can help the pathologists to a great extent. So this type of automatic detection of breast cancer can help in early detection and diagnosis which can save patients.

VII. ACKNOWLEDGMENT

We would like to offer our gratitude to Dr. J.D.Sharma, Chief consultant, Dr Anupam Sarma, Asst Professor, Pathology department of Dr. B.Barooah Cancer Institute for their valuable guidance and precious time and for providing us the images for Experimentation and providing medical books and help in understanding the medical terminologies related with this work. This paper has the consent of all co-authors and authorities of the institute, where this study has been carried out and there exists no conflict of interest anywhere.

VIII. REFERENCES