BLOOD CANCER DETECTION USING IMAGE PROCESSING

BIJAYA BHATTA, ASHA SHAH, ANKITA KARNA, AAYUSHI SAH
ADVANCED COLLEGE OF ENGINEERING AND MANAGEMENT

Introduction

Blood is an important part of human body. It consists of blood cells (RBCs, WBCs ,Platelets) and plasma. RBCs are used to transport oxygen and other necessary materials throughout the body. WBCs are used to fight against foreign bodies and protect the body from infections and the platelets are used in the clotting of blood .Bone marrow is the site where the WBCs and other blood cells are made. Generally, cells grow and multiply to form new cells as the body needs them. When cells grow old, they die and new cells take their place. Sometimes, this cycle does not work correctly. In cancer, new cells are formed when the body does not need them, and old cells do not die when they should such that new cells do not get enough space to live. In this way, functioning of blood disturbs and white blood cells production is abnormal and uncontrolled. This abnormal increase in WBCs is referred to blood cancer. Blood cancer is commonly found in children and is also seen in old age groups. Every year a lot of people suffer from blood cancer and it is regarded as a lethal disease. The ratio of WBC:RBC is 1000:1 in a blood cell. The detection of blood cancer is done manually by lab technician by counting the number of WBCs and RBCs present. This traditional way of detection is time consuming and takes about 3-4 days .The accuracy and efficiency solely depends on the technician's skill and experience and is an expensive test.

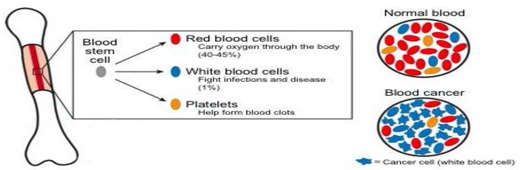


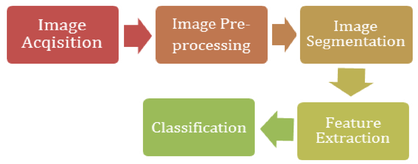
Figure: Bone marrow showing blood cells and distinguishing cancerous and non-cancerous cells

Objective

- To put light on the scope of usage of image processing for the detection of blood cancer in human body.
- To ease the task , save the time and compute the result with accuracy.

Methodology

This poster proposes to use image processing to detect the cancerous cells. It will be completed in 5 basic steps:



1. **Image acquisition:** Microscopic image of the blood cell will be taken from human body .
2. **Image enhancement:** There might be excessive staining of the image or the image may not be clear enough to do the further processing or may contain irreveleant features, these should be removed using various techniques. This can be done by:

- Clean the image by Gaussian blur
- Convert into grayscale
- Remove noise by median filtering
- Convert to binary form

3. Image segmentation: RBC,WBC and platelets are separated using k-means clustering algorithm. It is a machine learning clustering technique which simplifies larger datasets into simpler datasets. The algorithm will evaluate distinct patterns and group the similar data sets together.

Steps:

Assume an initial set of n elements is given and m1(1) ,….., mk(1) are k means at time stamp 1.

1. Initialize Cluster Centers .We randomly select 2 clusters.

2. Assign each observation to the nearest mean cluster. Mathematically,

$$S_i^{(t)} = \left\{ x_p : \left\| x_p - m_i^{(t)} \right\|^2 \le \left\| x_p - m_j^{(t)} \right\|^2 \ \forall j,\ 1 \le j \le k \right\}, \qquad (1)$$

Where each observation xp will be assigned to one S(t).

3. Update: For the centroid calculate the new mean in the new cluster.

$$m_i^{(t+1)} = \frac{1}{\left| S_i^{(t)} \right|} \sum_{x_j \in S_i^{(t)}} x_j. \qquad (2)$$

4. Repeat step 2 and 3 until convergence.

We keep on iterating between assigning points to cluster centers and updating the cluster centers until convergence.

Finally, we will be separating the WBC from other components.

This algorithm will be implemented in the image segmentation process to group the WBC from the RBC and platelets. We will select appropriate K=2 value and group it into 2 clusters.

4. Feature extraction: Extraction of feature is the technique that extracts the features of desire from the pre-processed images containing various abnormalities. The image's various characteristics can be size, shape, composition, location, mean, standard deviation, moisture, etc. Feature extraction is an important step in building any classification of patterns that intend to extract the patterns and distinguish them from RBC and platelets, we will use morphological and shape feature. We're going to classify patterns based on area, perimeter, radius, orientation, etc.

Test Attribute

- Area
- Perimeter
- Radius
- Elongation
- Compactness
- Blood Cancer Cell(Yes/No)

5. Classification: Image classification is a computational procedure that sorts images into groups or classes according to their similarities. The cancerous and non cancerous cells are separated here using K-NN algorithm.

Steps:

5.1 Calculate similarity based on distance function. We will use Euclidean distance. Mathematically,

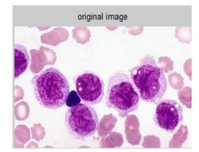
$$d(p,q) = \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}$$

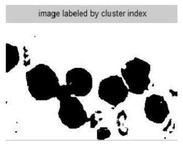
$$d(p,q) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + (p_3 - q_3)^2}$$

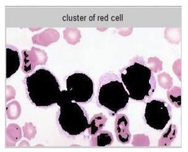
5.2 Find K nearest neighbor

Expected Output

The methodology followed sequentially is expected to extract region of interest from the image, and train the machine to identify and classify their features and accordingly classify the image to contain cancerous cells or not.







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