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BLOOD CANCER DETECTION USING NEURAL NETWORK

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ABSTRACT:

A wide range of diagnostic tests can be used to diagnose blood cancer. This paper describes the main and first stage of the cancer of the blood. Initially, in leukemia, which should be efficiently detected in order to achieve efficient results, blood cancer can cause damage to blood cells called a plasma issue. The medical society is very much talking about the specific stage of blood cancer, which leads to the plasma issue of the blood on the side of the blood cells. Blood cancer is a form of leukemia, lymphoma. This paper describes three models for the diagnose the BC complications: Convolutional Neural Network (CNN). BC is spread only in particles and the abnormal properties in blood cells may be removed. The White Blood Cells division is divided into several groups and sub-types. Granulocytes, monocytes and lymphocytes are the main forms of white blood cells.

Granulocyte classification into neutrophils, eosinophils and basophils is graded. blood cancer cells and macrophages are the branch of the monocytes. B-lymphocytes and T-lymphocytes are described for the division of the lymphocytes. Many imaging strategies for white blood cell recognition, segmentation, leucocyte grouping labeling methods and blood cell extraction characteristics that are often presented in this paper. The user can classify blood cells, type leukemia and lymphoma images by image manipulation as this can cause and the areas that are classified as inputs. CNN was used to determine the ranking of blood cancer levels in the human body. 91.5% precision was obtained by CNN. According to this precision, we can assume that the CNN is excellent compared to other types.

Keywords: plasma, leukemia, lymphoma, classification, support vector machine, probabilistic neutral network, accuracy level of blood cells.

1. INTRODUCTION:

Blood cancer has a wide variety of malignancies. The analysis comprises of the lymph node, vessel lymph, tonsil, thymus, spleen and lymph tissue tumors, blood cells, and the lymph system. Leukemia, myeloma, which begins in the bone marrow, and lymphoma that begins in the lymph system are the most prevalent forms of blood cancer. The causes of these cancers are unknown. Blood cells, including white blood cells, red blood cells and platelets, can inhibit their ability to generate normal blood cells to treat leukemia and myeloma in the bone marrow. Infections, anemia and flushing can occur.

Lymphomas that normally occur as lymph nodes enlargement may conflict with the body's ability to manage infection. In addition myeloma generates an unnatural protein and degrading substance that can cause other body symptoms. Treatments for blood cancer have greatly changed leading to higher cure and survival rates. Remission occurs where the symptom of cancer does not exist. As, over 1 million people in the U.S. have or are in remission from blood cancer. Patients with blood cancer can have bleeding and serious problems with disease. To improve the contrast of the graphic, histogram equalization is applied. To minimize image size, the discrete wavelet transform (DWT) is applied. To decrease image noise, Matched Filter Response (MFR) is performed. For image segmentation, an algorithm known as the clustering source is used. The different personality uses techniques such as PNN, Bayes and SVM, since its success is different.

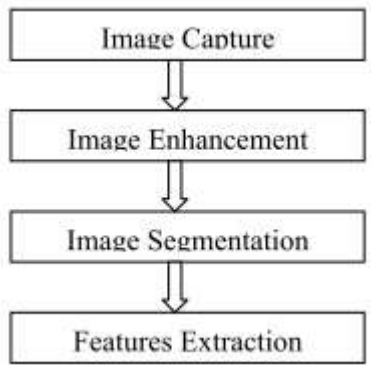


Fig 1 - Comparison of classifier for diagnosing BC

2. TYPES OF BLOOD CANCER:

There are mainly three crucial forms of blood cancer. Although this cancer is usually categorized as the following, each form can have many variants,

2.1 LEUKEMIA:

The type of leukemia is blood cell cancer. White blood cells are one part of the blood. This helps in fighting infections in your body. When someone is afflicted with leukemia, DNA in the cells mutates to contain more young white blood cells in the body. The cells are known as bursts. Leukemia may involve the different blood cell types and the disease is classified by cell infection into four types. These cells increasingly take on the functioning of the bone marrow and the disease is spreading further.

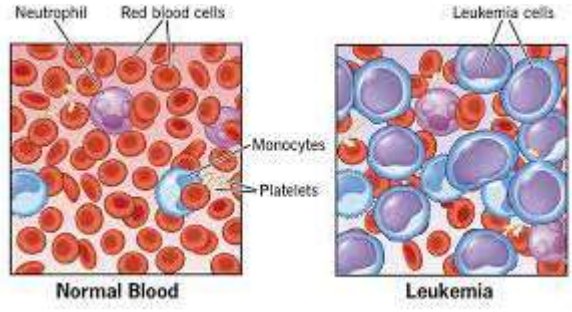


Fig 2 – Leukemia cells

2.2 LYMPHOMA:

Lymphoma is a form of blood cancer that causes the lymphocyte to expand, a portion abnormally high in the blood. Solid tumors including lymph nodes, bone marrow, spleen are also found in many areas of the body. The causes are not known in most situations. The typical symptoms include fever, heavy cold, weakness, lymph node pain, and other particular parts of the body. Chemotherapy, radiation therapy and bone marrow transplants are the most effective treatment choices for lymphoma.

Lymphocytes B or T are the blood component. They are an important part of the immune system and help body fight infection. There are lymphatic tissues that combine the lymph glands. Lymphoma is a type of lymph node cancer of the blood. The outcome is the lymphocytes are abnormally composed. They also multiply rapidly and prevent normal cell development before the system gets overloaded. However, with a prompt diagnosis, certain cases of lymphoma can be completely cured.

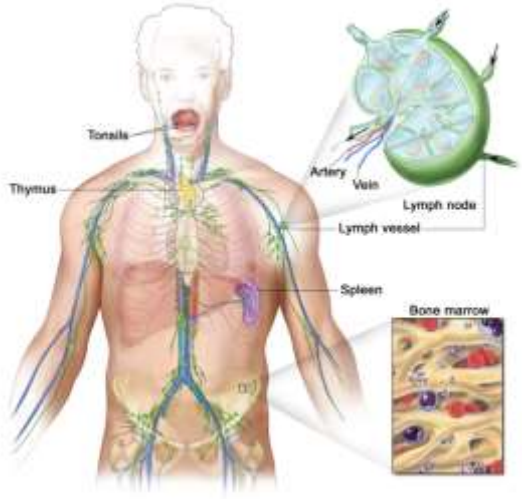


Fig 3 – Lymphoma cells

2.3 MYELOMA:

Plasma cells in the bone marrow make antibodies that help the immune system combat external aggression. Myeloma is carcinogenic cancer in plasma cells. The tumors outside a solid bone become abnormally complex and expand. The gradually weakens the bones. Also, bone marrow does not allow the production of healthy blood cells. The causes of the disease are not apparent. The blood cells are produced in the human body in the thick spongy tissue of the bone marrow. One of the cells produced here are B lymphocytes or plasma cells. These cells help to develop blood antibodies. The body's anti-bodies are the body's main troops.These plasma cells are rare in the occurrence of myeloma. Tumors expand quickly and ultimately on the surface of firm bones. This attacks the bones to prevent efficient implementation.

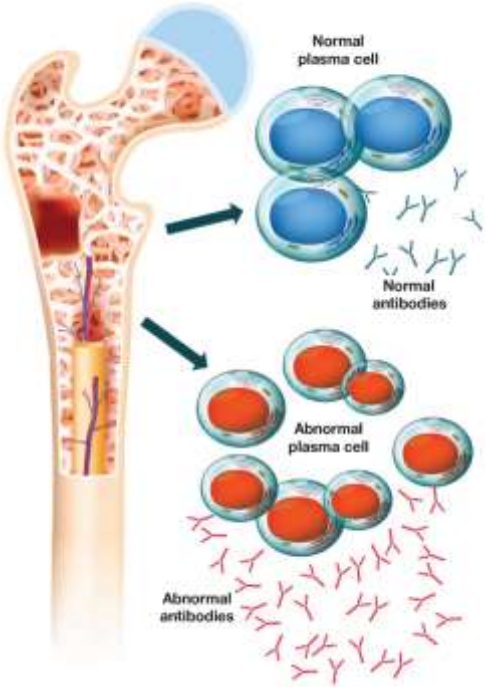


Fig 4 – Myeloma cells

3. PREPROCESSING OF IMAGE:

The view is preprocessed by changing the contrast between Leukemia and Lymphoma and Operations on images at the lowest level of analysis are known as image pre-processing. If entropy is an information measure, these actions do not increase image information content, but they do reduce it. Pre-processing is used to improve picture data by minimizing unwanted distortions or enhancing certain image features that are important for subsequent processing and analysis.

3.1 GRAY SCALE CONVERSION:

The intensity value of 8 bits has been used to represent the grayscale image. The brightness of a grayscale image pixel value ranges from 0 to 255. The RGB values (24 bit) are converted to grayscale values when converting a colour image to a grayscale image (8 bit).

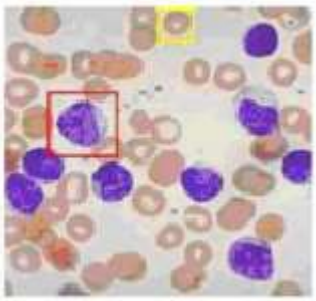


Fig 5 – Image before gray-scale Conversion

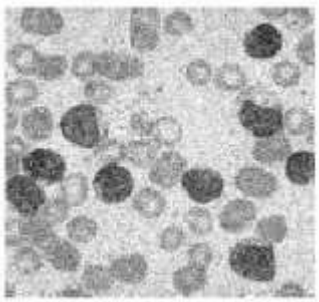


Fig 6 - Image after Gray-Scale Conversion

3.2 HISTOGRAM EQUALIZATION:

Histogram equalization is a contrasting correction technique in image processing that uses the image's histogram. This approach is generally used to enhance the overall contrast of a large number of photos, especially when the image's useable data is represented by close contrast values.

The intensities can be more evenly spread on the histogram after this change. This enables locations with low local contrast to obtaining a boost in contrast. This is performed using histogram equalization, which effectively spreads out the most frequent intensity values

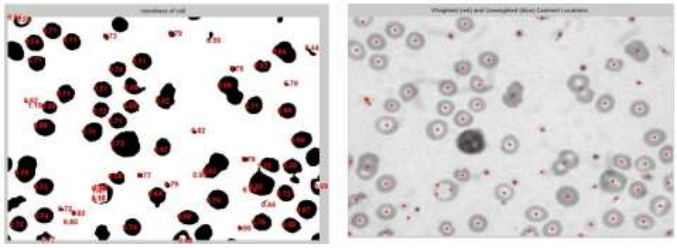


Fig 7 - Histogram Equalization images

4. DISCRETE COSINE TRANSFORM (DCT):

The discrete cosine transform (DCT) is also called the cosine transform. It is mainly used for image data compression.

4.1 ONE – DIMENSIONAL DCT:

The 1 – D forward discrete cosine transform is define as

$$C(u) = \propto (u) \sum_{x=0}^{N-1} f(x).cos\left[\frac{(2x+1)u\pi}{2N}\right] \quad for\ u = 0,1,\dots\dots N-1 \qquad (5)$$

Where, $\propto (u) =$

$$\begin{cases} \sqrt{\frac{1}{N}} & for\ u = 0 \\ \sqrt{\frac{2}{N}} & for\ u = 1,2\dots\dots N-1 \end{cases}$$

Similarly, the 1-D inverse DCT is given by

$$f(x) = \sum_{u=0}^{N-1} \propto (u)C(u).cos\left[\frac{(2x+1)u\pi}{2N}\right] \quad for\ x = 0,1,\dots\dots N-1 \qquad (6)$$

Equation 5 and 6 are called the 1-D DCT pair

4.2 TWO – DIMENSIONAL DCT:

The 2-D forward DCT is obtained by

$$C(u,v) = \propto (u). \propto (v) \sum_{x=0}^{N-1}\sum_{y=0}^{N-1} f(x,y).\ cos\left[\frac{(2x+1)u\pi}{2N}\right].cos\left[\frac{(2y+1)v\pi}{2N}\right] \quad for\ u = 0,1,\dots\dots N-1 \qquad (7)$$

Where $\propto (u) or \propto (v) =$

$$\begin{cases} \sqrt{\frac{1}{N}} & for\ u\ (or) v = 0 \\ \sqrt{\frac{2}{N}} & for\ u\ (or) v = 1,2\dots\dots N-1 \end{cases}$$

Also, the 2-D inverse DCT is defined as

$$f(x,y) = \sum_{u=0}^{N-1}\sum_{v=0}^{N-1} \propto (u). \propto (v) C(u,v).cos\left[\frac{(2x+1)u\pi}{2N}\right].cos\left[\frac{(2y+1)v\pi}{2N}\right] \quad for\ x,y = 0,1,\dots N-1 \qquad (8)$$

Equation 7 and 8 are called the 2-D DCT pair

The result of this transformation was a compression method which reduced the image size, as shown

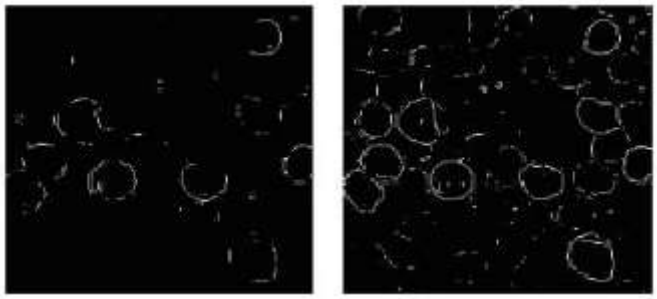


Fig 8 – DCT images

5. THE MATCHED FILTER RESPONSE (MFR):

A matched filter is a communications filter that is used to "match" a specific transit waveform. It allows the maximum signal power to flow but reduces any frequency components where there is simply noise. The matching filter's focus is to maximize the signal-to-noise ratio at a bit stream's sampling point while lowering the possibility of unnoticed errors. To achieve maximum SNR, we want to let all signal frequency components get through, but we want to focus on signal frequency components that are large and hence contribute to general SNR enhancement. The matched filter is applied that optimizes (S/N)out and it has a transfer value of ,

$$h(f) = \frac{w\,(s^{*}(f)e)}{P_n(f)}$$

where S(f) = F[s(t)] with a duration of T sec and a sample period of t0 sec.

w is a nonzero, arbitrary, real constant.

It's possible that the filter won't be able to be implemented.

6. FEATURE EXTRACTION:

This equation generated the resulting image by reducing the unwanted noise until the clear image was produced. There some feature extraction using to detect the blood cancer. Various types of features from the segmented image are

extracted in this step. To achieve the desired result, features containing critical information are selected. Multiple features are required in this proposed approach for improved classification. Energy, Correlation, Sum Entropy, Difference Entropy, entropy, information measure of Correlation, Contrast, and Correlation are some of the features extracted in this study.

7. THRESHOLD:

A method of processing digital images that involve allocating a certain property or operation to a pixel whose luminance value exceeds a threshold level. Consider the gray-level histogram corresponds to a picture, f(x,y), consisting of dark objects against a light backdrop, with grey levels sorted into two dominating modes for both object and background pixels.

$$g(x,y) = 1 \; if \; f(x,y) \geq T$$

$$g(x,y) = 0 \; if \; f(x,y) < T$$

Selecting a threshold "T" that divides these modes is one simple technique to isolate the objects from the backdrop. Any point (x,y) for which f(x,y) > T is referred to as an object point; otherwise, the point is referred to as a background point.

8. CONVOLUTIONAL NEUTRAL NETWORKING:

The input layer receives images in the form of numbers. The intensity of pixels in the image is represented by these numerical numbers. These values are subjected to a few mathematical computations by the neurons in the hidden layers. Certain parameter values are initialized randomly to accomplish certain mathematical processes. After the hidden layer has completed these mathematical operations, the result is transferred to the output layer, which generates the final forecast.

Step 1: Create a variable to hold the input images (say X)

Step 2: Set a filter matrix (randomly generate it). With the filter, images are convolved.

Z1 = X * f

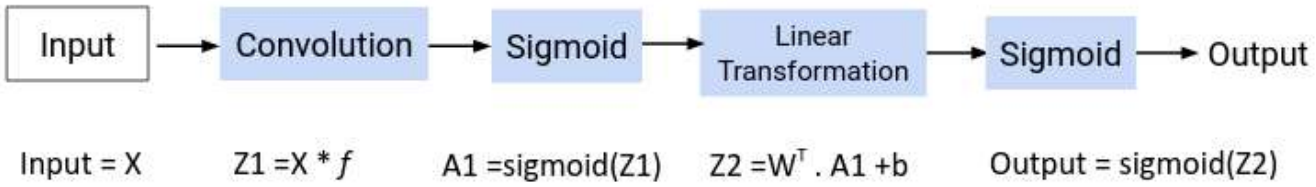
Step 3: On the result, use the Sigmoid activation function. A = sigmoid(Z1)

Step 4: Create a weight and bias matrix (randomly initialized). Transform the values with a linear

transform. Z2 = WT.A + b

Step 5: Run the data through the Sigmoid function. The final product will look like this.

O = sigmoid(Z2)



After the output has been generated, the output must be compared to the real value. The values of the parameters are changed based on the final result and how close or far it is from the actual value (error). New outputs are generated after the forward propagation process is repeated with the modified parameter values.

9. CONCLUSION

Blood cancer is a disorder that affects blood cells. Only after the preprocessing functions have been successfully processed in the input image are the functions input color blood cells images are fed for preprocessing techniques like grayscale conversion enhanced. The functions will use the output from the preprocessed image as input for the classification process.

Blood cancer is now categorized into two categories based on the movement of blood cells using CNN and ConvNet after the classification process. This research concludes that, as compared to the descent CNN performs exceptionally well in detection calculations. As a result, this work eliminates manual labor by detecting blood cancer issues early on and diagnosing it at an early stage.

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