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Multiple Type of Blood Cancer Detection System Using CNN

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Multiple Type of blood Cancer Detection System Using CNN

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***Abstract*—Now a day's blood cancer is one of the most common causes of death with an incidence of more than one lakh people being diagnosed every year .The detection of multiple types blood cancer still remains a significant challenge in healthcare.Various applications are developed which detect blood cancer from the input of provided by the user through images.It detect that whether the cell is infected with cancer or not but system is not able to detect different types of cancer properly.Therefore ,it is very difficult to understand which type of blood cancer detected.Developed system are not able to find the type of blood cancer.To overcome these challenging problems,we have proposed a multiple type blood cancer detection system ,which can detect a type of blood cancer through the input provided by the user in the form of image using Convolution Neural Network (CNN) model.Also it improves the accuracy of the model. In the form of output the system provides the user the information about the particular type of blood cancer and also generates the report of the overall result.The proposed application will help user to identify the type of blood cancer and also provide information and precautions to be taken about a particular type of blood cancer.**

Keywords—Leukemia, Lymphoma, Multiple Myeloma, Classification algorithms, Deep Learning, Convolution neural networks, Image processing

I. Introduction

Blood Cancer is the most serious disease today's world, which affects both children and adults. The majority of blood cancer cells start in bodily parts, but leukemia is a type of cancer that starts in blood cells and thrives there. Cells proliferate and multiply into new cells in the human system. In order for new cells to take their place, old cells are eliminated. In cancer, old cells do not die and linger in the bloodstream, leaving young cells with little space to live. As a result, blood function is disrupted, and white blood cell production is aberrant and uncontrolled. On a daily basis, billions of these cells, predominantly RBCs, are created. These cells do have a life cycle and perish at regular intervals. Blood is composed of platelets, red blood cells (RBC), and white blood cells (WBC).Platelets help with clotting and preventing bleeding. The red blood cells, or erythrocytes, are in charge of carrying oxygen from the lungs to the body's tissues. White blood cells (WBCs), also known as leukocytes, fight infections and diseases. The creation of a large number of premature WBC is referred to as leukemia. Bone marrow produces an abnormal number of WBCs in leukemia as compared to the other two types (RBCs and platelets). Such premature cells, commonly called blasts, are unable to perform their normal functions and crowd out other cells, causing their function to be compromised. Blood cancer is broadly categorized as three types of blood cancer

1) Leukemia

2) Lymphoma

3) Myeloma

As per the National Cancer Institute, the percentage of all new cancer cases in a year is 3.5 percent. Every year, more than 700 children under the age of 15 are diagnosed with blood cancer. Of these 500 of them have leukaemia blood cancer, and about 200 have lymphoma blood cancer.Blood cancer affect your blood cells in the body.Blood cancer arises when the blood cells start growing abnormally and interfere with the normal function of blood cells like fighting infections or clotting.A healthy body produces fresh new white blood cells on a regular basis to replace the old blood cells. Blood cancer is brought on by the bone marrow's excessive synthesis of white blood cells.

The Platelets, red blood cells, and white blood cells are the three different types of blood cells. Each of them is continuously produced in the bone marrow and released into the blood stream at specific times. Blood cancer is primarily caused by the exponential growth of abnormal blood cells, which inhibits the normal blood cell growth. Leukemia, myeloma, and lymphoma are the three main sub-types of blood cancer.Manually performing the detection process by technicians requires more time and effort, and using an instrument increases the cost.We are going to create a application that is more accurate than practising doctors in identifying blood cancer from blood cell images. In regions of the world where access to qualified medical staff is scarce, this technology can enhance healthcare delivery and expand access to medical imaging knowledge.

There are many blood cancer detection systems which can detect blood cancer to the user. The technique is Convolution Neural Network (CNN) It is based on computer vision . The common algorithm for this approach consists of several rigid steps: image pre-processing, clustering, morphological filtering, segmentation, feature selection or extraction, classification, and evaluation.

We can identify multiple type of cancer from blood cell images. This technique uses a convolution network to analyse images of blood cells and determine whether or not they are cancerous. Blood cell pictures of cancer may show ambiguous symptoms, overlap with other diagnoses, and resemble several benign abnormalities.The System can

provide user-friendly solutions by uploading images of blood cells using smartphones ,laptops which detect the correct type of blood cancer .The diagnosis of cancer varies significantly between medical professionals as a result of these inconsistencies. Automated cancer identification from blood cell images at the level of highly skilled medical experts would be extremely helpful in clinical settings as well as in providing healthcare to populations with insufficient access to diagnostic imaging specialists.

We have proposed a Multiple Type of blood Cancer Detection System Using CNN , which detect the type of blood cancer and display necessary precaution. System provides the user detail information about blood cancer. The proposed application will help the user to detect type of blood cancer at early stage.

II. LITERATURE SURVEY

The researchers [1] tried to create a system that would be able to recognise morphological defects in RBCs using support vector machines and image processing which was primarily focused on medical technicians, haematologists, and pathologists in identifying RBC by developing a device using a Raspberry Pi that can measure the various RBC parameters, including area, perimeter, diameter, shape geometric factor (SGF), and identifying the target flag and central pallor. Support Vector Machine (SVM) classifier accuracy of 93.33% and (ANN) accuracy of 90.54% in classifying RBC. It will be possible to enhance the system and increase accuracy by adding more parameters that were not included in this study. With the use of this approach early diagnosis of aberrant red blood cells, a disease linked to abnormal RBCs can be identified.

[2] Early detection of leukaemia substantially aids medical professionals in giving patients the right care. White blood cells are first separated from other blood components to complete the segmentation stage. The suggested Methodology K-means, for detecting malignant phases and its early identification, uses SVM and KNN for blood cancer detection. With an accuracy of 90%, experiments and findings it was found to be encouraging. A larger data set was then used to improve accuracy.

In the paper [3] we can identify leukaemia using machine learning, which can assist medical science in determining if a patient has cancer or not. As a result, the Leukemia detection system needed a system for decision-making. It utilised many machine learning techniques to forecast accuracy and find blood cancer.It does not employ image processing as a means of detecting blood cancer. We gathered 401 data from Z H Shikder Medical College and Hospital for our dataset. The analysis of precision, recall, and F1 score for all of our data samples using various techniques.

[4]In this study, the geometric, texture, and colour properties linked to RBC images were obtained by employing a photo imaging microscope and the optimised segmentation and mean filter image processing approaches. SVM was utilised as the classifier, and accuracy rates using validation measures of sensitivity, specificity, and Kappa showed that they were 95%, 94%, and 96%, respectively. They can not accurately identify the type of blood cancer.

In the paper [5], authors will examine various image processing and machine learning methods used for the classification of leukaemia detection and attempt to concentrate on the merits and limitations of various related researches in order to summarise a result that will be useful to other researchers. It is fairly simple to classify images when using a computer-based technique for image processing. Also used for classification include ANN, CNN, and SVM. There was only one type of blood cancer found.

[6] This system will use extracted form features from each cell in microscopic blood images. This feature retrieval will be used as a classifier input which is divided into two classification classes, namely Acute Lympotic Leukemia (ALL) and Acute Myolegenous Leukemia (AML). Identification of the blood cancer used Image Processing technique,Classification accuracy of 80% .Leukemia blood disease identification is done but could not identify lymphocyte and myelogenous blood disease ,and improve accuracy.

Researchers [7] Author approach identified an important feature for the images that can help doctors or technicians for better understanding of stained images to aid diagnosis of leukemia patients to extract features from images and built classifier using SVM and GBDT accuracy of 85.6% Identify and detect type of blood cancer using image processing.Improve accuracy by classifying and detecting different types of blood cancer using image processing.

The paper [8] system used Faster-RCNN (Region Convolutional Neural Network) algorithm for object detection.Continued with a larger data set to improve performance of system.object identification, we have determined the relevant item and, using the corresponding object's count, have identified leukaemia. The observed mean average precision values are 0.10, 0.16, and 0, respectively, for the epochs of 40, 60, and 120.

9. The system proposed are authors to take microscopic blood images as an input image. A dataset of 100 images in which 68 training and 35testing images is taken. After that we have converted the image's into proper format (YCbCr) for segmentation. We combined the Gaussian Distribution and Otsu Adaptive Thresholding methods for segmentation, and the K-Means method for clustering. K-Means clustering and Convolutional Neural Network Classifier (CNN) are used and system obtained after processing is 97.3%.It can identify and continued with large dataset to improve system performance.

The paper [10] Authors main goals are to establish a testing approach that strengthens reproducibility of results and to discover an ideal panel (in terms of the fewest blood biomarkers needed to reach the required diagnostic performance of 80% sensitivity and specificity). The complexity and expense of diagnosis as well as the potential creation of cost-effective point of care devices will be significantly impacted by the realisation that a panel with a less number of markers will be available. Supervised

machine learning algorithm (SVM) is employed. ?It does not produce an overall report, and enhances the accuracy and quality of the image.

[11] The research, investigate a new CBC detection method by using deep neural networks, and discuss state of the art machine learning methods in order to meet the medical usage requirements. The approach we applied in this work is based on YOLOv3 algorithm, deep learning algorithms,CNN(Convolutional Neural Networks).The system used large dataset to improve system performance and identify types of blood cancer.

Authors [12]This system uses RNA-sequencing data from blood samples to accurately classify different cancer kinds, and several feature selection approaches and machine learning algorithms are examined. Seven different cancer types were compared to healthy samples in the investigation. The Random Forest (RF), Naive Bayes (NB), and Support Vector Machine (SVM) techniques,85% accuracy was achieved by employing 10-fold cross-validation to all machine learning techniques. It does not Improve Accuracy in Classifying and Detecting Different Types of Blood Cancer.

Researchers [13]These cancer cells produce and emit special molecules, so-called biomarkers, which are symptomatic for the presence of anomaly, into the cardiovascular system. Detection of cancer biomarkers with conventional blood tests is difficult in the early stages of a cancer due to the very low concentration of the biomarkers in the samples taken.Mobile nano-sensor device are used to Improve the performance of system.

The paper [14] detection and counting of white blood cells (WBCs) in blood samples can be done with the help of a reliable, widely used computer-aided blood analysis service. WBCs, also known as leukocytes or leucocytes, are immune system cells that help the body defend itself against both infectious diseases and foreign invaders.Analysis of leukocytes provides valuable information to medical specialists, helping them in diagnosing different important hematic diseases, such as AIDS and blood cancer (Leukaemia)It used a mobile-cloud aided framework, SVM for classification, and naive Bayes classification to find blood cancer. Improve the system's accuracy

[15] The system uses preactivated ready-to-use cartridges embedded with capacitive biosensors with shelf-life of three months under optimal conditions, and is capable of onsite diagnosis and can report the result in less than 30 min. The device is verifified with real patient blood samples for six different disease biomarkers.It used Biosensor Device to detect the blood cancer. Researchers have created a number of image processing methods to identify blood cancer in biomedical images of human blood samples. They have also been created by scientists to identify leukaemia. Convolution Neural Network is one of the most used methods (CNN).In recent years, it has been based on computer vision. The typical algorithm for this strategy entails a number of fixed phases, including picture pre-processing, clustering, morphological filtering, segmentation, feature selection or extraction, classification, and evaluation, but not in a single application that can identify several types of blood cancer. All users can use the suggested online application to determine the many types of body cancer.

III. OBJECTIVE

- Develop Multiple Type of blood Cancer Detection System
- To display necessary percaution
- Develop web based application

IV. PROPOSED SYSTEM

A. System Architecture

Multiple type of blood cancer Detection System Using CNN architecture consist

of following steps :

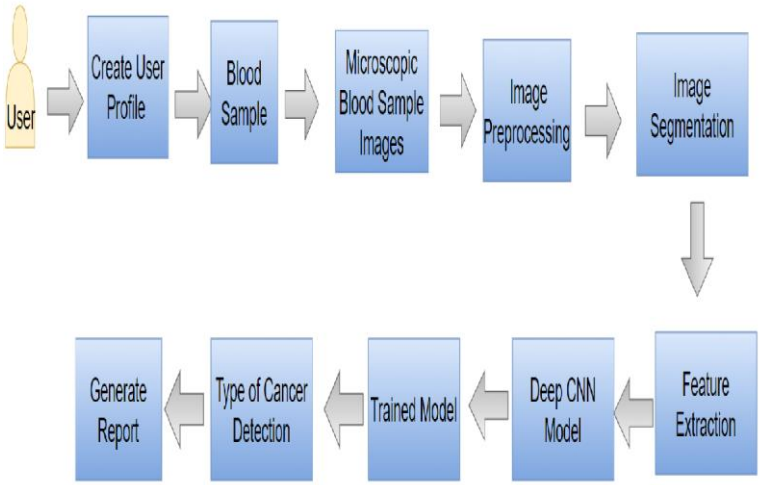

Fig1. system Architecture of the proposed system

The image from the database provided by "ALL -IDB The Blood Cancer Image Database for Image Processing" was used as the system's input [7]. The input image is then pre-processed to improve the quality of the image via colour conversion. For picture segmentation, the Otsu's thresholding and morphological processes are applied. The feature extraction block, which consists of a section of blast cells examination for its form, colour, and texture attributes, receives the segmented image next.

- Data Collection : The images used in this research came from the publicly accessible online dataset known as Kaggle. Two classes were created from this dataset. There were 4961 training images in all, 2482 of which were of healthy patients and 2479 of which were of blood cancer patients. With a total of 1240 images, 620 from each class, we tested the model. The resolution of these images was 320*240.

- Data Prepocessing **:** Data Preprocessing reconstruct and analyses data received during data acquisition phase. In data preprocessing raw data is converted into comprehensible format using data cleansing, data integration, data conversion, data reduction methods.

- Segmentation **:** segmentation involves converting an image into number of pixels that are represented by a mask or a labelled image. to dividing an image's into segments, you can process only the important parts of segments in the image rather than processing the whole image**.**

B. Methodology

Research methodology follows:

1. Microscopic Image Acquisition:

image of blood cells has to be collect from hospital's and lab's with sufficient magnification.

2. Image Enhancement:

Due to extensive staining, the obtained medical image could be noisy. Any picture denoising technique that improves the image's quality must be used; however, the image may still appear slightly blurry. The blood sample image's backdrop must be removed because white blood cells are the area of interest. The edges of the white blood cells will appear sharper in the image as a result of this image preprocessing, which includes noise reduction and enhancement.

3. Image Segmentation

The main aim of theimage segmentation involves converting an image into number of pixels that are represented by a mask or a labelled image. to dividing an image's into segments, you can process only the important parts of segments in the image rather than processing the whole image.the image segmentation divide to the white blood cell (WBC) to RBCs and plasma in the blood sample image's. Image segmentation technique is a very important of research in the field of Image Processing.

The several researchers' and approaches' work on medical picture segmentation has been covered. Blasts are immature, abnormal white blood cells. The blast cell and regular cells should be distinguishable using the proposed method. Blood lymphocytes and myelocytes are the only cells that need to be taken into account when deciding if a cell is a blast or not; other cells, such as neutrophils, basophils, and eosinophils, can be excluded from the picture. When the blast cells are located, the process can move on to the next stage and the subimages that contain the nucleus only need to be focused, which minimises errors because the colour scales of WBCs and other blood particles can be comparable [4].

4. Image Feature Extraction

Feature extraction is a method that takes pre-processed images including various anomalies and extracts many features from them. The image's various characteristics include its height, size, shape, composition, location, etc. The classification of desirable objects depends on feature extraction. [23]. In order to collect the pertinent data that distinguishes each pattern, feature extraction is a crucial step in the design of any pattern classification [8].

• Geometrical Features : Area, radius, perimeter, symmetry, boarder, concavity, compactness, solidity, eccentricity, elongation, and form factor are some examples of geometrical features.

• Texture Features : Homogeneity, energy, correlation, entropy contrast, and angular second momentum are among the texture features.

• Color Features : The RGB colour spaces used in Color Features are converted to HSV colour spaces. We'll find out what their mean colour values.

• Statistical Features : Statistical features include the gradient matrix for RGB or HSV colour space, as well as the mean value, variance, skewness, and kurtosis of the image matrix's histograms.

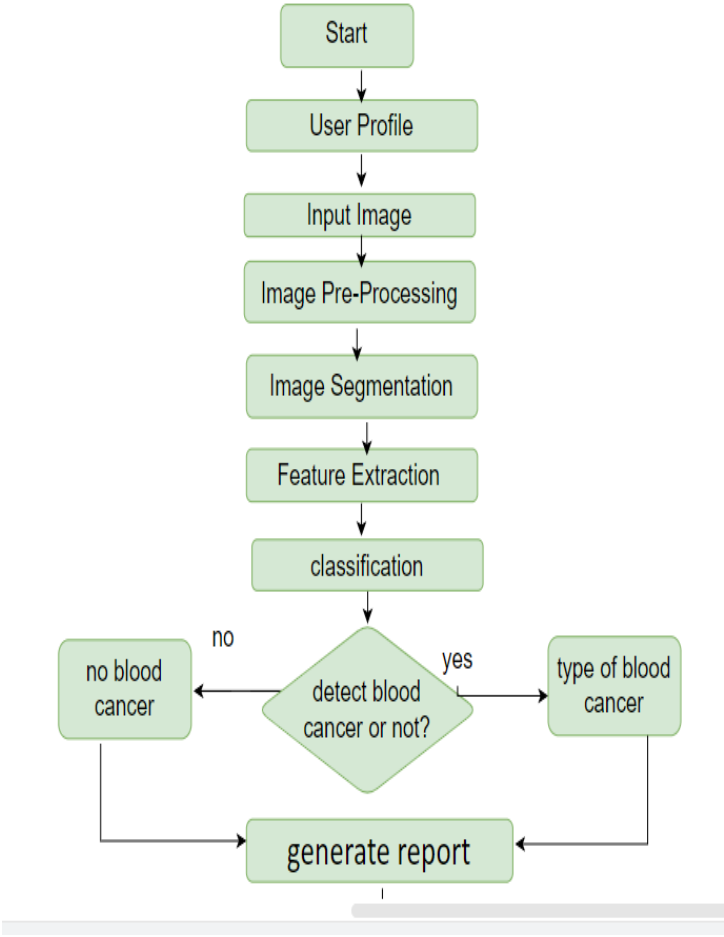

Fig2. flowchart of the proposed system

5. Image Classification:

Depending on the features extracted from the above step the classifier classifies a cell as normal cell or cancer affected cell i.e. blast cell. This is done by comparing some of the features like geometric, statistical, texture and size ratio from regions obtained in the segmentation process with standard feature. Then the results are analyzed to identify the types and subtypes of acute leukemia.

automatically detect cancer in blood samples, neural networks are used. Due to the well-known method of the neural network as a good classifier for many practical applications, it is chosen as a classification tool. One of the crucial elements in creating a precise process model using CNNs is the training and validation processes. The training features set is used to train the CNN model, and the testing features set is used to check the accuracy of the trained utilising the feed-forward back propagation network. The dataset for the training and validation operations is divided into these two sections. Connection weights were continuously changed during the training phase until they reached the specified iteration number or the appropriate error. Using neural networks, cancer can be automatically detected.

V. CONCLUSION

The proposed method extracts the features in microscopic images by examining changes on various parameters like texture, geometry, colors and statistical analysis input.

The system will have high reliability, accuracy and efficacy, less processing time, smaller error, less cost and robust and fully automatic system that would accurately identify Leukemia cancer.

Firstly, for model creation we have taken blood microscopic images from train and testing dataset and then utilized 3 pre-trained deeplearning models for checking accuracy. The system can detect more than one blood cancer types.

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