A Survey on Blood Cancer Classification based on Image Processing

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Abstract-The incidence of blood cancer is one of the chief causes of loss of life for men and women. As the case is quite complex and detection in the preliminary phase is difficult. So the faster detection helps in better planning and treatment possibilities. With the advent of advancement in medical technology and medical imaging services, it has become easier to handle intricate cases. Detection and evaluation of cancers is an important and active field of research today. The robust technology of image processing has proven to help with the several cases of blood cancer. Hence this paper puts forth a survey on various methods employed for classifying blood cancer by using digital Image Processing.

Keywords: Digital Image Processing, Blood cancer Classification, Medical Imaging, Accuracy, Detection, Evaluation.

I. INTRODUCTION

The incidence of blood cancer is one of the leading causes of life loss for a large number of populations, all over the world. These cases have been significantly increasing with time. As with cancer, it is a highly complex form of illness, so it is hard to detect. With an array of symptoms, sometimes these symptoms coincide with other common ones, so one cannot ascertain the occurrence of cancer easily. After going through lots of tests and health checkups, it gives a sure shot conclusion. But detection of this disease at an early stage is the major factor in successful treatment. The earlier it is diagnosed, the better are the recovery and treatment possibilities.

There has been rapid technological developments and progress in the image processing field. The advancement in soft computing and efficacy of accurate diagnosis has been of major support in the medical domain [8]. Though the most common symptoms of blood cancer can signify the occurrence of the disease, yet many times the cases are asymptomatic in nature. This gives result to erroneous classification which can occur due to small variations in the microscopic blood sample images of benign type as well as malignant type. The microscopic imges which are seen by the expert indicate the nature of the blood cells and their infection. So the visual images of the microscopic blood samples are the major tool of detecting the disease accurately. Any missing link or absence of necessary image data can make the task of identification complex and difficult. Visual image clarity is of enormous importance in this scenario.

II. SYSTEM MODEL

a. Digital Image Processing

The concept of digital image processing is beneficial in this medical diagnosis world. Images processed using the help of computer is termed as digital image processing. As today the medical domain has to rely on digital medical reports of which major constituents are images of different organs, blood and different body parts. So accurate treatment can only happen when the digital images that are obtained and processed are accurate. Digital Images comprise of a finite set of elements each of them having a specific location and value. Today there are numerous applications of digital images. Education, military, defense, banking sector, information technology and communication etc have tremendous use of digital image and processing. In this proposed review, it is intended to evaluate the medical microscopic images with various types of patterns of blood cancer. So Digital image processing plays crucial role in proper processing of the image and making sure that the images obtained are clear and very accurate.

Classification of the microscopic patterns shall help greatly in this regard with the help of digital images. The quality of image is a major component here. The analysis and evaluation of the symptoms rely on the microscopic image data of the disease, henceforth the identification method has to be free from errors and any glitches. Then only a smooth detection can be done with greater accuracy.

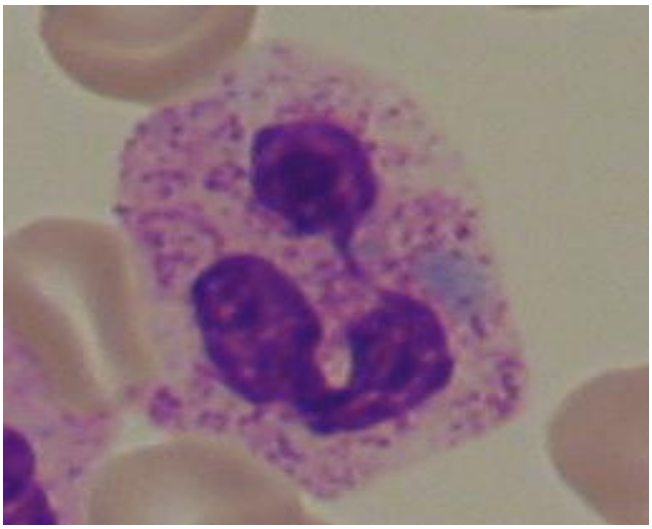

Fig. 2.1 Typical Brain Tumour Image

b. Image Pre-Processing

Before the method of feature extraction is done, the process of image pre-processing is carried out . This is important to ensure proper feature extraction process. The image is pre- processed and checked for any inconisitencies. Hence this a crucial step.

c. Principal Component Analysis (PCA)

Principal Component Analysis can be referred to as process that aids in finding the attributes that primarily helps in dataset final clasiification.(PCA) is a mathematical method that does ocnversion of a group of correlted variables into a set of uncorrelated values of variables that are called principal components. The amount of real variables is generally greater than or similar to the principa components. This step by step modifiaction and transformation greatly increases the dataset versatality. This kind of classification using the principal component analysis has been used widely for pattern recognition and analyis of data compression. This method helps in preventing loss of data and information and helps in data compression.

d. Discrete Wavelet Transform (DWT)

The Discrete discrete wavlet transform is a kind of tool for analysis and evaltuation of non smooth signals that randomly vary and fluctuate. The traditional and popular used Fourier Transform delas with the flutuations in smooth signals, it is incapable of identifying the variations in quickly varying signals like ECG. Hence here DWT helps immenesly to recognize such abrupt variations in the signal.

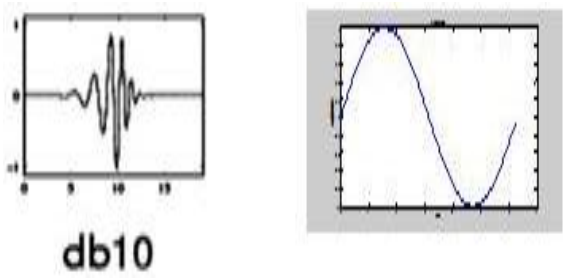

Fig. 2.2 Base Functions of Fourier Transform and Wavelet Transform

The wavelet transform can be mathematically illustrated as follows:

$$C(S, P) = \int_{-\infty}^{\infty} f(t)\,((S,P,t))\,dt$$

Here S denotes scaling

P refers to position

t signifies time shifts.

C is the Continuous Wavelet Transform (CWT)

The major demerit of the CWT is that it consists of a huge quantity of data. The DWT is sampled form of the CWT. The DWT is down sampled and its primary feature is to smoothen out the rapid and sudden fluctuation in non smooth signals which happen due to the quickly changing base function of the signal. So here DWT is of major advantage and helps in good performance of the signals.

e. Artificial Neural Networks

Artificial Neural Network is type of neural network that can be trained with an input data set and can be tested for accuracy. It comes under the branch of artificial intelligence. The neural network can be trained to perform classification of various types by feeding it an input of information or useful data. This is called training of the neural network. A parallel data stream enters the neural network. It is very useful learning and this machine learning approach is being used widely in the recent times. The neural networks are being used extensively in wide range of areas and application .In digital image processing as well it can use for classification of the images in an accurate and efficient manner. Below is the mathematical equation of a neural network:-

$$y = \sum_{i=1}^{n} X_i . W_i + \theta_i$$

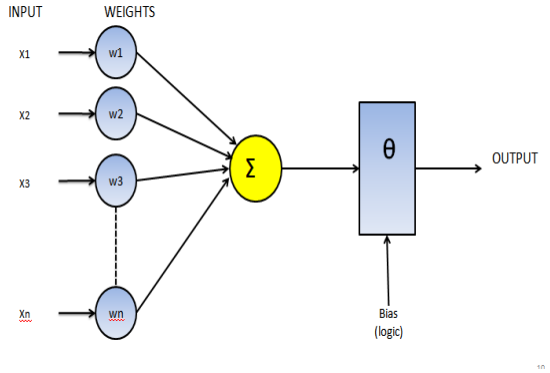

Fig. 2.3 Mathematical Model of a Neural Network

The mathematical representation can be enunciated as follows:

X signifies the parallel inputs.

Y refers to the output ANN output.

θ denotes the bias.

W denotes the weights associated with the inputs received the ANN.

Today the field of machine learning has been an area of popularity and progress. The field of artificial intelligence is showing enormous advancement and possibilities for applications. This is the branch where the machines and computers can perform a lot tasks and hence a lot of work can be automated without needing human intervention. As in the area of medical applications and diagnosis, there

even more complex cases cropping up. There is need for such advanced techniques of machine learning that can more effectively handle such cases and provide effective lines of solution and planning. So combining the efficient method of digital image processing along with neural networks can give improved performances

III. PREVIOUS WORK

[1] Malek Adjouadi et.al. proposed Classification of Leukemia Blood Samples Using Neural Networks, Springer 2010 In this work the authors proposed a neural network approach for the accurate detection of blood cancer. The method worked very fast and accurately and gave improved results. The neural network being the part of artificial intelligence can help with efficient diagnosis.

[2] N.Z Supardi et.al. presented Classification of blasts in acute leukemia blood samples using K-Nearest Neighbor, IEEE 2012.In this paper the authors introduced novel concept of classifying the blood samples utilizing the K clustering approachs. Classification of the microscopic patterns shall help greatly in this regard with the help of digital images. The quality of image is a major component here. The analysis and evaluation of the symptoms rely on the microscopic image data of the disease, henceforth the identification method has to be free from errors and any glitches.

[3] Chaitali Raje et.al. proposed Detection of Leukemia in Microscopic Images Using Image Processing, IEEE 2014 . The authors proposed a concept of image processing to detect leukemia on the microscopic blood images. The various parameters that are investigated for it include area, of the WBC and the wbc nucleus shape size. As the wbc's get affected by the disease, so it is important to identify the changes and modifications in it. The proposed methodology is applied for large number of images of the blood. Various algorithms are employed for accuracy like the image enhancement threshold etc. It is implemented using the MATLAB tool.

[4] Jyoti Rawat et.al put forth Computer Aided Diagnostic System for Detection of Leukemia using Microscopic Images, Elsevier 2015.This paper proposes a novel technique that can distinguish between different types of blood cancers and leukemia. It uses a separation and extraction approach. The computer assisted diagnosis is important. It is an efficient approach that uses the computer aided system. It is quite fast and effective approach for categorizing the samples of the blood. As this is a complex form of illness, hence a robust method has to be in place. The CAD system is created to detect such disorders of the blood cells effectively and accurately. It gives better accuracy.

[5] S. Ravikumar et.al proposed Image segmentation and classification of white blood cells with the extreme learning machine and the fast relevance vector machine, Elsevier 2015.The white blood cells forms the defense system of the body. The white blood cells are also termed as leukocytes. There is uncertainty in the blood microscopic images. This paper provides a research on the WBC detection based on vector machine approach. Segmentation concept is also applied for faster and reliable system model. . As today the medical domain has to rely on digital medical reports of which major constituents are images of different organs, blood and different body parts.

[6] Desai Devanshi Manojbhai et.al. presented Large Scale Image Feature Extraction from Medical Image Analysis, IJAERS 2016.In this approach and system model, medical image analysis has been given tremendous importance. The big data is a novel concept that circles around the idea of collection of data from intelligent data formats and categorizing on the basis of its need. The idea of doing large scale image evaluation can be a daunting concept. The biggest thing is to have quality performance and at the same time a very good feature classification. Henceforth this technique gives us different image analysis and classification methods of the medical domain that demand high end accuracy and details.

[7] Jean-Baptiste Fraisona et. al gave Efficacy of Azacitidine in autoimmune and inflammatory disorders associated with myelodysplastic syndromes and chronic myelomonocytic leukemia, Elsevier 2016.In this study, the authors explained on usefulness of Azacitidine on autoimmune disorders (AID). It was a pure medical domain and the use of it significantly improved the accuracy and performance for the chronic symptoms that were presented by the patients. The microscopic images which are seen by the expert indicate the nature of the blood cells and their infection. So the visual images of the microscopic blood samples are the major tool of detecting the disease accurately.

[8] Fuyong Xing and Lin Yang studied on Robust Nucleus/Cell Detection and Segmentation in Digital Pathology and Microscopy Images: A Comprehensive Review, IEEE 2016. The authors presented their ideas on the cell detection concept and also the idea of segmentation in the microscopic images. As the digital images of the medical domain are the key identification indicators and markers, any distortion or unclear feature can hamper the accuracy of diagnosis. As the nucleus detection also depends on a number of parameters, it is important to take into account the usefulness of the segmentation concept. The digital pathological space is showing gradual advancement with the new age technologies in place.

[9] M.Saritha et.al.Detection of Blood Cancer in Microscopic Images of Human Blood Samples: A Review, IEEE 2016.Obtaining accurate data from the medical

images is a very crucial task. This paper brings forth some of the key aspects in medical images processing and acquiring image information from it .It mainly focuses on the ALL disease that is more prevalent in children. The detection mainly depends on the accuracy in determining the normal and abnormal blood image and leukocyte features and the corresponding normal measures of its production. Various image processing methods are employed and applied to observe the efficacy of the method. It is a very good pproach with improved process and gives accurate outcomes in a short span of time.

[10] Gurpreet Singh et.al proposed Design of New Architecture to Detect Leukemia Cancer from Medical Images, IJAER 2016. The authors discuss about the newer mechanisms for detection of leukemia from the medical image data. This is novel concept and the use of the advanced techniques always fastens the process. The abnormal features and visual appearance of the blood cells can be only recognized when the images are very clear and show the details with utmost precision. Many times the cases are asymptomatic in nature. This gives result to erroneous classification which can occur due to small variations in the microscopic blood sample images of benign type as well as malignant type. The microscopic images which are seen under microscope should have sharp clarity. Hence in this method the techniques used for image processing and classification have been explained and illustrated.

IV. CONCLUSION

It can be concluded from the aforementioned discussions that classifying different types of blood cancer accurately is a relatively complex task. It needs the help of several advanced and effective techniques and methodologies for better performance and outcomes of improved detection from the microscopic images. Few of the primary methods which are a form of image processing techniques include the Discrete Wavelet Transform, PCA and the machine learning and artificial intelligence based approaches. Using the artificial intelligence based methods can go a long way in giving accurate results and aid in faster classification with high accuracy. The works done earlier in this domain are also discussed and they provide an insight into different research possibilities under this domain.

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