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Study Leukemia Detection Techniques using Acute Myelogenous Leukemia Detection in Blood Microscopic Images

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Abstract- Leukemia is a powerful terminal hematologic cancer which starts in blood –forming tissue, such as a bone marrow and activates high manufacture of undeveloped and not normal moulded blood cells. Capable medical captains are required to diagnose leukemia from blood slurs. This paper a difficulty in isolated area and rustic areas where there is deficiency of capable medical personnel. This paper represented a computer aided finding system that can detect and identify leukemia from blood microscopic images. Acute Myelogenous leukemia is a fast developing cancer of the blood and bone marrow. The requirement for automation of leukemia detection occurs because recent methods include manual study of the blood slurs as the first step forward finding. This is time consuming, and also the accuracy of the method depends on the operator's ability. We study several image segmentation and feature extraction techniques study for AML detection is discussed.

Keywords- Leukemia detection, Data mining, Cancer Bone marrow, AML detection and Blood cells.

I. INTRODUCTION

Data mining also recognized as information discovery in records (KDD) is procedure of extracting potentially useful information from fresh data. A software machine can scan huge amounts of records and automatically report interesting patterns without requiring human intervention [1]. Other knowledge discovery technologies are Statistical Analysis, OLAP, Data Visualization, and Ad hoc inquiries. Unlike thisequipment, data mining does not need a human to ask specific questions.

Here is the list of regions where data mining is extensively used:

- Financial Data Analysis
- Retail Industry
- Telecommunication Industry
- Organic Data Analysis
- Other TechnicalRequests
- Intrusion Detection

In this globalization era, there are somekinds of human sicknesses that have been intimidating mankind. The impacts of these diseases especially cancers must severely exaggerated the life expectation of the human populace. Leukemia is a series disease, which is among the deadliest sicknesses in the biosphere. Leukemia can be hard to diagnose. A computer-aided [2] judgment system is crucial in country areas wherever there is a deficiency of capablemedicinal personnel. Computer-aided diagnosis can be achieved using computer idea and pattern detectionmethods that can recognize and diagnose leukemia from peripheral blood film pictures.

Leukemia is aextremely fatal hematologic tumour which starts in blood-forming matter, such as the bone marrow and generate high manufacture of immature and irregular shaped blood cells. Normally, bone marrow creates three distinct kinds of cells which erythrocytes, leucocytes and thrombocytes. Usually, the marrows produce the precise number of cells in agreement with the want of the body. However, in leukemic patients the process becomes violated and starts producing abnormal premature white blood cells with abnormal shapes that cannot function normally and in uncontrolled manner.

Leukemia is the cancer of the blood. It starts in the bone marrow [3], it is the area where blood cells are made. When you have leukaemia, the bone marrow begin to make lots of irregular white blood cells, called leukaemia cells. They don't do the effort of normal white blood cells. They produce faster than usual cells, and they don't stop growing when they would. Over interval, leukaemia cells can troop out the standard blood cells. This can lead to serious hitches such as blood damage,anaemia and contagions. Leukaemia cells can also spread to the lymph knobs or other structures and cause engorgement or pain.

There are several different types of leukaemia. In general, leukaemia is gathered by how earlier this process gets poorer and what kind of white blood cell it distresses.

The microscopic pictures of the blood cells are observed to find out many diseases. Changes in the blood condition show the development of diseases in an individual. Leukemia can lead to death if it is left untreated. Based on some statistics it is found that the leukaemia is the fifth reason of death in men and sixth reason of death in women. Leukemia originates in the bone marrow. Each bone contains a thin material inside it which is also known as a bone marrow which is shown in the fig. 1[5].

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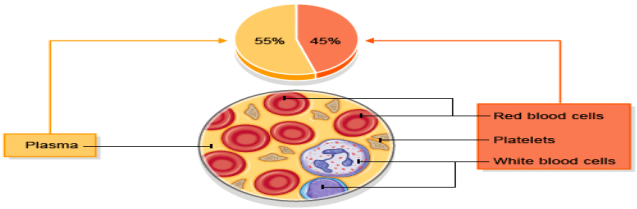

Fig. 1 Bone marrow and blood component [1]

The cells in the bone marrow start changing and they get infected and convert leukaemia or diseased cells. These leukaemia cells in blood are having abnormal properties than the standard cells.

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II. TYPES OF LEUKEMIA

- ALL meansAcute lymphoblastic leukaemia.
- AML meansAcute myelogenous leukaemia.
- CLL meansChronic lymphocytic leukaemia.
- CML meansChronic myelogenous leukaemia.
- Symptoms may depend on what type of leukaemia you have, but common symptoms include [4]:
- A new lump or swollen gland in your neckline, below your arm, or in your breakwater.
- Recurrent nosebleeds, bleeding since the gums or rectum, more recurrent bruising, or very weighty menstrual bleeding.
- Recurrent fevers.
- Night sweats.
- Bone pain.
- Unexplained appetite damage or recent weight damage.
- Feeling weary a lot without a recognized reason.
- Inflammation and pain on the left sideways of the belly.

III. TYPES OF CELLS

Two types of cells mainly name define:

- White blood cell
- Red blood cell.

A. *White Blood Cell*

White blood cells or leukocytes show a major part in the diagnosis of various sicknesses [6]. So extracting information about them is valuable for haematologists. Leukemia is the cancer of blood and bone marrow. The bone marrow creates a large amount of abnormal white blood cells in the situation of leukemia. These cells are immature and they do not workcorrectly. Without handling, leukemia can be a deadly sickness.

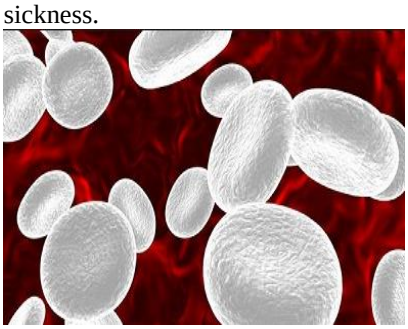

Fig. 2 White Blood Cell

1) B. *Red Blood Cell*

The plasma red cells that transmit oxygen.BloodRed cells shelterhemoglobin and it is the hemoglobinwhocertificates them to transportation oxygen(carbon dioxide). Hemoglobin, sideways from being a conveyance molecule, is a pigment. It gives the cells their red color . The abbreviation on behalf of red blood cells is RBCs. Red cells in the blood are earlier simply called blood red cells. Also they are called erythrocytes or, infrequently today, red blood corpuscles.

Fig. 3 Red Blood Cell

Table no: 1 Types of White Blood Cell

Sr.no	WBC Name	Description
1.	Neutrophil	This cell is having the nucleus which is containing the cytoplasm. The granules of it are of two types – primary and secondary. Primary granules are seen at the pro-myelocyte stage while the secondary granules are seen at the myelocyte stage. The diameter of it is 12-15 µm.
2.	Eosinophil	These look very similar to the neutrophil. The only change is in the cytoplasmic granules which are red. They insert seditious exudates. They react to the allergies. The diameter of it is 12-15 µm.
3.	Basophil	Basophils can be found only in the normal peripheral blood. Basophils are having more no of cytoplasmic granules in it. These granules overlie nucleus. The diameter of it is 9-10 µm.

IV. RELATED WORK

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N.H.AbdHalim et.al,2011 [7] In this paper described as, a global contrast stretching and segmentation based on Hue, Saturation, Intensity colour space will be used to improve the image quality. Image improvement is very important to increase the pictorial aspect of blast cells. HayanT. Madhloom et.al, 2012 [8] presented and application of feature extraction, selection and cell organisation to the recognition and differentiation of normal lymphocytes versus irregular lymphoblast cells on the image of peripheral blood smears. This is considered as a very useful procedure in the initial behaviour process of leukemia patients. A computerized recognition system has been developed, and the results of its mathematical verification are presented and discussed.R. Hassan et.al, 2012 [9] presented the study on blasts categorising in acute leukemia into two chief forms which was acute myelogenous leukemia and acute lymphocytic leukemia by using k-NN. 12 main features that represent size, colour-based and shape were extracted from acute leukemia blood images. LiviuBadeaet.al,2012 [10] They were integrating the largest publicly available gene expression datasets of leukemia and normal haematopoiesis with the aim of uncovering the main gene modules involved in normal haematopoiesis as well as in the various leukemia subtypes. Dong Ling Tong et.al, 2014 [11] aimed to sought a systems biology approach to suppose gene supervisory networks of leukemia related markers. Consequences demonstrated the effectiveness of a schemes ecology method to simplify compound genetic interactions without losing important biological information of the genes. Key indicators that inter-connected other leukemia associated markers were identified. ChaitaliRaje et.al, 2014 [12] proposed system was on microscopic images to detect Leukemia. The first and fast identification of Leukemia greatly aids in providing the suitable treatment. Initial segmentation is done using Statistical parameters such as mean, standard deviation which separates white blood cells since other blood components i.e. erythrocytes and platelets. Geometrical structures such as area; perimeter of the white blood cell nucleus is investigated for diagnostic prediction of Leukemia. MashiatFatima et.al, 2014[13] was proposing a technique for correct and quick classification of leukemia images and cataloguing them into their individual types. For this, different features are extracted from the input images and then based on these geographies a data set for the input images were created. This data set is then utilized as input data to a neural network for exercise purposes. This neural network had designed and created to classify the images permitting to their consistent leukemia type. YingboZhai et.al,2015 [14] proposed an approach that collective the least absolute reduction and selection worker and heat map visualization to detect possible biomarkers from a statistical perspective. In the research, they firstly classify our sample data into two classes: gene information from blood tasters of normal contributors and that of diseased patients. Then apply the LASSO on the sample data for feature selection and measurement reduction to classifypossible biomarkers.

V. DETECTION TECHNIQUES

There are generally two famous methods to identify leukemia: fluorescence in situ hybridization method and flow cytometer technique.

A. FISH Technique

Fluorescence in situ hybridization [15] is a common method to detect DNA sequences by using fluorescent probes. This method allows the discovery, analysis and control of abnormalities of genetic structure. FISH technique consists of 3 chief steps which are exampletraining, hybridization and fluorescence microscopy .

1) Sample preparation: The first tools used is multi-probes marked with a dissimilar combination of fluorophore, allows simultaneous visualization of dissimilar molecular constituent of the cell. The second is Multi-band fluorescence microcopy, enhance in discriminating the labeledcolor specimens.

2) Hybridization: Initially, denaturation of target and sequential probes is carried obtainable by submersing them for 5 notes in denaturing answer which consist of chemicals such as 49ml (70%) of form amide and 7ml (30%) 2X Saline Sodium Citrate (SSC) with pH value 5.3. This method helps them to form new hydrogen bonds to facilitate the hybridizations procedures [16]. The probes mixture is made by mixing up together the probe and target orders. Consequently, the investigation is obviously hybridized with the chromosome to form its better balancing sequences. The investigations mixture is beforeenclosed by the coverslip on the slides after that excess liquid mixture is removed to prevent contamination [13].

B. Flow Cytometry

Flow cytometry as depicted in Fig. 2 refers to the way used to analyze multiple physical and chemical physiognomies of atoms, normally cells, conjoined with different array of fluorochromes. With flow cytometry, the changed cell characteristics can be identified by establishing the heredity such as cytotoxic T lymphocytes (CTLs) domestic. This technique also recycled to form the dual heredity in special phenotypic leukemia, uncommon co appearance of antigen or abnormal outline and exhibition similar genetic factor [14]. Flow cytometer generally entails three stages: specimen training, pattern detection, and data interpretation.

1) Specimen preparation

Two ml of cell (blood cells) is mixed in ethylenediamine tetra-acetic acid and heparin for clotting prevention. The deterrence is done by properly shaking the taster from 5 to 10 times before proceeding to the next step. The slides were discoloured in Jeiner-Wright resolution for every sample. If required, cells feasibility can be tested also by using dye barring method which coverstrypan blue. Subsequently, the cells were treated in no-cell loss method. This method diminishes the failure of cells in the examples. This blood lyse and wash method is the basis for red blood cells lysis.

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Usual cell number recommended for immune-staining is 10 million cells for all tasters necessary for antibody mixture [15].

2) Pattern recognition

Every peculiar monoclonal antibody, antigen strength expressions and fraction of cells which gives positive results are very significant for defence. Though, gating by CD45/SSC is very precise, but it is plentiful more suitable to use the conservative side and forward scatter SSC/FSC gating. Also, sequential and back gating can be recycled as an elective choice. For a state of AML M0 and M1, blasts population with FSC and SSC had established diffident intensity of appearance for CD45; This CD45 and SSC goods discrete blasts number merging with growing granulocytic elements for the circumstances of myeloid leukemia with granular variation. In the case of monocyticleukemia, intersections in the area of the usual monocytes and the blasts are noticed[11].

3) Data interpretation

The blasts' ratio stating each antigen tested typically considered as optimistic whenever any markers shows blast presence is equal or more than 20%. Though, 20% as the limit point is personal and changeable. Alternative technique of examining is by scheming antigen appearance intensity i.e. measured fluorochrome antibody conjugate binding capacity. There are four different varieties that show either poor(+), reasonable (++) and robust (+++) which starts with first log value between 100 and 101 for the feeble range upto the robust range of fluorescence strength[16] is consecutively for second, third and fourth periods. Occasionally, since of the diverse staining intensity, bimodal may appear in the malicious group of cells.

Table no: 2 Colour Descriptor

Color method	Advantages	Disadvantages
Histogram	Simple to figure easy to use and escalate	Subtle to noise greatmeasurement no spatial information
CM	Compact Robust	Not enough to describe all colours no spatial information
Correlogram	Spatial info	Very high calculation cost delicate to noise
SCD	Compact on need Scalability	No spatial info less precise if dense
DCD	Dense robust perceptual meaning	Essential post dispensation for spatial info

VI. CONCLUSION

We have presented a mechanism vision founded approach to sense leukemia from blood microscopic pictures. Assumed a blood microscopic spitting image, the scheme predicts whether the blood microscopic image comes from a patient with leukemia and the kind of leukemia the enduring has. We have did experiments on a dataset of leukemia blood microscopic images. This paper clarified the various leukemia concealmentprocedures used for AML detection.

VII. REFERENCES

[1] Madhloom HT, Kareem SA, Ariffin H, Zaidan AA, Alanazi HO, Zaidan BB. Anautomated white blood cell nucleus localization and segmentation using imagearithmetic and automated threshold. J ApplSci 2010;10(11):959–66.

[2] Kovalev VA, Grigoriev AY, Ahn H. Robust recognition of white blood cell images.In: Kavanaugh ME, Werner B, editors. Proceedings of the 13th international conference on pattern recognition, August 25–29. Vienna, Austria: IEEE Publisher;1996. p. 371–5.

[3] Scotti F. Robust segmentation and measurements techniques of white cells inblood microscope images. In: Daponte P, Linnenbrink T, editors. Proceedingsof the IEEE instrumentation and measurement technology conference, 24–27April. Sorrento, Italy: IEEE Publisher; 2006. p. 43–8.

[4] Piuri V, Scotti F. Morphological classification of blood leucocytes by microscope images. In: Proceedings of the IEEE international conference on computational intelligence for measurement systems and applications, 14–16 July. Boston,MA, USA: IEEE Publisher; 2004. p. 103–8.

[5] Halim NHA, Mashor MY, Hassan R. Automatic blasts counting for acute leukemia based on blood samples. Int J Res Rev ComputSci 2011;2(August(4)). 35

[6] Mohapatra S, Patra D, Satpathy S. An ensemble classifier system for early diagnosis of acute lymphoblastic leukemia in blood microscopic images. J NeuralComputAppl 2014;24:1887–904.

[7] Badea, Liviu. "Unsupervised analysis of leukemia and normal hematopoiesis by joint clustering of gene expression data." Bioinformatics & Bioengineering (BIBE), 2012 IEEE 12th International Conference on. IEEE, 2012.

[8] Tong, Dong Ling, and Graham R. Ball. "Exploration of leukemia gene regulatory networks using a systems biology approach." Bioinformatics and Biomedicine (BIBM), 2014 IEEE International Conference on. IEEE, 2014.

[9] Raje, Chaitali, and JyotiRangole. "Detection of Leukemia in microscopic images using image processing." Communications and Signal Processing (ICCSP), 2014 International Conference on. IEEE, 2014.

DOI: 10.13140/RG.2.1.1733.0166

[10] Fatma, Mashiat, and Jaibir Sharma. "Identification and classification of acute leukemia using neural network." Medical Imaging, m-Health and Emerging Communication Systems (MedCom), 2014 International Conference on. IEEE, 2014.

[11] Zhai, Yingbo, Xuandong Huang, and Xiaoxue Chang. "Combining least absolute shrinkage and selection operator (LASSO) and heat map visualization for biomarkers detection of LGL leukemia." Systems and Information Engineering Design Symposium (SIEDS), 2015. IEEE, 2015.

[12] Sarrafzadeh, Omid, et al. "Detecting different sub-types of acute myelogenous leukemia using dictionary learning and sparse representation."Image Processing (ICIP), 2015 IEEE International Conference on. IEEE, 2015.

[13] Goutam, D., and S. Sailaja. "Classification of acute myelogenous leukemia in blood microscopic images using supervised classifier." Engineering and Technology (ICETECH), 2015 IEEE International Conference on. IEEE, 2015.

[14] Li, Zisheng, et al. "Evaluation of medical image registration by using 3D SIFT and phase-only correlation." Abdominal Imaging. Computational and Clinical Applications. Springer Berlin Heidelberg, 2012. 255-264.

[15] Singla, Savita, and Reecha Sharma. "Medical Image Stitching Using Hybrid Of Sift & Surf Techniques." International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 8, August 2014.

[16] Ning, Yuan, et al. "Comparison of different BP neural network models for short-term load forecasting." Intelligent Computing and Intelligent Systems (ICIS), 2010 IEEE International Conference on. Vol. 3. IEEE, 2010.