A Review on various techniques used to Detect Leukemia Cancer in Medical Blood Smear Images

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Abstract: Medical imaging has become one of the most significant conception and explanation methods in ecology and medicine over the previous decade. This time has perceived incredible expansion of new, prevailing apparatuses for detecting, packing, conducting, analyzing, and exhibiting medical images. This has led to enormous growth in the application of digital image dispensation techniques for cracking medical difficulties. Leukemia is a progressive, malignant disease of the blood forming organs, marked by distorted proliferation and development of leukocytes and their precursors in the blood and bone marrow. In this paper we discuss about leukemia types of leukemia and how to detecting apply various algorithms like ANN, LDA (Linear Dependent Analysis),

Keywords: leukemia, acute leukemia, chronic leukemia, myelogenous leukemia, lymphocytic leukemia

I. INTRODUCTION

Cancer research is one of the most concerning area of interest in medical field. The early diagnose of the cancer can help in decreasing the mortality rate of humans. 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 starts to make a lot of abnormal white blood cubicles, called leukaemia cells. They don't do the exertion of normal white blood cells. They grow faster than normal cells, and they don't break increasing when they should. Over time, leukaemia cells can crowd out the normal blood cells. This cans chief to serious difficulties such as anaemia, bleeding, and infections. Leukaemia cells can also spread to the lymph nodes or other organs and origin bulge or pain [2]. The microscopic images of the blood cells are experiential to find out numerous diseases. Variations in the blood condition show the development of diseases in an individual. Leukaemia can central to demise if it is left unprocessed. Based on some statistics it is found that the leukaemia is the fifth cause of death in men and sixth cause of death in women. Leukaemia originates in the bone marrow. Each bone comprises a thin substantial inside it which is also known as a bone marrow which is shown in the fig. 1. The cells in the bone marrow start changing and they get infected and become leukemia or infected cells. These leukemia cells are having strange properties than the normal cells.

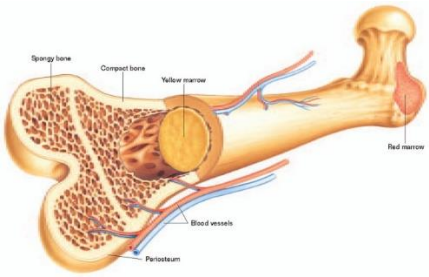

Fig.1: bone marrow [15]

II. RELATED WORK

Luis H. S. Vogado et.al (2016) [3] present an automatic segmentation technique that uses two-color systems and the clustering algorithm K-means. The proposed approach is evaluated on three public image databases with different characteristics and performance measures used are: accuracy, specificity, sensitivity and Kappa index. Hou, Jundi et.al (2016) [4] describe particularly investigate the effect of AMD3100 on the union property of leukemia cells on stromal cells by using engineering implements, namely, optical tweezers (OT) and electrophoresis (DEP), to probe single cell property. AMD3100 not only constrains the CXCR4/SDF-1α signal pathway but also decreases gene expression of CXCR4 and VLA4 on leukemia cells. The drug also softens leukemia cells. Lim et.al (2016) [5] present the classification of bone marrow acute leukemia cells into three groups namely normal, acute promyelocytic leukemia subtype (M3) and other acute leukemia subtypes. The images are implemented with a series of digital image processing technique such as image enhancement, median filtering and feature extraction. Thirteen features are extracted on whole image, inclusive of color and geometrical based features of the cells. Multilayer Perceptron neural network trained using Levenberg Marquardt training algorithm is used for classification purpose. Leow Bin, et.al (2016) [6] presents a HDR rendering technique by using contrast stretching technique to enhance the morphological features of blast cells. The technique called Partial contrast stretching had been used to render HDR image.

III. TYPES OF LEUKEMIA

Leukemia is classified into 4 main categories, based on the type of white blood cell affected (lymphoid vs. myeloid) and characteristics of the disease (acute vs. chronic):

Based on features of disease categorized as:

a) ACUTE LEUKEMIA

b) CHRONIC LEUKEMIA

Based on types of WBCs affected classified as:

a) MYELOGENOUS LEUKEMIA

b) LYMPHOCYTIC LEUKEMIA

a) Acute Leukemia's

Acute leukemia develops from early cells, called "blasts". Blasts are young cells that divide frequently. In acute leukemia cells, they don't stop dividing like their normal counterparts do [7].

b) Chronic Leukemia's

In chronic leukemia, the leukemia cells come from mature, abnormal cells. The cells thrive for too long and accumulate. The cells grow slowly.

c) Myelogenous Leukemia

Myelogenous leukemia develops from myeloid cells. The disease can either be chronic or acute, referred as chronic myelogenous leukemia (CML), or acute myelogenous leukemia (AML).

d) Lymphocytic Leukemia

Lymphocytic leukemia develops from cells called lymphoblasts or lymphocytes in the blood marrow. The disease can be acute or chronic, mentioned as chronic lymphocytic leukemia (CLL), or acute lymphocytic leukemia (ALL).

- ACUTE MYELOID LEUKEMIA

Acute myeloid leukemia (AML) is a cancer of the blood and bone marrow. It usually progresses rapidly if it is not treated. The disease accounts for about 10,600 novel cases of leukemia each year, and it occurs in both adults and children.

Other names for AML include:

- Acute myelogenous leukemia
- Acute myeloblastic leukemia
- Acute granulocytic leukemia
- Acute non-lymphocytic leukemia.

Normally, the body produces bone marrow stem cells (immature cells) that grow into mature blood cells. The 3 types of mature blood cells include:

- Red blood cells that carry oxygen and other materials to all tissues of the body
- White blood cells that fight infection & disease
- Platelets that help stop bleeding by causing blood clots to form.

- ACUTE LYMPHOCYTIC LEUKEMIA

Acute lymphocytic leukemia (ALL) is a kind of cancer diesis in which the bone marrow makes too many lymphocytes, which is a type of white blood cell. Acute lymphocytic leukemia, which is also known as acute lymphoblastic leukemia, accounts for nearby 3,800 new cases of leukemia each year. Although acute lymphocytic leukemia is the most common type of leukemia in young children, it can also affect adults [8].

The three types of lymphocytes include:

- B lymphocytes that make antibodies to help fight infection
- T lymphocytes that help B lymphocytes create the antibodies that help fight infection
- Usual killer cells that attack cancer cells and viruses.

In acute lymphocytic leukemia:

- The lymphocytes are not able to fight infection very well
- The quantity of lymphocytes increases in the blood & bone marrow
- There is less room for healthy white blood cells, red blood cells, and platelets. This may cause infection, anemia, & easy bleeding. Acute lymphocytic leukemia can similarly spread to the central nervous system (brain and spinal cord).

- CHRONIC MYELOGENOUS LEUKEMIA

Chronic myelogenous leukemia is a form of cancer in which the bone marrow makes too several white blood cells. In utmost cases, the cause involves a genetic mutation called the

Philadelphia chromosome. Common symptoms of this situation include tiredness, night sweats, & fever.

- CML
- Chronic myeloid leukemia
- Chronic granulocytic leukemia.

Chronic myelogenous leukemia usually occurs during or after middle age, & rarely occurs in children. It accounts for around 4,400 new cases of leukemia each year.

➢ CHRONIC LYMPHOCYTIC LEUKEMIA

Chronic lymphocytic leukemia (also known as CLL) is a kind of cancer in which the bone marrow makes too various lymphocytes (a type of white blood cell). Also known as chronic lymphoblastic leukemia, this is the second most common type of leukemia seen in adults, accounting for about 7,000 fresh cases of leukemia every year. In chronic lymphocytic leukemia, too many stem cells develop into a type of white blood cell called lymphocytes [9].

The three types of lymphocytes include:

- B lymphocytes that make antibodies to help fight infection
- T lymphocytes that help B lymphocytes make antibodies to fight infection
- Natural killer cells that attack cancer cells &viruses.

Through chronic lymphocytic leukemia, the lymphocytes are not able to fight infection very well, and as the amount of lymphocytes increases in the blood & bone marrow, there is less room for well white blood cells, red blood cells, and platelets. This may result in infection, anemia, and easy bleeding.

IV. VARIOUS TECHNIQUES FOR LEUKEMIA DETECTION AND PREVENTION

Various methods have been applied to automate the task to find out leukemia cells and count it.

A. ANN (Artificial Neural Network)

An artificial neural network does not shot to be like the thought process and if/ then sense of the people brain as completed by an expert structure. It mimics careful aspects of the in turn dispensation and objective sympathetic of the brain by means of a network of neural link [10]. As a result, a quantity of writers records it as a microscopic, white box structure & a professional system as a macroscopic, black box system. An Artificial Neural Network consists of a huge amount of simple dispensation elements that are dependable and covered.

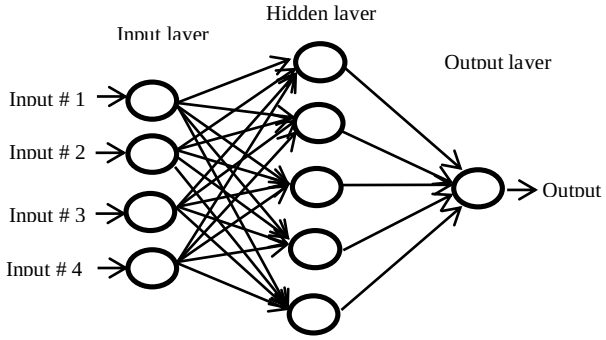

Fig.2 Artificial Neural Networks

B. LDA (Linear Dependent Analysis)

Linear Discriminant Analysis is utmost commonly used as dimensionality lessening technique in the pre-processing stage for machine learning applications in addition to design classification. The main objective is to project a specific dataset on top of a lower-dimensional space with virtuous class reparability so as to reduction computational prices as well as evade over fitting. The novel linear discriminant was first selected for a two-class issue; in adding it was then afterwards widespread as "Multiple Discriminant Analysis" or "multi-class LDA" through C. R. Rao in the year of 1948. Linear Discriminant Analysis is "controlled" as well as analyzes the guidelines ("linear discriminants") which would probably signify the axes that are applied to make the most of the separation amongst various type of classes. Below are the five basic steps utilized for implementing a LDA method [11, 12].

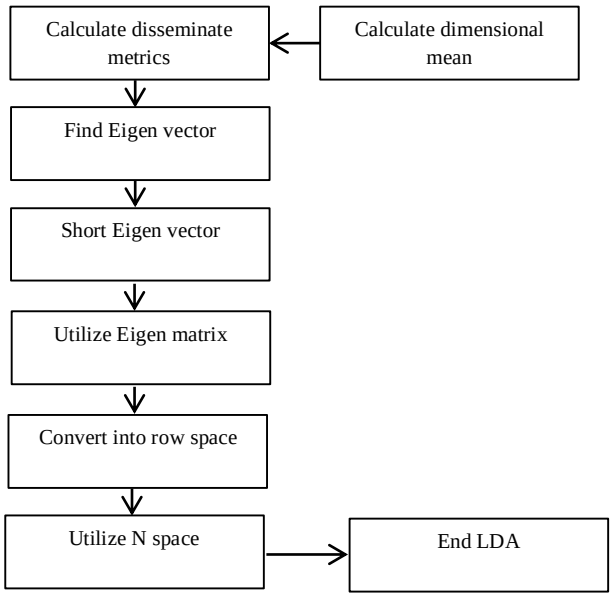

Fig.3 Linear Dependent Analyses

C. Support Vector Machines (SVM)

Support Vector Machine is one of the first and a leading classifier method that performs classification steps by constructing hyper-planes in a multi-dimensional space that distributes cases of dissimilar and different class labels [13].

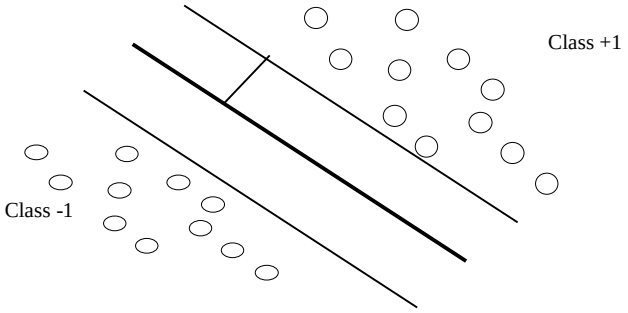

Fig.4 Support Vector Machines

SVMs are also known as kernel-machines and they have two dissimilar stages of training which are given below:

- Convert input-data into high-dimensional data.
- Resolve quadratic issue.

D. Genetic Algorithm (GA)

It is a prototypical-model of machine-learning that is used to derive system behavior from a metaphor of the procedures of development in nature. This process is completed by the formation of a population of some individuals that are represented by chromosomes within a specific machine, in essence a group of characters strings, which are similar to the base-4 chromosomes. The specific chosen individuals in the population then go-through a procedure of evolution [14].

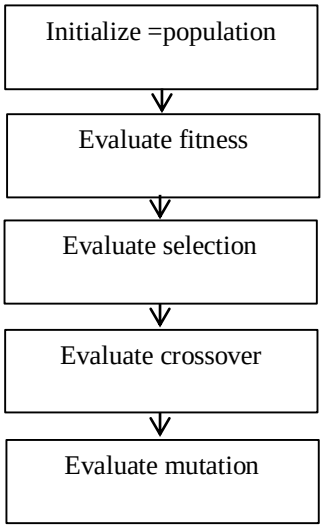

Fig.5 Genetic Algorithm

V. CONCLUSION

This paper has studied about leukemia-cell-detection utilizing numerous techniques. As leukemia is a type of cancer of the bone-marrow along with blood. These blood cells are undeveloped as well as they does not operate properly. Due to lack of proper treatment, leukemia could be a fatal-disease. This badly disturbs the development along with the general function of blood-tissues in addition to cells. So it must be diagnose at early stage. This time has perceived incredible expansion of new, prevailing apparatuses for detecting, packing, conducting, analyzing, and exhibiting medical images.

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