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Review on Leukemia Detection and Classification Frameworks

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ABSTRACT

Technology in this era is moving exponentially high. Adoption of technology in almost every aspect of our lives at all times can be found easily. From a decade, we have been studying the various approaches for the automated detection and classification of Acute Lymphoblastic Leukaemia (ALL) using the different technologies. However none of the techniques seems to be perfect by considering the robustness and reliability of prediction. While working with the leukaemia detection and its classification into L1, L2, and L3 classes the key steps under considerations are the accurate segmentation of overlapping blood cells and appropriate features extraction technique. Recently the deep learning methods gains the significant attentions in which the automated features extracted, however such methods most based on automated features extraction and learning which leads the high dimensional features. The high dimensional features extracted from the raw input image not only lead the higher computation complexity but also may degrade the performance in case of large datasets. The recent deep learning based method is introduced just at initial level in which the key steps are missing such as pre-processing and segmentation and evaluated only on small scale dataset. The performance of such methods affected due to lack of appropriate noise reduction and segmentation techniques.

KEYWORDS: *Cancer, Machine learning, Leukemia, Acute leukaemia detection and classification.*

1. INTRODUCTION

In the medical field, among various concerning area, cancer research is considered as the interesting and important. In order to reduce the mortality rate of humans, it is required to diagnose it at the earlier. Different categories exist, among them Leukaemia is a form of bone marrow cancer or categorization of blood by an uncommon increase in undeveloped WBCs known as "blasts" and is further characterized by thick word covers a various diseasescollection. This forms a section of wider group of diseases which affectsblood, bone marrow and lymphoid system, all known as haematological neoplasms [1, 2].

Acute Lymphoblastic Leukaemia is a type of leukaemia in young children and Acute Myelogenous. Leukaemia commonly occurs highly in adults than children, men when contrasted by women. Some sorts of symptoms were shown by leukaemia, which resembles at the initial stage to normal minor disease it is very difficult to identify, but it is very tedious to recognize it at the earlier stage, so manual analysis isn‟t much feasible [3, 4].

The demerits of the conventional methods can be overcome by recognizing the leukaemia and its classification using an automated system. So, this is feasible by recognizing the leukaemia image and classify it into its respective type, with the help of digital image processing.Here, input of these systems were considered as the microscopic blood cell images of various kinds of leukaemia. Image processing comprises of various techniques likepre-processing, segmentation, extraction of featureand classification [5, 6].

2. LITERATURE REVIEW

AML is a kind of intense leukemia, which is predominant among grown-ups [7]. The requirement for coinputerization of leukemia identification emerges since current techniques includes manual

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assessment of the images of blood as the first step towards conclusion. Right now, basic procedure that consequently distinguishes and fragments AML in blood spreads is displayed. So as to build a powerful list of capabilities, a few distributed articles were examined, and their element choice procedure was watched. lt was noticed that specific highlights were broadly utilized as they gave a decent classification. We executed these highlights on entire pictures in our framework. Those highlights were considered to support the classifier execution.

Precise and ear1y expectation of cancer can help human services experts to devise convenient storative techniques to avoid sufferings and the danger of casualty [8]. For the most part, an Al (ML) based prescient framework in human services utilizes informations to foresee object esteems disease discovery. RO classifier has been used for futher classification. Prescient exactness is the principle worry for choice emotionally supportive networks particularly in human service spaces. The advancement of GE microarray information supportive choice emotionally supportive networks is the key region of research these days. Writing signifies and hence shows the features of the examples are significant in these frameworks. Hereditary framework of an individual (solid or sick subject) might be critical for building up a proficient DSS.

Breast cancer, as the second most disease in the world after the lung cancer and this particularly demise in ladies [9]. And in US it is the most general disease for ladies after skin cancer. Practically a large portion of the ladies who partake in the screening for 20 years (453 of every 1,000) have in any event one extra assessment. This speaks to 156 a bigger number of ladies than in the 1,000 who don't take an interest in the screening. The Fuzzy C means algorithm is implied for the recognition of lekemia [10]. The agreement upgrade is finished as the straight forward expansion and subtraction activity to isolate the cores. The morphological shape division identifies the edges of cores and dispose of the typical white platelets from the minute blood picture. At that point the surface, geometry, shading and factual highlights of cores is assessed to decides the different elements of hernia. At long last it is prepared with the help of Fuzzy C mean bunching of single line highlight vector of every cell is utilized to characterize cancer from white platelets. The Acute leukemia classification methods are supportive of four main categories like threshold , limit, locale as well as half and half. The greater part of the systems joins limit and district criteria. Limit based strategies, for example, Otsu and histom sections the WBCs straight forwardly from the blood smear picture utilizing the level of force.

A smart decision support system suggested the Neoh et al[11] for an immediate diagnosis of lymphoblastic leukaemia from microscopic images of the blood. In particular we formulate the proposed inter-cluster assessment according to trade-off of many inter- cluster steps of feature extraction approaches. Huge classifiers have been introduced for lymphocyte or lymphoblast separation. Proposed SDM-based clustering rectifies theFuzzy C-mean‟s shortcomings that has been computed with the ALL-IDB2 database, which concentrates much on within-cluster scatter variance. For nucleus-cytoplasm separation, it beats the Linear Discriminant Analysis and Fuzzy Compactness and Separation.

Mohapatra, et al [12] suggested a quantitative microscopic method, which works towards differentiatinglymphoblast (malignant) and lymphocyte (normal) from stained blood smear samples and bone marrow samples.Its output is contributed to computer- aided ALL screening development. With the aid of segmentationof image, extractionof feature and stained blood films classification over light microscopic images, we can achieve automated lymphoblast identification. Experimental analysis was conducted and the result is acquired and distinguished over the available image data set, resulting in a classifier collection resulting in 99 percent accuracy when distinguished with other standard classifiers.

For automatic recognized and segments AML of blood smears, Agaian et al [13] gave a simple technique. The method proposed differs from other approaches in: 1) simplicity; 2) classification of entire blood smear images instead of sub-images; and 3) utilizationof these algorithms for segmenting and identifying nucleates. This work distinguishes the output on sub-images and whole

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images of the proposed algorithms and contrasts the effects of some of existing systems with proposedmethod. We test 80 microscopic blood images to find lymphoblast cells, and further segregate them from the sub-images and full images.

For automatically detecting image based acute leukaemia, Kumar, et al [14] presented an algorithm. With the help of basic enhancement, morphological filtering and segmentation techniques for extracting region of interest via k -means clustering algorithm, this method has been expected. An accuracy of 92.8% were attained in this experiment and further it has been checked with the Nearest Neighbor (KNN), Naïve Bayes Classifier on 60 samples dataset.

Zhao et al[16] suggested an automated identification as well as classification method of WBCs, and used peripheral blood images. This algorithm is utilized to distinguish WBCs of microscope images, which works according to simple R, B relationship and morphological process colors. Second, for distinguishingbasophiland eosinophil from other WBCs, we apply the granularity function and SVM.Finally, we use the neural convolution networks to extract high-level features of WBCs automatically, and a random forest has been implemented for classifying other three WBCstypes:lymphocyte, monocyte andneutrophil. Proposed method of detection has a better effect and is verified by an experiment conducted on a Cellavison database and ALL-IDB database, and is nearly better compared to an iterative threshold approach with reduced cost of time.

Ahmed et al [17] gave a new method for diagnosing leukaemia subtypes from microscopic images of blood cells via a convolutionary neural network (CNN). Huge amount of training data needs to be collected for this. Therefore the author synthetically analysed the effect of data increase on high-training samples. ALL-IDB and ASH Image Bank have been the commonly used leukaemia data source. Therefore seven different image processing methods have been applied as the data increases. CNN architecture was designed to identify entire subtypes of leukaemia, and the author also addressed various machine learning algorithms like naive Bayes, supporting vector machine, decision tree and k-nearest neighbour; a number of experiments were measured, using 5-fold cross- validation and test resultsdemonstrated that 88.25 per cent and 81.74 per cent accuracy of our performance in the CNN model.

S. NO.	AUTHOR NAME	METHODS	MERITS	DEMERITS
1.	Neoh et al [2015] [11]	Intelligent decision support system	outperforms	Time consuming
2.	Mohapatra, et al [2014] [12]	Quantitative microscopic approach	High accuracy.	Computationally slower.
3.	Agaian et al [2014] [13]	Simple technique	obtain 98% accuracy	Need to use other classifiers to improve the performance.
4.	Kumar, et al [2018] [14]	Automated image based acute leukaemia detection systems.	Achieved good accuracy.	Very expensive
5.	Madhloom et al [2015] [15]	Histogram equalization and arithmetic addition	Robustness	It is not a complete computer-based acute leukaemia diagnosis system
6.	Zhao, et al [2017] [16]	Simple colors R, B relation and morphological Operation	Better accuracy	Lymphocyte classification has to be enhanced

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7.	Ahmed et al [2019] [17]	CNN architecture	Helping to solve the overfitting problem	It is so expensive in execution time.

3. SIGNIFICANCE OF RESEARCH

The scope of this work is to present the enhanced deep learning based framework to detect and classify the leukaemia from the raw input medical images. The significance is to overcome the scalability, reliability and robustness challenges of existing techniques. The framework consists of pre-processing, segmentation, convolution neural network (CNN), features reduction using PCA, and Long Short Term Memory (LSTM) for the classification. The proposed framework is called as Segmented (S)-CNN-PCA (P)-LSTM model i.e. S-CNN-PCA-LSTM. For pre-processing we may try and apply the various methods to suppress the noise from the images which could enhance the performance of the algorithm. These methods include median, mean, unsharp filters, Gaussian smoothing, conservative smoothing, and frequency filter. After the pre-processing we propose the segmentation technique to effectively extract the region of interest. To obtain the region of interest in the current research, we propose a simple segmentation approach based on simple threshold method, which results in an efficient way. Further the segmented images passed to the deep learning model called CNN which extracts the features from the segmented images. As the size of features vector is large, we apply the PCA to select the more unique features for the LSTM based classification.

4. CONCLUSION

In this research work, we have studied, analysed and compared the various automatic leukaemia detection and classification methods. It is the descriptive study as it aims an in-depth analysis on relationship standard methods in leukaemia detection and classification. This study covers the title of the study, significance, objective, detailed literature and comparison of various researches in this area. Several recent approaches are discussed in literature for the detection and classification of ALL using image processing and machine learning terminologies. Segmentation is taken under consideration a significant step inside the automatic diagnosing of assorted pc systems. It had been found that a lot of strategies supported cluster based mostly and color based inside the literature have shown promising results. As per the analysis it's prove that K-Means Cluster and Color based mostly combine technique gives accurate segmentation then K-means. Thus In proposed work consider color and K-Means cluster based segmentation technique and it Reduce time because only extract B from LAB color and M from CMYK color. Then extract the Contrast, Energy, Homogeneity, Correlation, etc. and Shape Features (i.e. Area, major and minor axis, perimeter etc.) from segmental image and also the applicable. Features are employed in supervised Random Forest classifier to classify ALL and its subtypes i.e. L1-L2-L3. In Future system can use for subtypes of CML and CLL classification.

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