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Detection and Classification of Leukemia Using Deep Learning

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Abstract: ***The practice of medicine is getting modernized every year and continuously moving towards more automated systems that help and improves the healthcare practice to be more productive with treatments and accurate in their assessments. Leukemia is a form of cancer that can be a fatal disease, and to rehabilitate and treat it requires a correct and early diagnosis. Standard methods have transformed into automated computer tools for analyzing, diagnosing, and predicting symptoms. Advanced methods can be used to help patients detect terminal disorders such as leukemia, which is a fatal disorder and common cancer type amongst children. The methods used for the identification of leukemia subtypes in the suggested framework are Dense Convolutional Neural Network (DenseNet-121) and Residual Convolutional Neural Network (ResNet-34). Because advanced CNN models, such as ResNet and DenseNet, are deeper and more complex having the ability to learn better.***
Keywords: Leukemia, Deep Learning, Classification, DenseNet, ResNet, CNN.

I. INTRODUCTION

Among all types of blood cancers, leukemia is the most common form of malignancy in different age groups, especially in children. This abnormal phenomenon is caused by excessive proliferation and immature growth of blood cells, which can damage red blood cells, bone marrow, and the defense system. There are different types of leukemia that hematologists in cell transplant laboratories can differentiate/diagnose based on microscopic images. If the slide is correctly stained, some types of leukemia can be more easily identified and distinguished than others, but more equipment is needed to determine underlying leukemia. An early diagnosis of leukemia has always been a challenge to researchers, doctors, and hematologists because Leukemia diagnosis is difficult in its early stages due to the mild nature of the symptoms.

A. Problem Definition

As we know Leukemia is a very fatal disease, which is why it is important to early diagnose it. The aim is to develop a system which accurately detects and classifies Leukemia using Deep Learning techniques from blood smear images provided by the microscope.

II. LITERATURE SURVEY

B. IoMT-Based Automated Detection and Classification of Leukemia Using Deep Learning:

This study provides an Internet of Medical Things- (IoMT-) based framework to enhance and provide a quick and safe identification of leukemia. In the proposed IoMT system, with the help of cloud computing, clinical gadgets are linked to network resources. the system allows real-time coordination for testing, diagnosis, and treatment of leukemia among patients and healthcare professionals, which may save both time and efforts of patients and clinicians.

C. Machine Learning in Detection and Classification of Leukemia Using Smear Blood Images

This review study presents a comprehensive and systematic view of the status of all published ML-based leukemia detection and classification models that process PBS images. the average accuracy of the ML methods applied in PBS image analysis to detect leukemia indicating that the use of ML could lead to extraordinary outcomes in leukemia detection from PBS images. Among all ML techniques, deep learning (DL) achieved higher precision and sensitivity in detecting different cases of leukemia.

D. Leukemia Detection Mechanism through Microscopic Image and ML Techniques

In this paper Faster-RCNN machine learning algorithm is used to predict the odds of cancer cells forming. Here two loss functions are applied to both the RPN (Region Convolutional Neural Network) model and the classifier model to detect the similar blood object. After identifying the object, calculated the corresponding object and based on the count of the corresponding object finally Leukemia is detected.

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E. Leukemia Disease Detection and Classification Using Machine Learning Approaches: A Review

In this paper, author's analyse different image processing and machine learning techniques used for classification of leukemia detection and try to focus on merits and limitations of different similar researches to summarize a result which will be helpful for other researchers. Here, authors conclude that leukemia disease can be classified using many latest machine learning algorithms. But when there is a large dataset of images then it is better to use deep learning architectures for classifications.

F. FAB Classification based Leukemia Identification and prediction using Machine Learning:

This propounded task has developed French-American and British (FAB) classification-based detection module on blood smear images (BSIs). Methods like pre-treatment, segmentation, feature extraction, distribution are used in detection method. The Propounded algorithm-based propounded model is used for segmentation, which is combination of the segmented results of the Linde-Buzo-Gray (LBG) algorithm, Adaptive canny used for edge identification and Hysteresis and watershed algorithm used for thresholding. The shape, texture features, colour of segmented image are picked by neural network and classification is performed by Support Vector Machine (SVM) and prediction by Naïve Bayes Classifier (NBC).

G. Detection of Blood Cancer-Leukemia using K-means Algorithm

In the proposed methodology author's make use of K-means, for identifying cancerous stages and its early detection. Image processing is one of the easy methods to extract the function from the image. The proposed system is implemented in MATLAB 2018.

H. Automated decision support system for detection of leukemia from peripheral blood smear images

In this study, SVM classifier was used for classification of white blood cells into normal and abnormal, and also for detection of leukemic WBCs from the abnormal class. Classification of the normal white blood cells into five sub-types was performed using NN classifier. Overall classification accuracy of 98.8% was obtained using the combination of NN and SVM.

I. Automated Detection of Acute Lymphocytic Leukemia Using Blast Cell Morphological Features

In this study, authors propose a novel combination of techniques to overcome the most challenging parts of the detection process and present detailed insights into the greatest shortcomings of the existing classification methodologies, such as the overfitting and the reliability of particular classifications. The final recognition of ALL from peripheral blood smear images is accomplished by an artificial neural network (ANN) and optimized support vector machine (SVM).

J. Identification of Acute Lymphoblastic Leukemia in Microscopic Blood Image Using Image Processing and Machine Learning Algorithms

This paper proposed a system which uses openCV and skimage for image processing to extract relevant features from blood image and not just sheer number of features and further classification is carried out using various classifiers: CNN, FNN, SVM and KNN.

K. Diagnosis of Leukemia and its types Using Digital Image Processing Techniques

Acute and Chronic leukemia are subdivided as Acute Lymphoid Leukemia (ALL), Acute Myeloid Leukemia (AML), Chronic Lymphoid Leukemia (CLL), Chronic Myeloid Leukemia (CML). The classification can be done by using a machine learning classifier called SVM (Support Vector Machine) classifier. This paper analysis the types of blood cancer by using the blood smear images of healthy and leukemic people with help of image processing techniques.

III. METHODOLOGY

As shown in the figure below, the input is Blood smear images obtained from the microscope. The given input will go through the following stages: pre-processing i.e. data augmentation, Processing i.e. feature extraction and classification and then for performance evaluation.

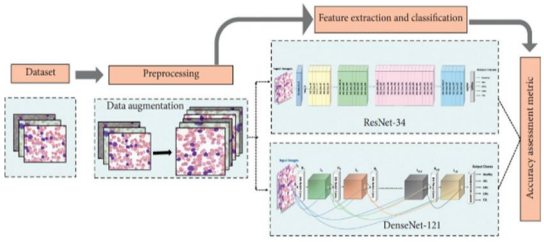


Fig. 1. System Architecture

IV. ALGORITHMS

A. *ResNet-34*

ResNet-34 is a pre-trained 34-layer model. A deep network of CNNs and large dataset produce better performance. However, the performance deteriorates after a certain depth when the network gets deeper. The reason of this problem is the vanishing gradient. The ResNet solves this problem as gradients flow from starting layers to the final ones by skipping some layers.By skipping the connections between layers, the gradient can easily flow and the training of the layers becomes faster. ResNet-34 consists of a total of 34 layers wherein one is convolutional and pooling layer in addition to four other layers with the same pattern.

B. *DenseNet-121*

DenseNet-121 consists of 121 layers. In DenseNet architecture, each layer is connected to all subsequent layers. Thus, each layer receives important features learned by any preceding layers of the network that makes training of the network more efficient.A significant part of DenseNet is a dense block, which is used for enhancing the information flow between layers.

V. CONCLUSION

The use of image processing with Computer-Based algorithm makes possible the classification of very easy. The system should classify Leukemia accurately on the basis of blood smear images. To classify we have used the Dense Convolutional Neural Network (DenseNet-121) and Residual Convolutional Neural Network (ResNet-34). The early and fast identification of Leukemia greatly aids in providing the appropriate treatment.

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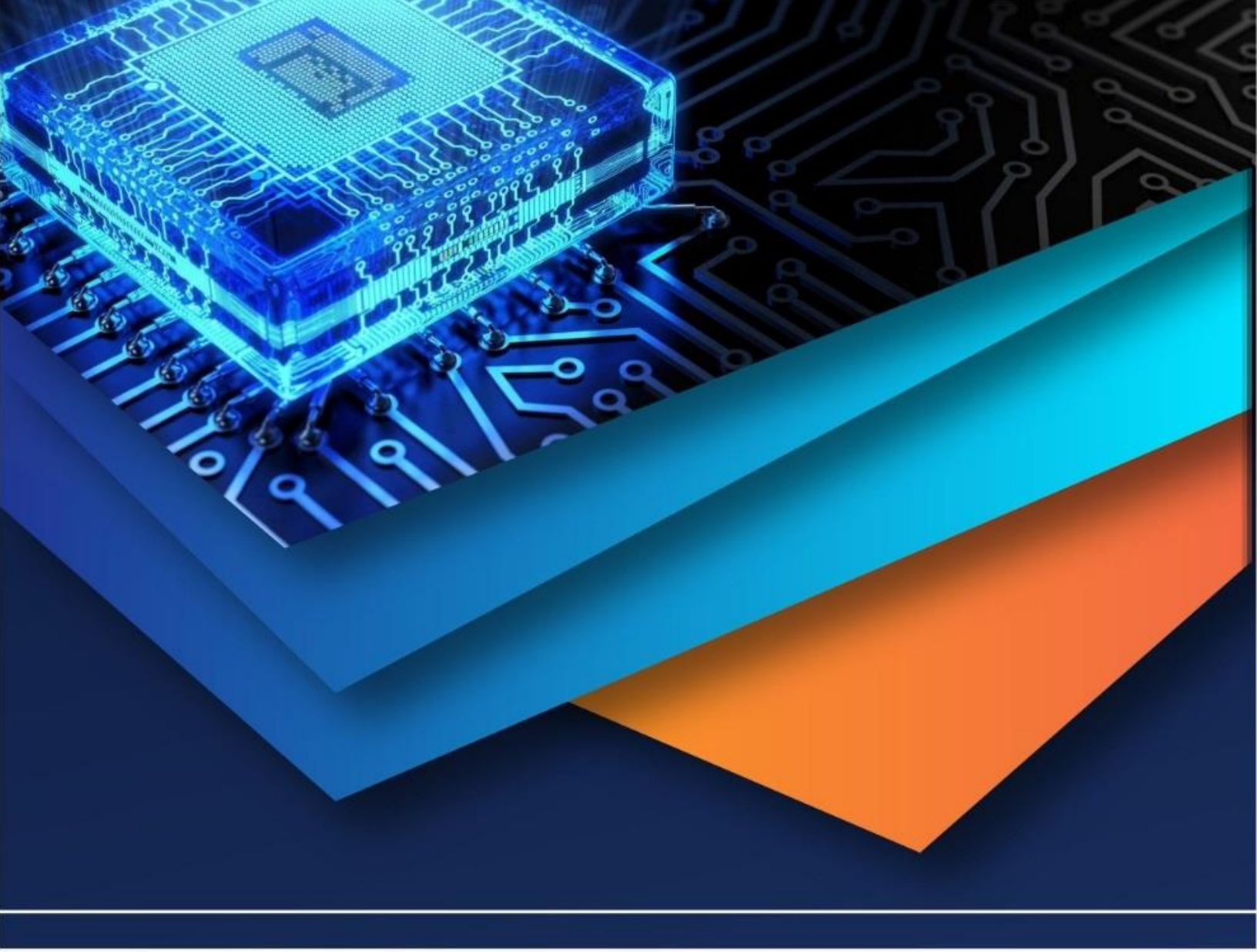
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