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Leukemia Diagnosis Using Deep Learning

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***Abstract:** Leukemia is a deadly malignancy and there are two main types: acute and persistent. Each type has two subtypes: lymphoid and myeloid. There are a total of four subtypes of leukemia. This study proposes a new approach to the disease of all leukemia subtypes from the concept of small blood cells using convolutional effects on living neural organ networks (CNNs) that require large preparative files.*
***Keywords:** leukemia diagnosis, recognizing leukemia subtypes, multi-class classification, microscopic blood cells images, data augmentation, deep learning, convolutional neural network*

I. INTRODUCTION

Cancer detection has always been an important diagnostic and therapeutic problem for pathologists and medical professionals. Manual identification of leukemia from microscopic biopsy images can vary from expert to expert based on their expertise, and errors include specific and precise quantitative criteria for classifying biopsy images as healthy or leukemia. May include lack of scale. The likelihood of developing leukemia may be related to tobacco addiction and diet. Recent advances in medicine and technology have improved the treatment of disease.

Choice of treatment depends on the stage of the malignancy. Therefore, the patient's microscopic anatomy is examined for accurate registration. The severity of the disease depends on the number of blasts. Chronic leukemia is therefore the most difficult to treat. There are many different tests that can be used to diagnose leukemia. A complete blood count determines the number of white blood cells, red blood cells, and platelets in the blood. A tissue biopsy can be taken from the bone marrow or lymph nodes to look for evidence of leukemia and how fast it grows. Biopsies of other organs, such as the spleen and liver, can show whether cancer is present. Once a diagnosis has been made, it is staged. AML and ALL are classified based on what the leukemia cells look like under the microscope and which cell types are affected. CML and CLL are classified based on the white blood cell count at diagnosis. The presence of immature leukocytes or myoblasts in blood and bone marrow is also used to classify AML and CML.

In this study, we propose a novel approach for leukemia diagnosis from microscopic blood counts that identifies four subtypes of leukemia (i.e., ALL, AML, CLL, and CML) using a deep learning CNN architecture. . To our knowledge, this is the first study to look at all four of his leukemia subtypes. Additionally, deep neural networks require large training datasets, which is not a trivial issue for us. Therefore, we used image enhancement techniques to increase the number of samples.

II. LITERATURE SURVEY

In [1] they discussed different techniques to classify leukemia disease like, Support Vector machine(SVM),Artificial Neural Network(ANN),Linear Discriminant Analysis (LDA), Alexnet CNN Model

In [2] they used classification along with median filtering and thresholding.They considering that the identifying system for acute lumphotic leukemia has identified disease with an accuracy of 80%.Demerits is that they used small test data

In [3] they used SVM algorithm to classify images to predict the leukemia disease .This paper puts forward a method to automatically detect whether the given microscopic blood smear image is infected by AML or not.

In [4] they used SVM algorithm to classify here the affected cells were detected from healthy cells

III. METHODOLOGY

A. Preprocessing

The preprocessing step involves removing the initial noise present in the microscope image. To perform noise reduction, you can apply various denoising filters such as: B. Wiener filter, median filter, etc. The preprocessing step modifies the pixel values of the image to reduce random noise. Thresholding is another noise reduction technique that considers pixel values within a region to be the image and other pixel values to be noise.

B. Feature Extraction

Feature extraction can be done by separating similar gray values together. Other feature extraction techniques include texture feature, edge and shape feature, and color feature extraction.

C. Machine Learning Techniques for Classification

1) ANN (Artificial Neural Network)
2) SVM (Support Vector Machine)
3) LDA (Linear Discriminant Analysis)

D. Our Approach

Here, a convolutional neural network (CNN) is used to create a model to identify cells with leukemia disease. A CNN (Convolutional Neural Network or ConvNet) is a type of feed-forward artificial network whose connection patterns between neurons are inspired by the organization of the visual cortex of animals. Convolutional Neural Network (ConvNet/CNN) is a deep learning algorithm that can take an input image and assign importance (learnable weights and biases) to different aspects/objects in the image to distinguish between them. ConvNet requires much less preprocessing compared to other classification algorithms. The primitive method requires manual development of the filters, but with enough training the ConvNet can learn these filters/properties.

E. Working of CNN

A convolutional neural network consists of multiple layers of artificial neurons. An artificial neuron is a crude imitation of its biological counterpart, a mathematical function that computes a weighted sum of multiple inputs and returns an activation value. When we feed an image into a ConvNet, each layer generates multiple activation functions that are passed to the next layer.

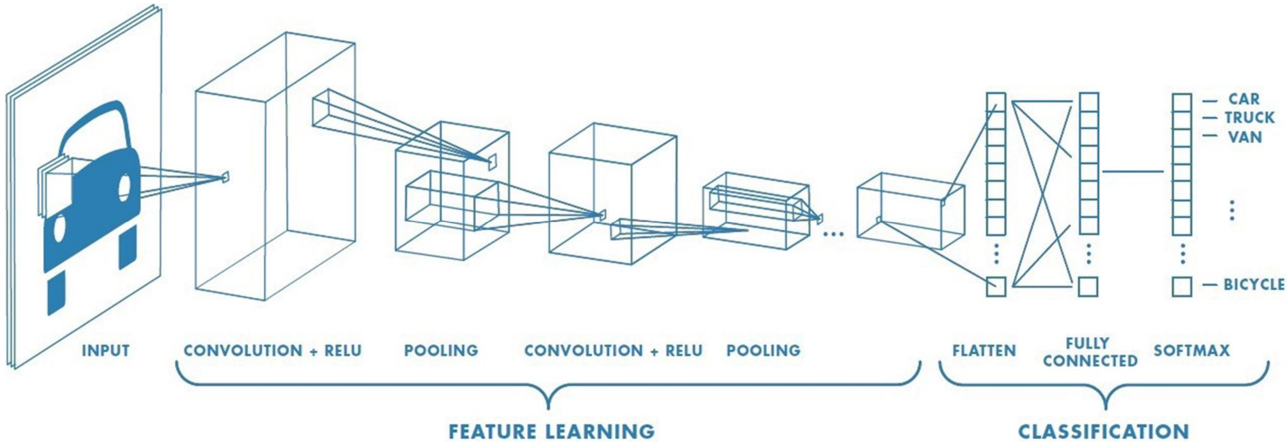

Fig1. CNN Architecture

The 3 most important parts of this convolution neural networks are,

1) Convolution
2) Pooling
3) Flattening

These 3 actions are the very special things that make convolution neural networks perform way better compared with other artificial neural networks.

a) Convolution Layer

This is the first step towards extracting valuable features from images. A convolutional layer has multiple filters that perform convolutional operations. Each image is displayed as a matrix of pixel values. Consider the following 5x5 image with pixel values of 0 or 1. There is also a filter matrix of dimension 3x3. Slide the filter matrix over the image and compute the inner product to get the convolved feature matrix.

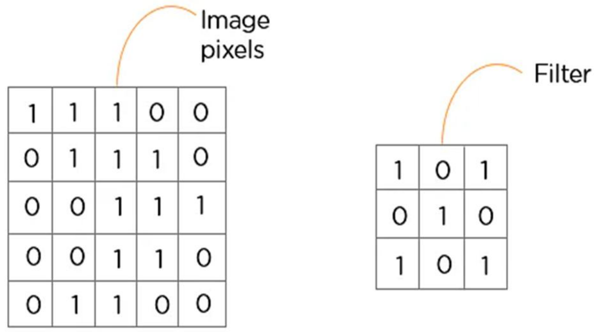

Fig2.Convolutional Layer

b) Pooling Layer

Pooling layers are used to reduce the dimensionality of feature maps. This reduces the number of parameters to learn and the computational work performed by the network. A pooling layer summarizes the features present in the region of the feature map produced by the convolutional layer. Therefore, more operations are performed on the merged features instead of the precisely placed features produced by the convolutional layer. This makes the model more robust to variations in feature positions in the input image.

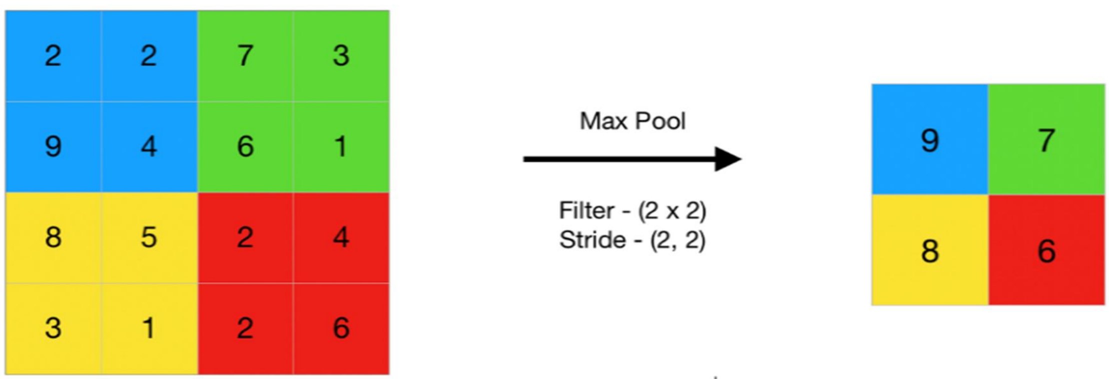

Fig3.Pooling Layer

c) Flattening

Flattening is nothing more than transforming a 3D or 2D matrix into a 1D input for a model. This is the final step to process the image and connect the input to fully connected dense layers for further classification.

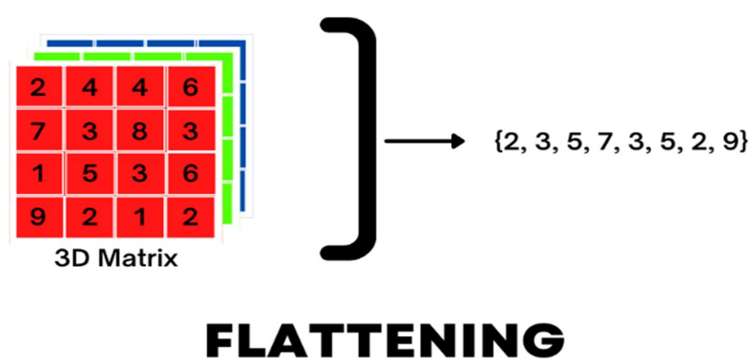

Fig4.Flattening layer

Algorithm

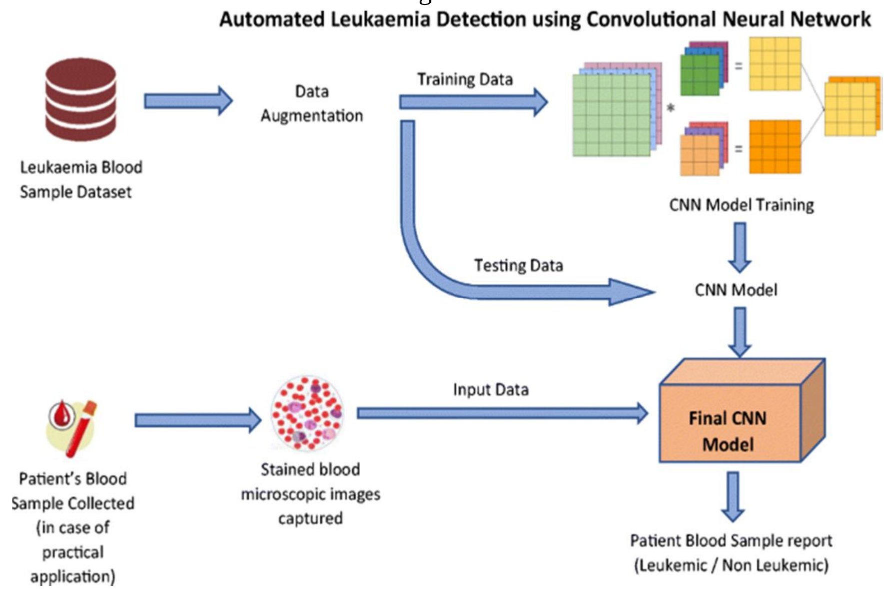

Fig5.workflow

IV. CONCLUSION

This paper presented an algorithm to hierarchically classify the leukemia disease Intensity, intensity difference, neighborhood information and wavelet features are extracted and utilized on multi-modality MRI scans with various classifiers. The use of wavelet-based texture features with CNN classifier has increased the classification accuracy as evident by quantitative results of our proposed method which are comparable or higher than the state of the art.

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