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Convolutional Neural Network Classifying Tumors

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Abstract: Leukemia is a worldwide disease. In this paper we demonstrate that it is possible to build an automated, efficient and rapid leukemia diagnosis system. We demonstrate that it is possible to improve the precision of current technologies from the literature using the description power of well-known Convolutional Neural Networks(CNN's). Therefore the clinical support for Chronic Lymphocytic Leukemia(CLL) type classification becomes a necessity. In this paper, the author has proposed a technique to classify the Chronic Lymphocytic Leukemia (CLL) using the methodology of Convolutional Neural Network (CNN) classifier. The experimental results can cover only the first classification process with high excellence in the accuracy of differentiating the normal and abnormal cells. Further the developed model can prove the effectiveness of the second neural network classifier.

Keywords: Chronic Lymphocytic Leukemia Classification, Convolutional neural network (CNN), Deep learning, Diagnosis, Keras, White blood cell.

I. INTRODUCTION

A. What is Leukemia?

Leukemia is a malignant neoplasm of the blood or bone marrow that affects both infants and adults which leads to cause of death around the world. Diagnosis is an important process performed by doctor, which consists of determining the presence or absence. These data are useful for identifying the disease and can be of types of signs, examinations, images and signs. An error in diagnosis due to the cause of examinations can cause a large problem and also cause side effects to the patients due to the possible change of medicinal prescriptions that are not appropriate for the disease treatment.

There are types of Leukemia based on infected cells:

- 1) Acute Lymphoblastic Leukemia (ALL)
- 2) Acute Myeloid Leukemia (AML)
- 3) Chronic Lymphocytic Leukemia (CLL)
- 4) Chronic Myeloid Leukemia (CML)

Early diagnosis of these disease may cause less problem and easy to diagnose and leads to success in the treatments. The methods for classifying or detecting these types of diseases are costly and very difficult to diagnose. These types of diseases affected patients undergo the treatment, but really does not cure the patient completely but can affect their survival. Leukemia is a very rare tumor and can be affected to any of the human being irrespective of their ages. This Leukemia tumor originates in the bone marrow. The abnormality and normality is characterised by the number of white blood cells. The diagnosis of these diseases are done through various tests such as blood test, blood count where count of the white blood vessels are proliferated. The tests or diagnosis are done manually and hence to error or sometimes need to have a second opinion. So the authors has decided to make a computer aided system. In the survey of the system to be used it was seen that the machine learning through the image processing could be done using the architecture. The Convolutional Neural Network architecture was the proposed methodology. This method provides the classification on process in reaching 96% of accuracy to discriminate normal and abnormal all images.

II. RELATED WORK

Among the leukemia testing and diagnosing system, there are developed model using the blood images for the classification of AML, ALL, CLL, CML.

A. Acute Lymphocytic Leukemia (ALL)

This is the type of acute leukemia where there is abnormal forms of the lymphocytes cells in the bone marrow. This type is most often seen in the children rather than the adults but the deaths occur in adults and children's body can handle by the form of aggressive treatment. Here the ALL infected cells have the nucleus area of 80-90% almost of the whole cell and 20-30% of the cell area for the cytoplasm.

B. Acute Myeloid Leukemia (AML)

This is the another type of acute leukemia where there is abnormal forms of the myeloid cells in the bone marrow. This type of leukemia often occur in older people. The nucleus area is about 50-60% of the cell and 40-50% of cell area is cytoplasm.

C. Chronic Lymphocytic Leukemia (CLL)

Chronic Lymphocytic Leukemia is a type of chronic leukemia where the abnormal forms of the lymphocytic cells occur. CLL is similar to the ALL have nucleus cell size of 80-90%. Chronic Myeloid Leukemia (CLL)

Chronic Myeloid leukemia is another type of chronic leukemia where the abnormal forms of the myeloid cells occur CML the nucleus has different shape and the texture in which often the shape is round. The researches about the classification of leukemia using the computer developed model. There is a common algorithm with the several steps such as; Image pre-processing, feature extraction, segmentation, morphological process classification and evaluation. The authors of the papers researched have used machine learning to detect blood cell using the images. The images are collected from the hospitals which are already affected by the leukemia, Then the images undergo the above process and then through the convolution neural network architecture and we use deep learning for the classifications under some characteristics to classify normal and abnormal cell images.

III. PROPOSED METHODOLOGY

The system was done using the convolutional neural network (CNN) and the architecture of CNN is discussed below: Architecture of CNN: The network contains of four layers. The four layers consist of detecting the features and for classifying the features. Here in this we have three layers for detecting the features and other two layer for classifying the feature. The input image is of size 50X50X3 with the filter size 5X5. The stride of the image is 1 and move one pixel at a time. The zero padding is 2 when we altered the size of the image the accuracy of the classification was decreased by 40%. Thus the convolutional layer would/will give more accurate results. The convolutional layer 2 will have structure as convolutional layer 1. This size of the filter is 5X5 stride is 1, zero padding is 2. If we remove the second convolutional layer the accuracy of the result was decreased by the 50%. There were two other layers for the classification of size 25X25X30 called as the max pooling layer of the filter size 2 and the stride 2. there was another fully connected layer for neural detection. We have used softmax layer for the classification.

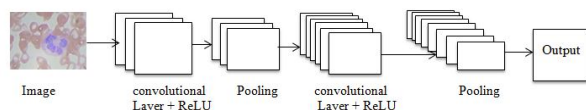


Figure: Flowchart of the proposed approach

The input image is processed and given to the convolutional neural network and then the images are compared using the deep learning code and the images are used for the detection. The images of different effects are collected and divided into two set consisting of both normal and abnormal cells. The first set of the images are put in the training set and one more set, the less number of images of that of training set are put into it. Software The experiments conducted on the deep learning using the python code from the keras library using the tensor flow. Using the convolutional neural network architecture, this system had accuracy of 96% odd.

The below table shows the count of the images used:

	Training set	Test set
Normal images	131	60
Abnormal images	113	100
Total	244	160

Keras is one of the high level neural networks which is an API. It is written in python and supports convolutional neural network. The tensor flow has adapted keras as the API. Keras is created to be user friendly and easy to work with python. The biggest reason to use keras is because of easy learning and model building. Keras supports for a wide range of production and integration.

The model is the core data structure and there are two main types of model in keras.

- 1) Sequential model
- 2) Model class

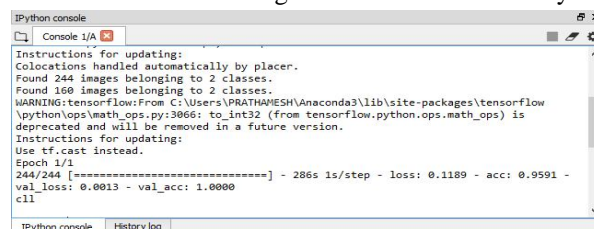
The layers which can be described simply is called sequential model, whereas we need to define two dense layers.

Keras Applications

- To predict classification of images
- To extract features from the images
- To tune the models on different set of classes

IV. RESULT

In this project we have used 244 images of blood smears consisting of lymphocytes where in there are 131 unhealthy cells and 113 healthy cells. These blood smear images are taken as inputs to the processing system. These images are the microscopic slides/images. The images are extracted and compared and are classified into healthy and unhealthy. Where data set consists of training set and test set. In training set there are total of 244 images in which 131 are healthy images and 113 are unhealthy images. In test set there are total of 160 images in which 60 are healthy images and 100 are unhealthy images.



```
Python console
Console 1/A
Instructions for updating:
Colocations handled automatically by placer.
Found 244 images belonging to 2 classes.
Found 160 images belonging to 2 classes.
WARNING:tensorflow:From C:\Users\PRATHAMESH\Anaconda3\lib\site-packages\tensorflow\python\ops\math_ops.py:3866: to_int32 (from tensorflow.python.ops.math_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.cast instead.
Epoch 1/1
244/244 [=====] - 286s 1s/step - loss: 0.1189 - acc: 0.9591 - val_loss: 0.0013 - val_acc: 1.0000
c11
```

When the input image is c11 affected the predicted output

V. CONCLUSION

Leukemia is one of the most threatening disease for human beings. This paper is proposed to classify Chronic lymphocytic leukemia using Convolutional Neural Network(CNN) as the architecture. The results obtained shows that this method is able to classify the input Chronic lymphocytic leukemia image into healthy as well as unhealthy cell with the higher accuracy of 96%. Accuracy can be further improved by expanding the input dataset.

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