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BLOOD CANCER DETECTION USING DEEP LEARNING MODELS

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Abstract *– Leukemia is a fatal order of cancer- related complaint that affects individualities of all periods, including children and grown-ups, and is a significant cause of death worldwide. Particularly, it's associated with White Blood Cells(WBC). thus, a rapid-fire and dependable cancer opinion is a critical demand for successful remedy to raise survival rates. presently, a homemade analysis of blood samples attained through bitsy images is done to diagnose this complaint, which is frequently veritably slow, time- consuming, and less accurate. To address this issues, Convolutional neural network(CNN) with deep infrastructures is being applied as it performs automatic point birth and learns complex high- position features in image bracket operations. This work proposed a different deep literacy models similar as Alexnet, Google Net and VGG- 16 models to classify white blood cell leukemia on intimately available dataset. The results demonstrated that the proposed CNN models are effective in leukemia cells bracket.*

Keywords *– CNN(complication Neural Network), ANN(Artificial Neural Networks), WBC(White Blood Cells), UML(Unified Modeling Language), VGG(Visual figure Group), ACC(Accurate).*

I INTRODUCTION

Image processing is a system to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to prize some useful information from it. It's a type of signal division in which input is image, like videotape frame or snap and affair may be image or characteristics associated with that image. generally, Image Processing system includes treating images as two dimensional signals while applying formerly set signal processing styles to them. It's among fleetly growing technologies moment, with its operations in colorful aspects of a business. Image Processing forms core exploration area within engineering and computer wisdom disciplines too. The two types of styles used for Image Processing are Analog and Digital Image Processing. Analog or visual ways of image processing can be used for the hard clones like printouts and photos. The main ideal of the design is to classify the white blood cell leukemia grounded on deep literacy. The thing of this proposed system is to address the failings of the being system. To promote and organize voluntary blood donation services. To coordinate with medical centers for the purpose of opinion and treatment of cases suffering from blood cancer and confederated conditions.

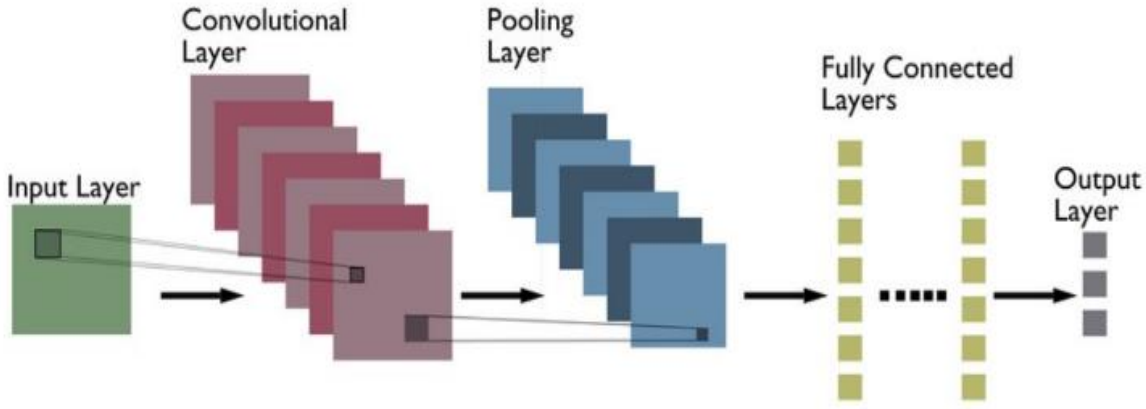

Figure 1 CNN Architecture

II ALGORITHM DESCRIPTION

CONVOLUTIONAL NEURAL NETWORKS(CNN)

The most popular deep literacy algorithm, CNN, is veritably good at detecting patterns in images. Identical to the neural networks set up in the mortal brain, CNNs are composed of neurons with configurable impulses and weights. Each neuron receives a number of inputs. also, the weighted sum of the inputs is determined. The activation function receives the weighted sum and produces an affair. Convolutional layers are a point of CNN that set it piecemeal from other neural networks. The three main types of layers that make up a CNN are convolutional subcaste, pooling subcaste and completely- connected subcaste.

Convolutional layer- The convolutional subcaste, which is composed of several convolutional kernels, is the brain of a convolutional neural network

Pooling layer - The pooling layer is typically employed between convolutional layers to reduce the complexity and network calculation; as a result, the input size is decreased in all depth sections through the subsampling operation, preventing overfitting during network training.

Fully Connected Layer - The final layer of a CNN architecture is typically composed of fully connected neurons. Similar to a regular ANN, each neuron in the fully connected layer is connected to every neuron in the previous layer. During training, the fully connected layer computes a score for each class based on the overall dataset.

Transfer Learning - In transfer learning, a pre-trained model is used as a starting point for a new model in machine learning. This technique involves applying an optimization that allows for rapid progress in modeling a second, related task using a model that was originally trained on a first task.

III PROPOSED ALGORITHM

ALEXNET

AlexNet was the first convolutional neural network utilized in the LSVRC competition. It was proposed by Krizhevsky et al. in 2012 and won the competition with significantly higher accuracy compared to all previous models, including the one that came in second place that year.

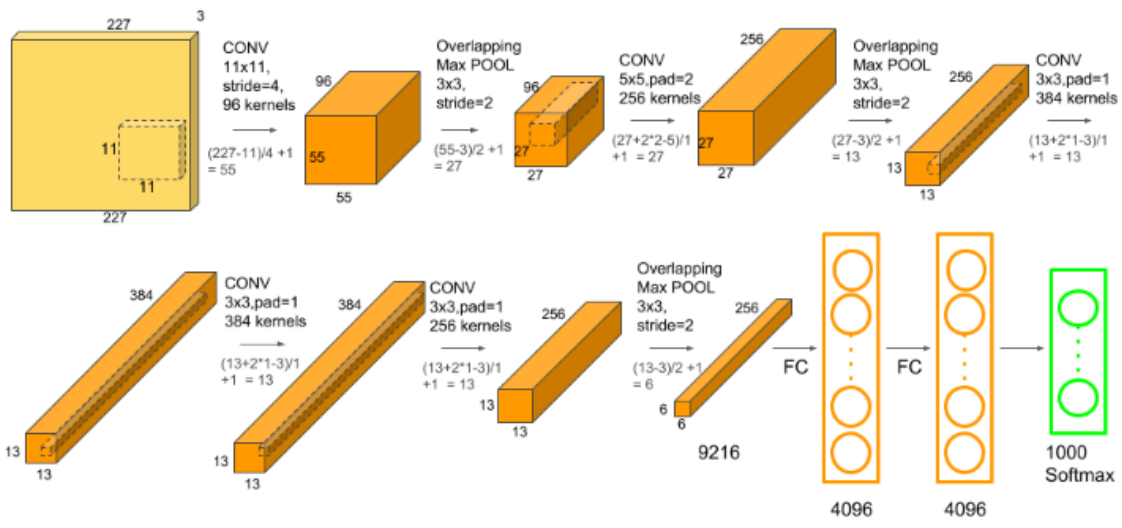

Figure 2 Alexnet Architecture

GOOGLENET

In 2014, Google (in collaboration with several universities) proposed a CNN called Google Net, or Inception V1, in their research paper "Going Deeper with Convolutions." This architecture achieved the highest accuracy at the ILSVRC 2014 image classification competition.

Figure 3 Googlenet Architecture

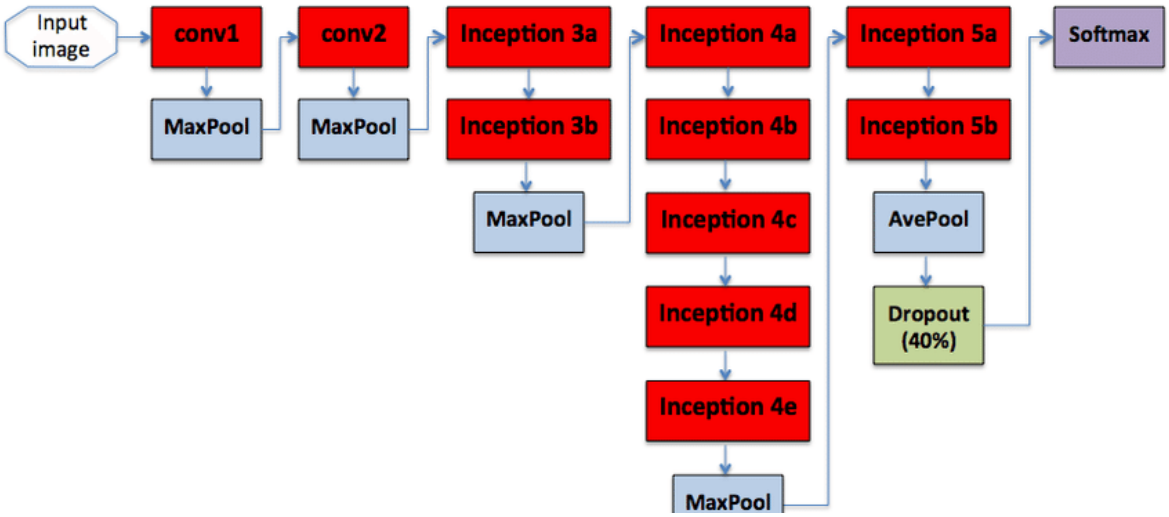

Figure 3 Googlenet Architecture

VGG16

The VGG16 is a convolutional neural network (CNN) that was collaboratively developed by the Visual Geometry Group at the University of Oxford and Google DeepMind. It can be viewed as an extension of the AlexNet architecture, and it is distinguished by the use of 3x3 convolutional kernels and 2x2 pooling layers. Additionally, smaller convolutional layers can be employed to deepen the network and improve feature learning.

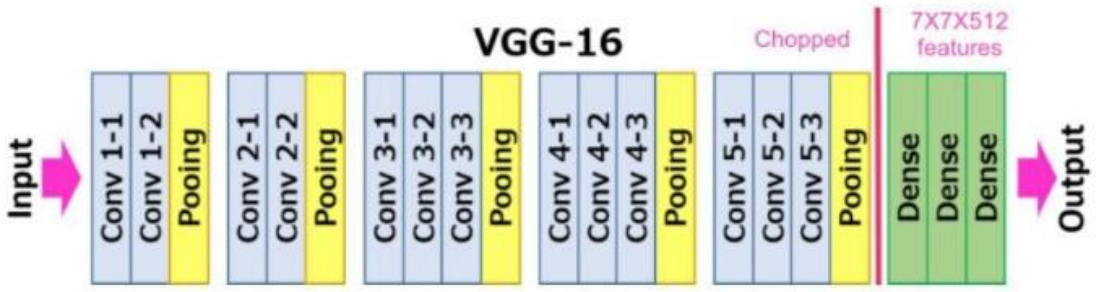

Figure 4 VGG-16 Architecture

IV SYSTEM DESIGN

DATA FLOW DIAGRAM

A data flow diagram (DFD), also known as a bubble chart, is a straightforward graphical representation used to illustrate a system by depicting its input data, the processing performed on this data, and the resulting output data generated by the system. It is a critical modeling technique used to model system components.

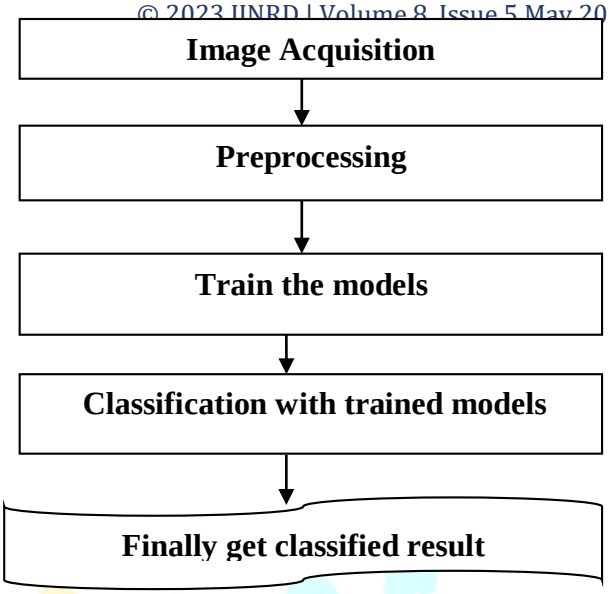

Figure 5 Data flow diagram

Figure 5 Data flow diagram

USE

A use case diagram is a type of behavioral diagram within the Unified Modeling Language (UML) framework that is derived from a use-case analysis. Its primary objective is to provide a visual representation of the functionality that a system offers, including actors, their objectives (expressed as use cases), and any interdependencies between those use cases. The key function of a use case diagram is to demonstrate which system functions are performed for specific actors, and the roles of those actors in the system may also be illustrated.

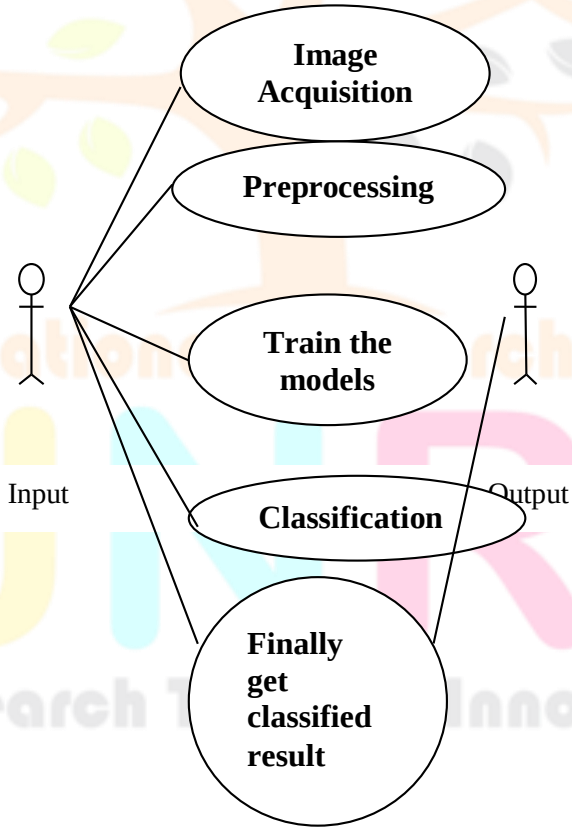

Figure 6 Use Case Diagram

SYSTEM ARCHITECTURE: TRAINING PROCESS

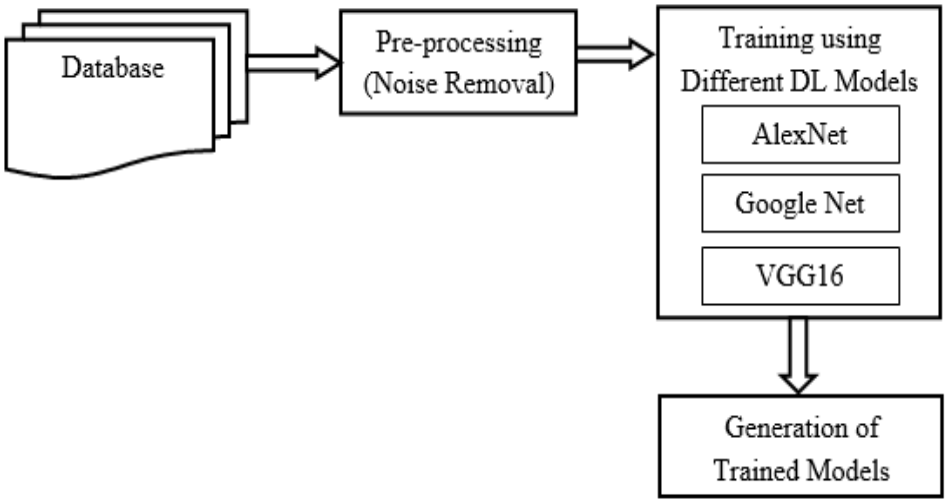

Figure 7 System Architecture Training process

SYSTEM ARCHITECTURE: TESTING PROCESS

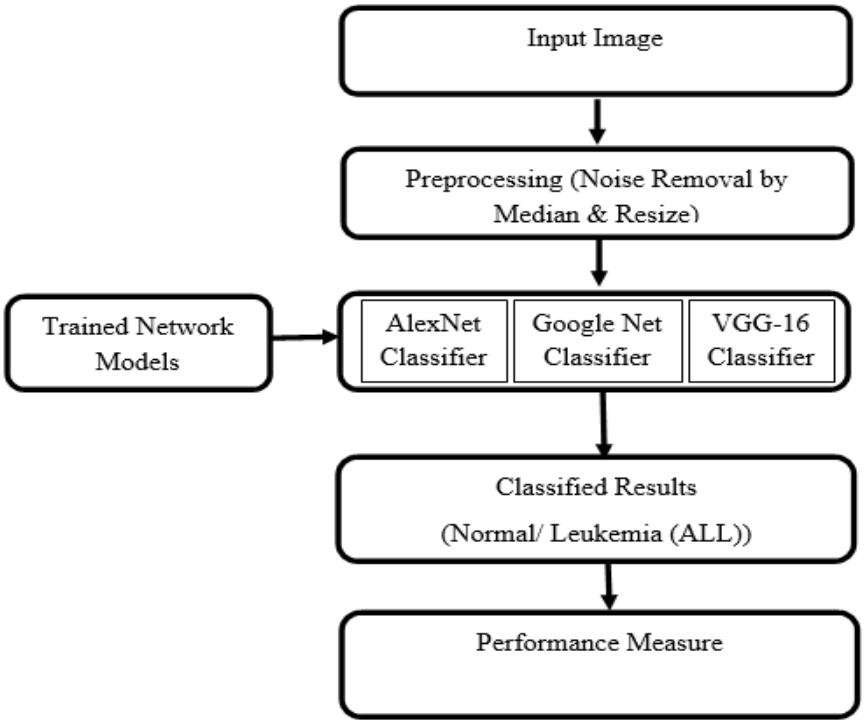

Figure 8 System Architecture Testing process

Here we have presented the training process and testing process of the system architecture. The training process includes the preprocessing of collected images and training the algorithms with the preprocessed images as illustrated above. The Testing process includes the preprocessing of input image that we have taken that includes noise removal, resizing and then the classified result is obtained by feeding the test image in the trained algorithm.

V RESULTS AND DISCUSSION

MODULES

The white blood cancer cell classification is done by the following modules:

1. Image Acquisition
2. Preprocessing
3. Classification
4. Performance Measure

ALEXNET

TRAINING PROCESS(ALEXNET)

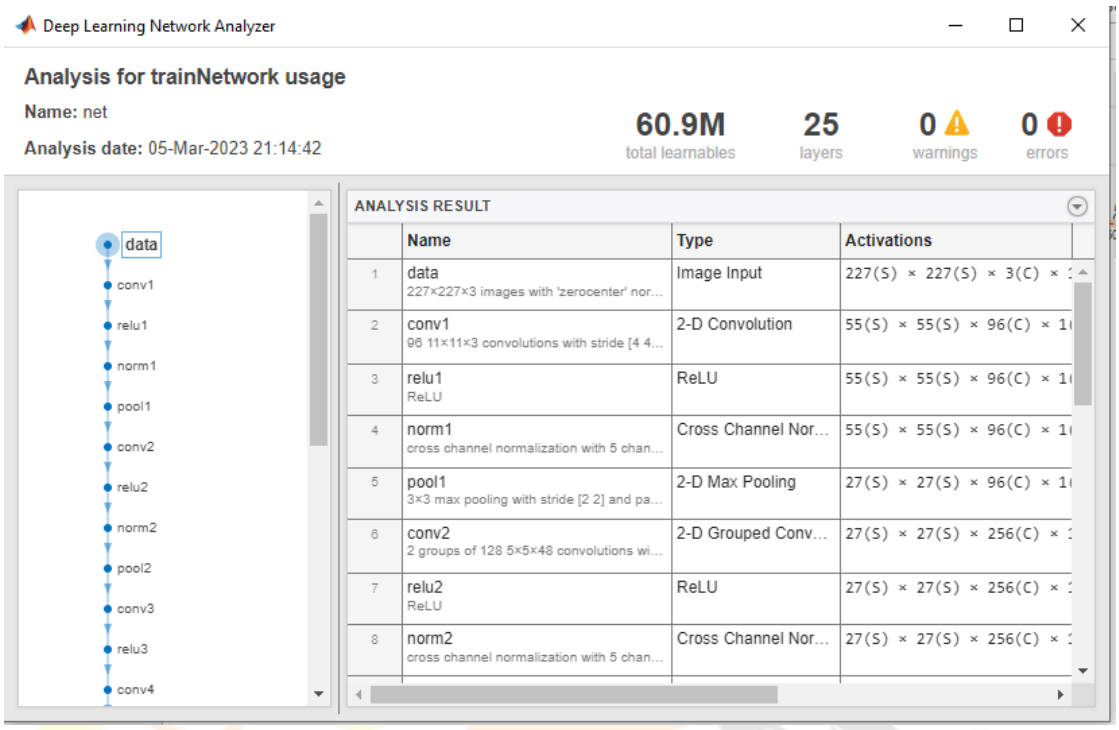

Figure 9 Analysis of Train Network Usage

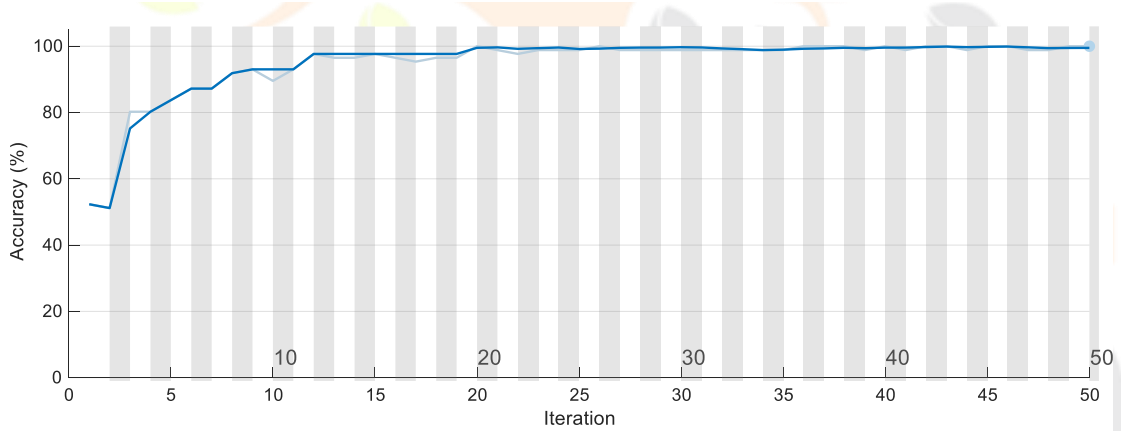

Figure 10 Accuracy of Trained network

TESTING PROCESS(ALEXNET)

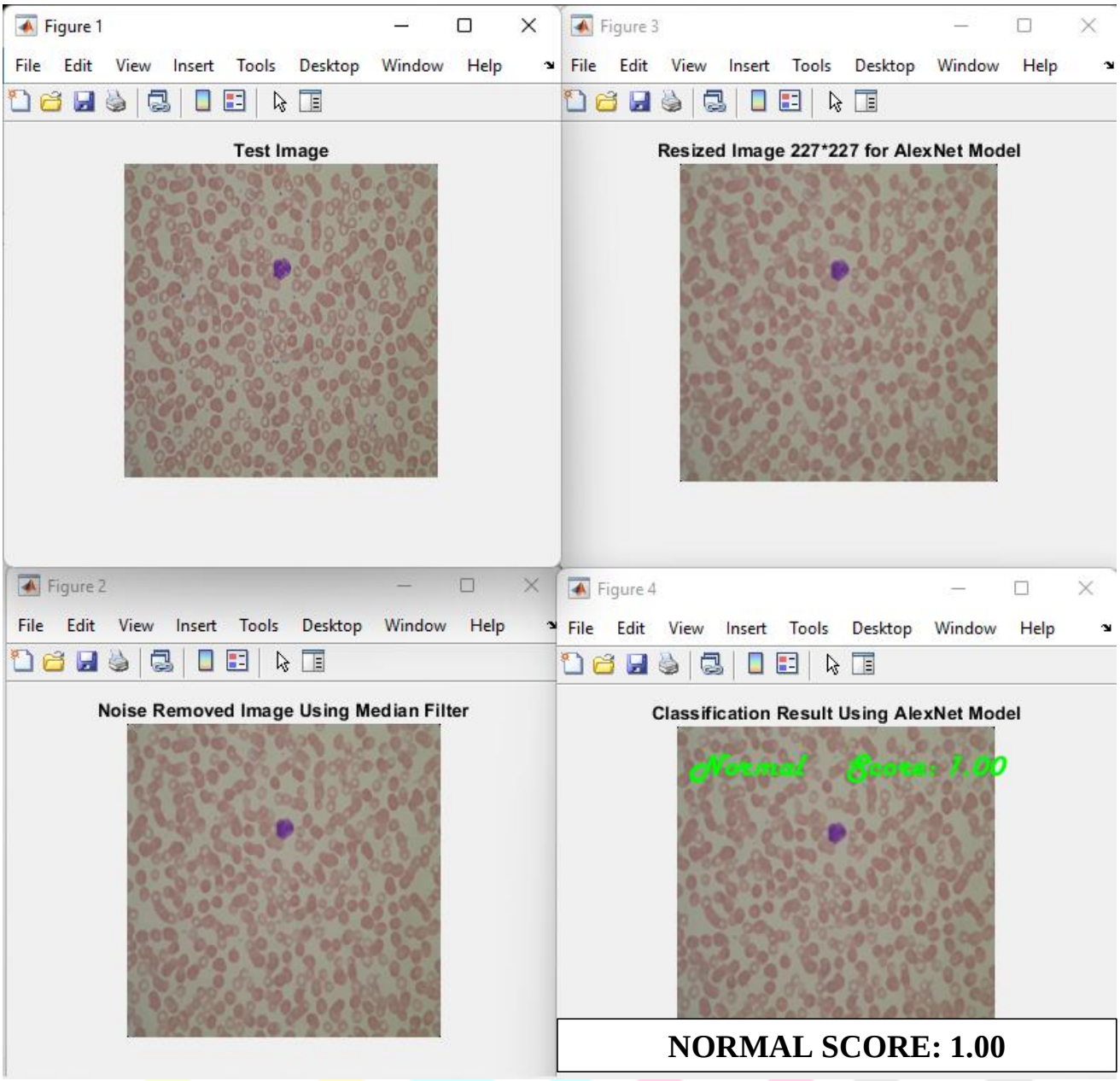

Figure 11 Alexnet Overall output

Figure 11.1 Test image
Figure 11.2 Resized test image
Figure 11.3 Noise Removed test image
Figure 11.4 Classification result of test image[Leukemia score: 100]

Here the Figure 1 describes the test image we have taken which is fed into the trained algorithm at first the algorithm preprocesses the input image which includes the noise removal and resizing as shown in the figure 2 and figure 3 and finally we got the classified result as shown in the figure 4 which is classified as normal with a score of 100%.

PERFORMANCE ANALYSIS(ALEXNET)

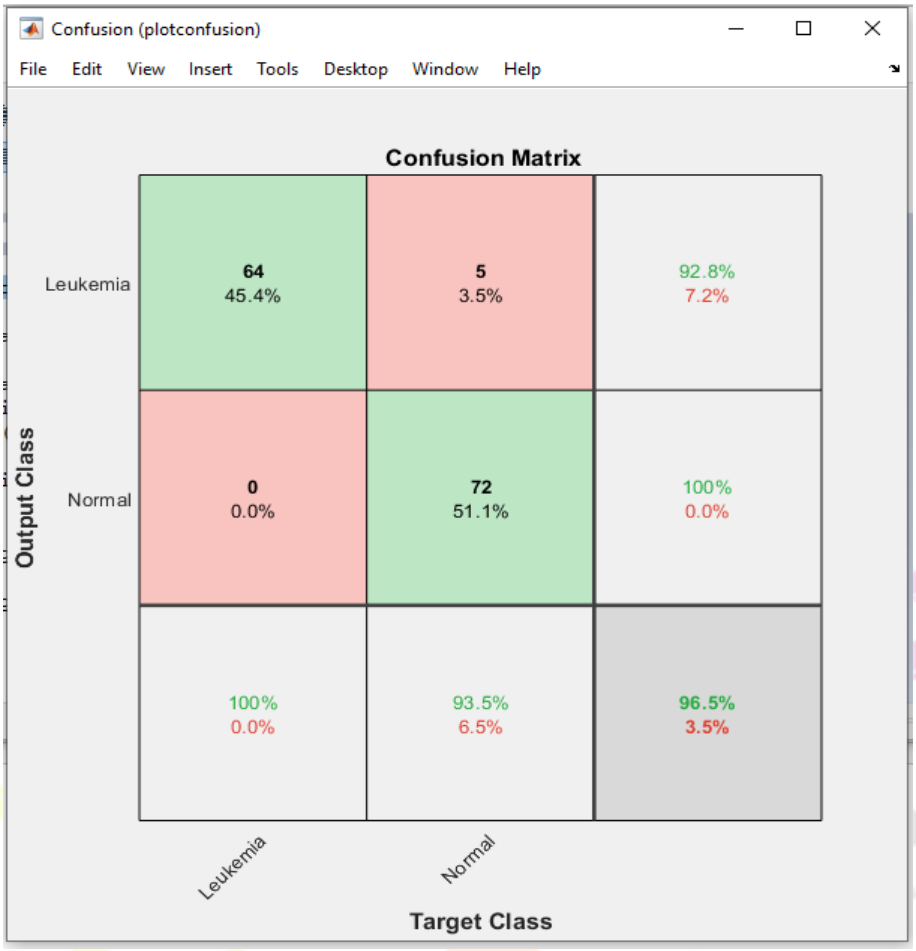

Figure 12 Confusion matrix

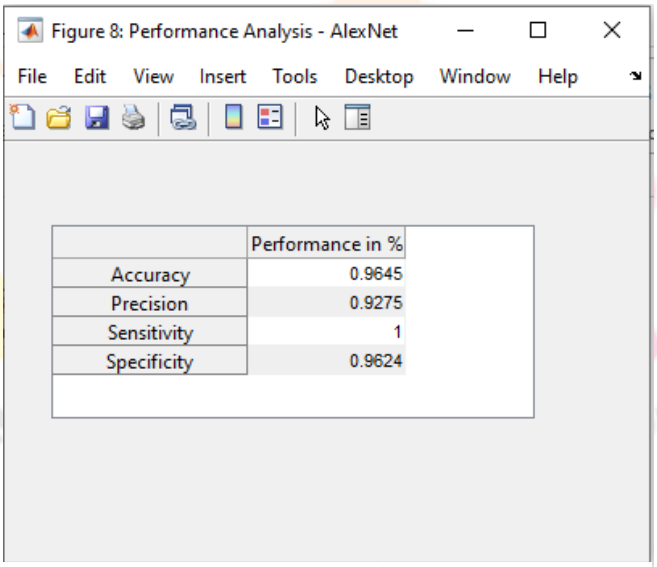

Figure 13 Performance Analysis of Alexnet model

GOOGLENET

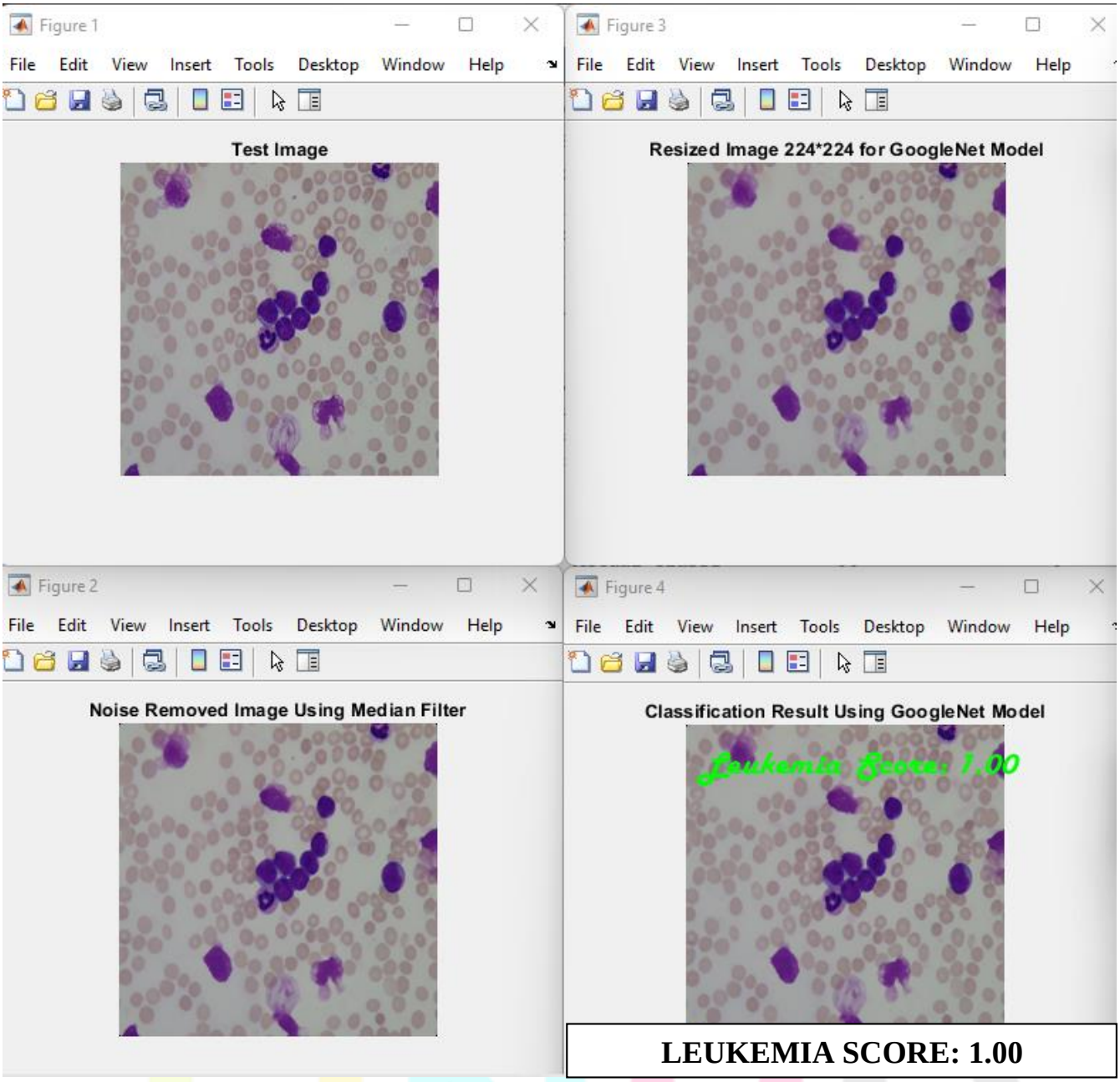

Figure 14 Googlenet Overall output

Figure 14.1 Test image
Figure 14.2 Resized test image
Figure 14.3 Noise Removed test image
Figure 14.4 Classification result of test image[Normal score: 100]

Here figure 1 describes the test image we have taken which is fed into the trained algorithm at first the algorithm preprocesses the input image which includes the noise removal and resizing as shown in the figure 2 and figure 3 and finally we got the classified result as shown in the figure 4 which is classified as normal with a score of 100%.

VGG-16

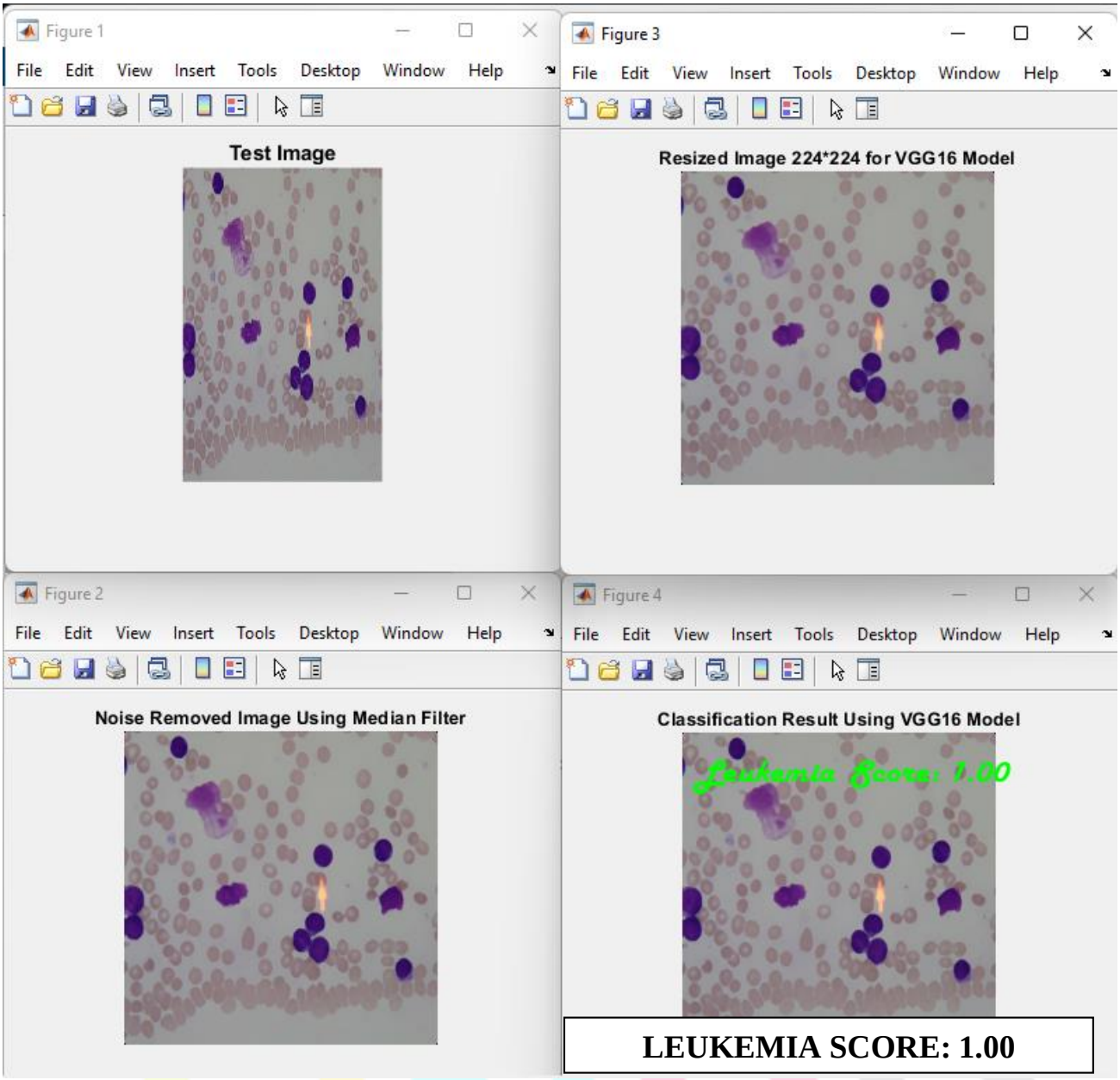

Figure 15 VGG 16 Overall output

Figure 15.1 Test image
Figure 15.2 Resized test image
Figure 15.3 Noise Removed test image
Figure 15.4 Classification result of test image[Leukemia score: 100]

Here the figure 1 describes the test image we have taken which is fed into the trained algorithm at first the algorithm preprocesses the input image which includes the noise removal and resizing as shown in the figure 2 and figure 3 and finally we got the classified result as shown in the figure 4 which is classified as normal with a score of 100%

(The training method for Googlenet model and VGG 16 is as same as the Alexnet model so we have presented only the test image(input) and Result(output) for Googlenet model and VGG 16)

COMPARISON OF CNN CLASSIFICATION ALGORITHM

Algorithms / Hyperparameters	Alexnet	Googlenet	VGG16
Accuracy	0.96	0.97	0.88
Precision	0.92	0.94	0.88
Sensitivity	1	1	1
Specificity	0.96	0.94	0.79

Table 1 Comparison of CNN Classification algorithms

In this project we have used three deep learning CNN classification algorithms(Alexnet, Googlenet,VGG16). On comparing all the classification algorithms against the hyperparameters such as Accuracy, Precision, Sensitivity, Specificity we have concluded that **Googlenet** classification algorithm provides the most accurate result.

FUTURE SCOPE

- In future we're planning to get only one output instead of outputs from all the three classification algorithms which has been chosen to be the most accurate output among all the three algorithms.
- More no. of inputs can be collected instead of getting single input(Test image) of the same case(same person) to obtain more clear and accurate result.

VI CONCLUSION

Leukemia is a type of cancer affecting the blood and is a major contributor to cancer-related fatalities. Our study presents novel models that have been validated on publicly accessible datasets and exhibit promising outcomes when compared to conventional models. The WBC dataset achieved a classification accuracy of 96.5% for Alex Net, 97.2% for Google Net, and 88.7% for VGG-16. Our proposed approach can be further examined on various subtypes of acute lymphocytic leukemia in the future.

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