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ADVANCED BLOOD CELL CLASSIFICATION - A CNN-BASED ANALYSIS FOR PRECISE IDENTIFICATION

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ABSTRACT_ White blood cells, also known as leukocytes, perform a crucial role in the human body by boosting immunity and combating infectious infections. The classification of white blood cells is critical in the detection of disease in an individual. The classification can also help identify disorders caused by immune system abnormalities, such as infections, allergies, anemia, leukemia, cancer, Acquired Immune Deficiency Syndrome (AIDS), and so on.

This classification will help hematologists distinguish the types of white blood cells seen in the human body and identify the underlying cause of disorders. There is now a significant amount of research being conducted in this topic. Given the importance of WBC classification, we will use a deep learning technique known as Convolution Neural Networks (CNN) to categorize WBC images into subtypes such as neutrophil, eosinophil, lymphocyte, and monocyte. In this study, we will present the results of numerous experiments carried out on the Blood Cell Classification and Detection (BCCD) dataset using CNN..

1.INTRODUCTION

White blood cells play an important role in the human body's immune system. Blood cells are classified into three types.Red Blood Cells (RBC) transport oxygen, White Blood Cells (WBC) serve as the immune system's front line, and platelets cause blood clotting in damaged tissues. In a healthy adult, white blood cells make up 1% of the blood. They are found throughout the body, and each type of White Blood Cell serves a specific function in the human body by protecting it from various infections and diseases. If they detect any of these elements in the blood, they attack them in order to mitigate any potential harm these elements may cause in the body. . The WBC structure consists primarily of a large lobed nucleus that can be used to distinguish a WBC from other blood cell types. WBC is made up of cytoplasm and a cell wall in addition to a nucleus. In the human body, there are five major types of WBC. Due to data set constraints, we have divided the data into four categories: Basophils (0.4% roughly), Eosinophils (2.3% roughly), Monocytes (5.3% roughly), Lymphocytes (30% roughly), and Neutrophils (62% roughly).

2.LITERATURE SURVEY

2.1 Mathur, A.S. Tripathi, & M. Kuse, M, "Scalable system for classification of white blood cells from Leishman stained blood stain images". Journal of pathology informatic, 2013.

White blood cells (leukocytes) are a very important component of the blood that forms the immune system, which is responsible for fighting foreign elements. The five types of white blood cells include *neutrophils*, *eosinophils*, *lymphocytes*, *monocytes*, and *basophils*, where each type constitutes a different proportion and performs specific functions. Being able to classify and, therefore, count these different constituents is critical for assessing the health of patients and infection risks. Generally, laboratory experiments are used for determining the type of a white blood cell. The staining process and manual evaluation of acquired images under the microscope are tedious and subject to human errors. Moreover, a major challenge is the unavailability of training data that cover the morphological variations of white blood cells so that trained classifiers can generalize well. As such, this paper investigates image transformation operations and generative adversarial networks (GAN) for data augmentation and state-of-the-art deep neural networks (i.e., VGG-16, ResNet, and DenseNet) for the classification of white blood cells into the five types. Furthermore, we explore initializing the DNNs' weights randomly or using weights pretrained on the CIFAR-100 dataset. In contrast to other works that require advanced image preprocessing and manual feature extraction before classification, our method works directly with the acquired images. The results of extensive experiments show that the proposed method can successfully classify white blood cells.

2.2 N. Sinha, & A.G. Ramakrishnan, "Automation of differential blood count". Conference on Convergent Technologies for Asia-Pacific Region, vol. 2, pp. 547-551, 2003, IEEE.

A technique for automating the differential count of blood is presented. The proposed system takes as input, color images of stained peripheral blood smears and identifies the class of each of the White Blood Cells (WBC), in order to determine the count of cells in each class. The process involves segmentation, feature extraction and classification. WBC segmentation is a two-step process carried out on the HSV-equivalent of the image, using K-Means clustering followed by EM-algorithm. Features extracted from the segmented cytoplasm and nucleus, are motivated by the visual cues of shape, color and texture. Various classifiers have been explored on different combinations of feature sets. The results presented here are based on trials conducted with normal cells. For training the classifiers, a library set of 50 paltems, with about IO samples from each class, is used. The test data, disjoint form the training set, consists of 34 pattems, fairly represented by every class. The best classification accuracy of 97% is obtained using Neural networks, followed by 94% using SVM Human peripheral blood consists of 5 types of white Blood Cells (WBC) called lymphocytes, monocytes, eosinophils, basophils and neutrophils [2]. Differential blood count (DBC) is carried out to calculate the relative percentage of each type of WBC, since it helps in diagnosing many ailments.

2.3 F. Özyurt, "A fused CNN model for WBC detection with MRMR feature selection and extreme learning machine". Soft Computing, 1-10, 2019.

Convolutional neural networks (CNNs) have recently emerged as a popular topic for machine learning in various academic and industrial felds. It is often an important problem to obtain a dataset with an appropriate size for CNN training. However, the lack of training data in the case of remote image research leads to poor performance due to the overftting problem. In addition, the back-propagation algorithm used in CNN training is usually very slow and thus requires tuning diferent hyper-parameters. In order to overcome these drawbacks, a new approach fully based on machine learning algorithm to learn useful CNN features from Alexnet, VGG16, VGG19, GoogleNet, ResNet and SqueezeNet CNN architectures is proposed in the present study. This method performs a fast and accurate classifcation suitable for recognition systems. Alexnet, VGG16, VGG19, GoogleNet, ResNet and SqueezeNet pretrained architectures were used as feature extractors. The proposed method obtains features from the last fully connected layers of each architecture and applies the ReliefF feature selection algorithm to obtain efcient features. Then, selected features are given to the support vector machine classifer with the CNN-learned features instead of the FC layers of CNN to obtain excellent results. The efectiveness of the proposed method was tested on the UC-Merced dataset. Experimental results demonstrate that the proposed classifcation method achieved an accuracy rate of 98.76% and 99.29% in 50% and 80% training experiment, respectively Over the past few decades, remote sensing has undergone dramatic changes in the spatial resolution of the image and increases in the acquisition rate. Innovations in the feld of computer technology and increasing spatial resolution ofer new opportunities to improve image detection and remote sensing, enabling the development of new approaches.

3.PROPOSED WORK

Our suggested method solves these constraints by employing deep learning techniques, specifically a CNN. The suggested CNN architecture includes numerous convolutional, pooling, and fully connected layers that allow the model to automatically learn complicated characteristics from input images. To improve the model's performance, we use data augmentation techniques like rotation, zooming, and flipping to diversify the training dataset. The network is trained and evaluated using a dataset that includes four types of white blood cells (Leukocutes): eosinophils, basophil monocytes, and lymphocytes.Red blood cells (erythrocytes) and platelets (thromocytes).The proposed classifier algorithm showed very good accuracy rates, with validation measures of sensitivity and specificity being 100% and 0.998%, respectively.

3.1 IMPLEMENTATION

3.1.1 Upload Image:

The "Upload Image, Input Blood Cell image to CNN, Predict Blood Cell" module is a computer vision application that uses convolutional neural networks (CNNs) to classify blood cell images into different categories.

3.1.2 Preprocess Image:

The “Run CNN" module is responsible for preprocessing the uploaded image to make it suitable for input to a Convolutional Neural Network (CNN). This involves resizing the image to a standard size, normalizing the pixel values, and converting the image to a format that can be fed into the CNN.

3.1.3 Predict Blood Cell:

The "Predict Blood Cell" module uses a pre-trained CNN to analyze the uploaded image and predict the type of blood cell that is present. This module takes the preprocessed image as input and applies the CNN's algorithms to identify the features and patterns that are indicative of different blood cell types. The output of the module is a prediction of the most likely blood cell type based on the image analysis.

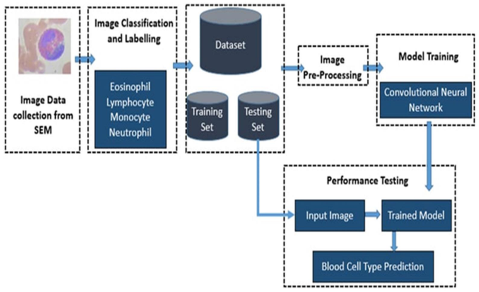
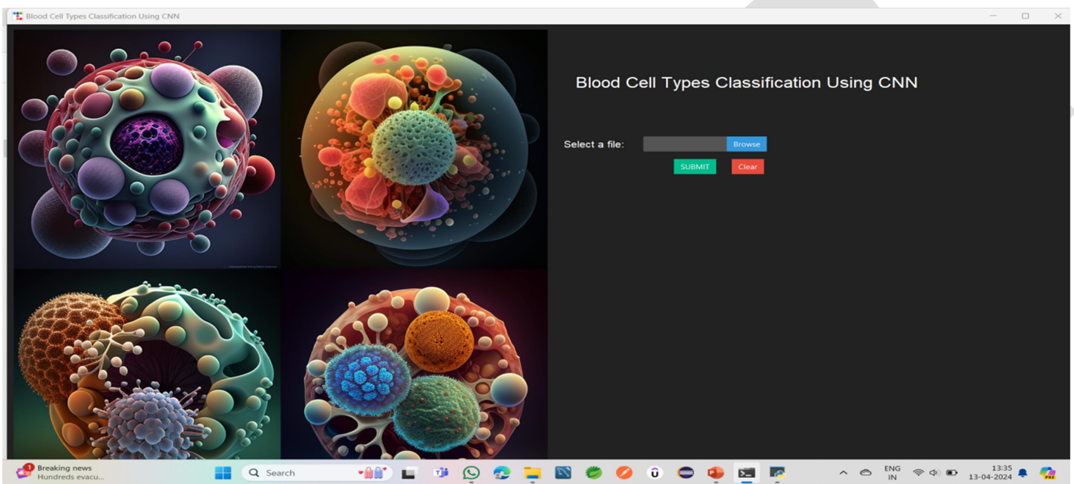


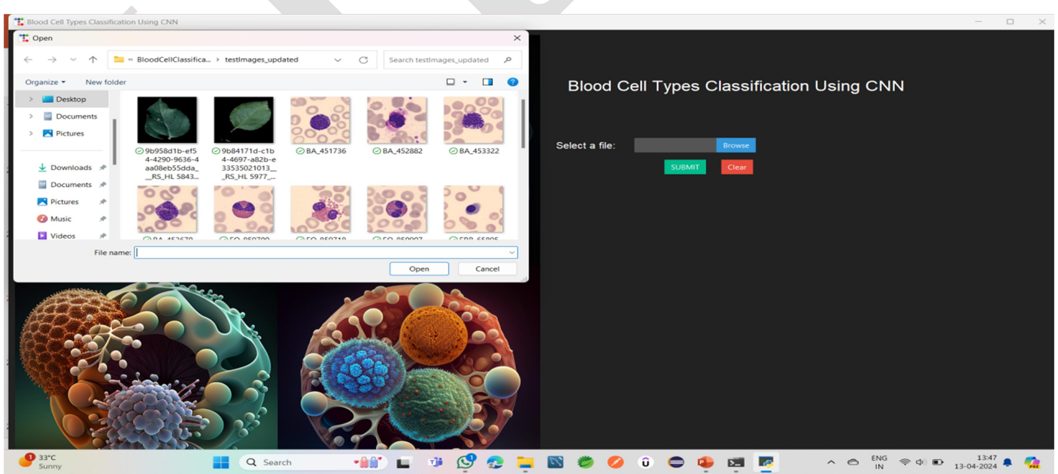
Fig 1:Architecture

4.RESULTS AND DISCUSSION



After that we get a windows application like this

UPLOAD IMAGE:



After clicking browse we get into a folder with test Images_updated

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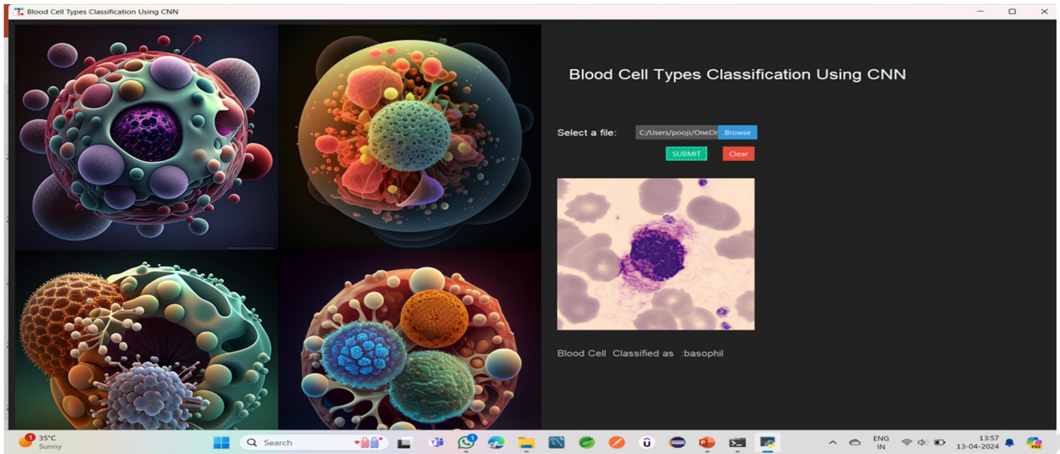
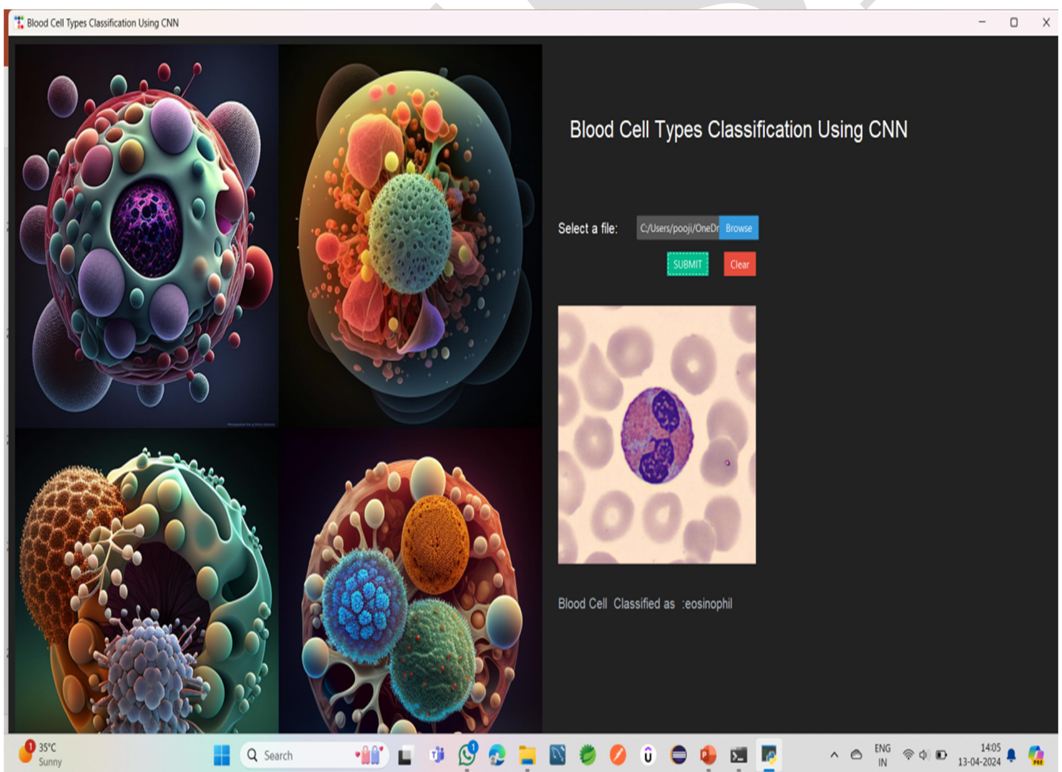
OUTPUT1:



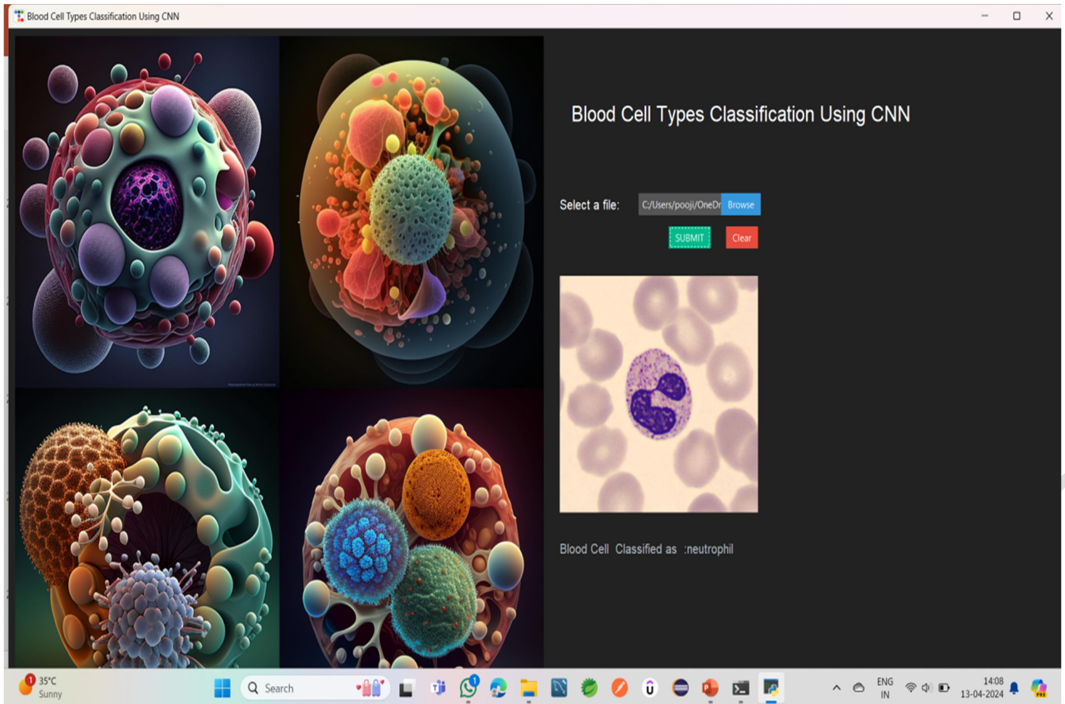
Cell is classified as Basophil.

OUTPUT2:



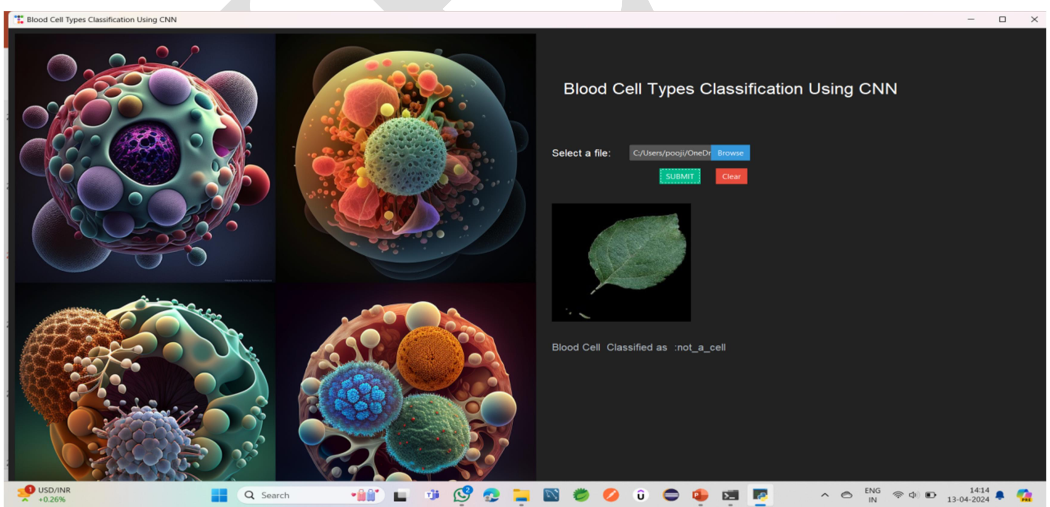
Above blood cell is classified as Eosinophil

OUTPUT3:



Above cell is classified as Neutrophil

OUTPUT4:



Above cell is defined as not a cell

5.CONCLUSION

This project allows blood type identification without the use of invasive tools such as syringes and needles. This is ideal for domestic use. It is a cheap method that allows for quick and accurate blood detection. It helps to prevent diseases such as Hepatitis, HIV, and others. It is ideal for persons who are afraid of needles. The image is resized before proceeding to the following stage, where its pixels are employed to extract specific features that aid in the separation of blood types. The feature extraction is done with the help of GLCM, or Gray Scale Co-occurrence matrix.

Once the traits are determined, the blood groups are classified into O+,A+,B+,AB+,O-, A-, B-, and AB-. The presence or absence of the rhesus antigen in specific blood types determines the negative and positive readings. We take datasets from hospitals and train them.

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REFERENCES

1. Matthew V. Bills, Brandon T. Nguyen, and Jeong-Yeol Yoon , “Simplified White blood cell Differential: An inexpensive, smartphone – and paper based blood cell count”, September 15,2019

2. [Nevine Demitri, Student Member, IEEE, Abdelhak M. Zoubir, Fellow, IEEE, “Measuring Blood Glucose Concentrations in Photometric GlucometersRequiringVerySmallSampleVolumes”,March01,2016

3. Mohammad Reza Rakhshani and Mohammad Ali Mansouri-Birjandi , “Engineering Hexagonal Array of Nanoholes for High Sensitivity Biosensor and Application for Human Blood Group Detection” , March 08,2018

4. Manuel Gonz´alez-Hidalgo, F. A. Guerrero-Pe˜na, S. Herold-Garc´ıa, Antoni Jaume-i-Cap´o, and P. D. Marrero-Fern´andez, “Red Blood Cell Cluster Separation from Digital Images foruse in Sickle Cell Disease”, 5. September 08,2015

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