Improved Blood Cell Categorization: A CNN-Based Study for Accurate Identifying

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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 C. Cheuque, M. Querales, R. León, R. Salas and R. Torres, "An efficient multi-level convolutional neural network approach for white blood cells classification", Diagnostics (Basel), vol. 12, no. 2, pp. 248, 2022..

The evaluation of white blood cells is essential to assess the quality of the human immune system; however, the assessment of the blood smear depends on the pathologist's expertise. Most machine learning tools make a one-level classification for white blood cell classification. This work presents a two-stage hybrid multi-level scheme that efficiently classifies four cell groups: lymphocytes and monocytes (mononuclear) and segmented neutrophils and eosinophils (polymorphonuclear). At the first level, a Faster R-CNN network is applied for the identification of the region of interest of white blood cells, together with the separation of mononuclear cells from polymorphonuclear cells. Once separated, two parallel convolutional neural networks with the MobileNet structure are used to recognize the subclasses in the second level. The results obtained using Monte Carlo cross-validation show that the proposed model has a performance metric of around 98.4% (accuracy, recall, precision, and F1-score). The proposed model represents a good alternative for computer-aided diagnosis (CAD) tools for supporting the pathologist in the clinical laboratory in assessing white blood cells from blood smear images..

2.2 S. Sharma and K. Guleria, "Pneumonia detection from chest X-ray images using transfer learning", 2022 10th International Conference on Reliability Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 2022.

Pneumonia is a disease that an individual can acquire at any stage of the life. As per a report from Cleveland clinic, America, pneumonia is responsible for about 18% of all contagious diseases. In the phases that follow, this condition may lead to death. Chest radiographs have been found to as constant value by field professionals in clinical practice in order to identify pneumonia. In this work, chest X-ray scans., which are accessible for the identification and diagnosis of pneumonia are utilized. For feature extraction from the images, a VGG16 transfer learning model is used. In this paper, various pre-existing models for pneumonia detection have been reviewed along with the identification of their performance results. A framework of VGG16 used for the study has been explained with a variety of applications of

deep learning in disease diagnosis. The dataset for the research is collected from kaggle containing 5., 856 images., which have been further divided into training and testing datasets. Further, the results have been presented in the form of accuracy, precision, Fl-score and recall as 90.8%, 0.9102, and 0.935, 0.9615, respectively..

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 proposed strategy uses a CNN and deep learning techniques to tackle these restrictions. Many convolutional, pooling, and fully connected layers in the proposed CNN architecture enable the model to

automatically extract complex features from input photos. We employ data augmentation methods, such as rotation, zooming, and flipping, to diversity the training dataset in order to enhance the model's performance. Eosinophils, basophil monocytes, lymphocytes, and other four types of white blood cells (leukocutes) make up the dataset used to train and assess the network.Platelets (thromocytes) and red blood cells (erythrocytes).The suggested classifier algorithm demonstrated remarkably high accuracy rates, with 100% and 0.998% for the validation parameters of specificity and sensitivity, 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.

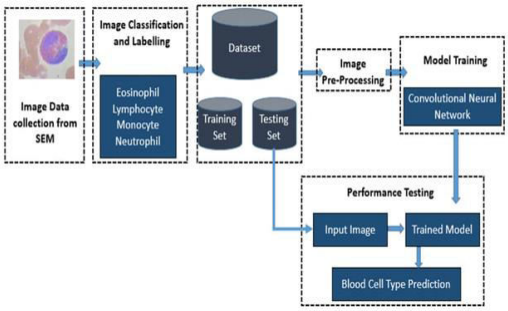
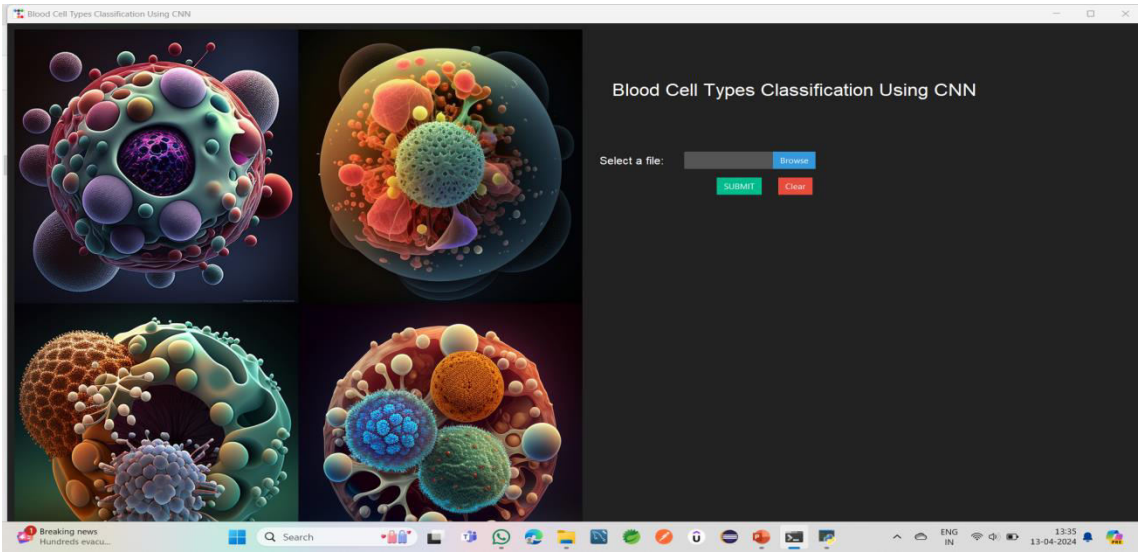


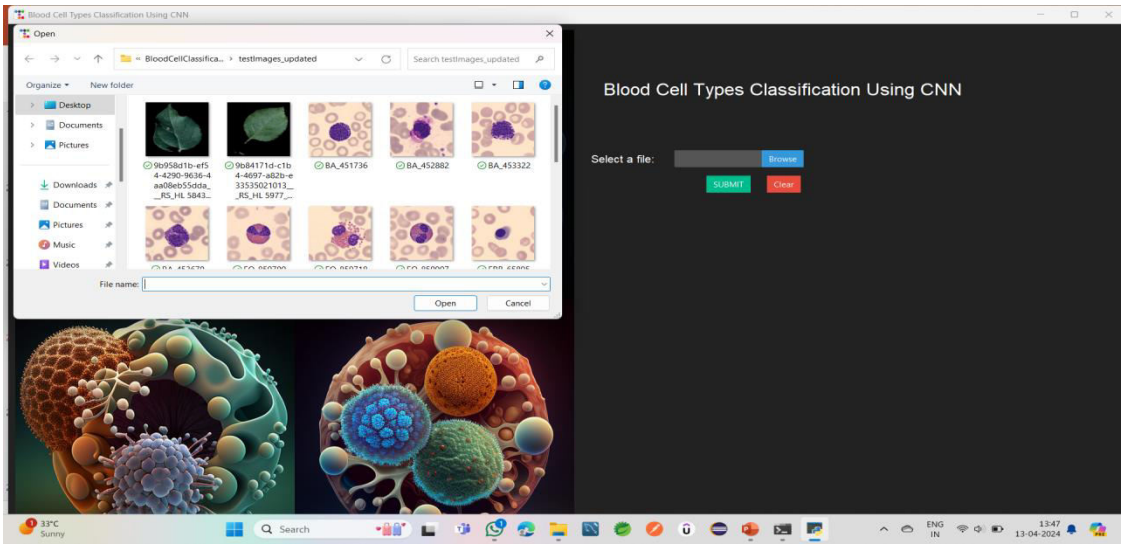
Fig 1:Architecture

4.RESULTS AND DISCUSSION



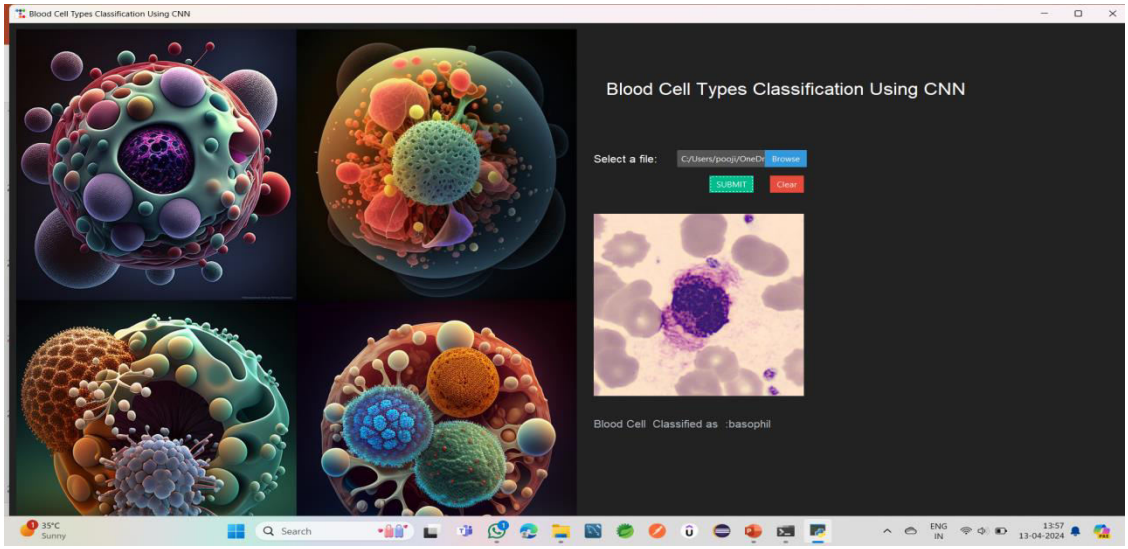
After that we get a windows application like this

UPLOAD IMAGE:



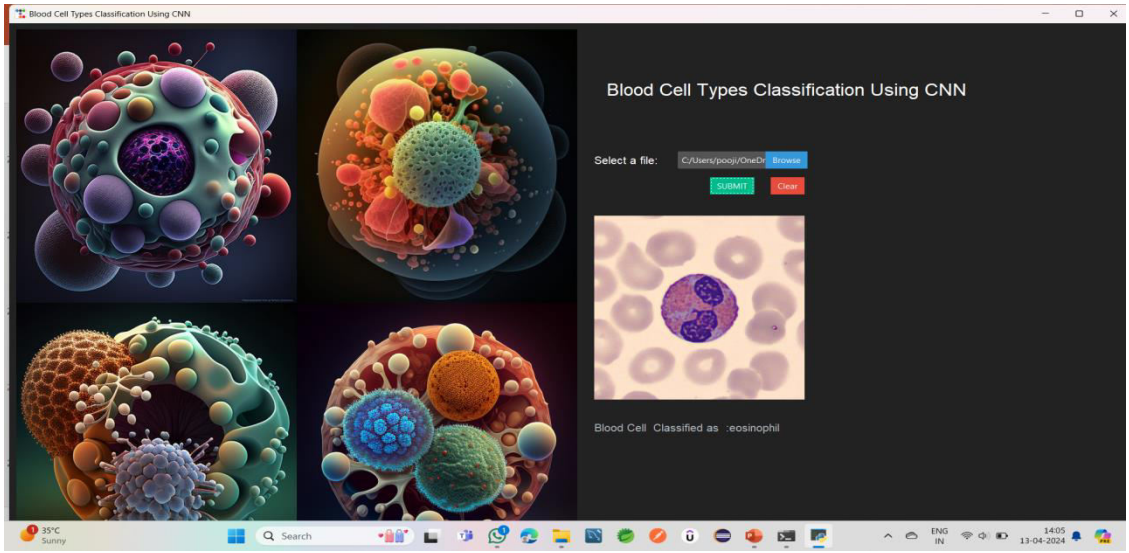
After clicking browse we get into a folder with test Images_updated

OUTPUT1:



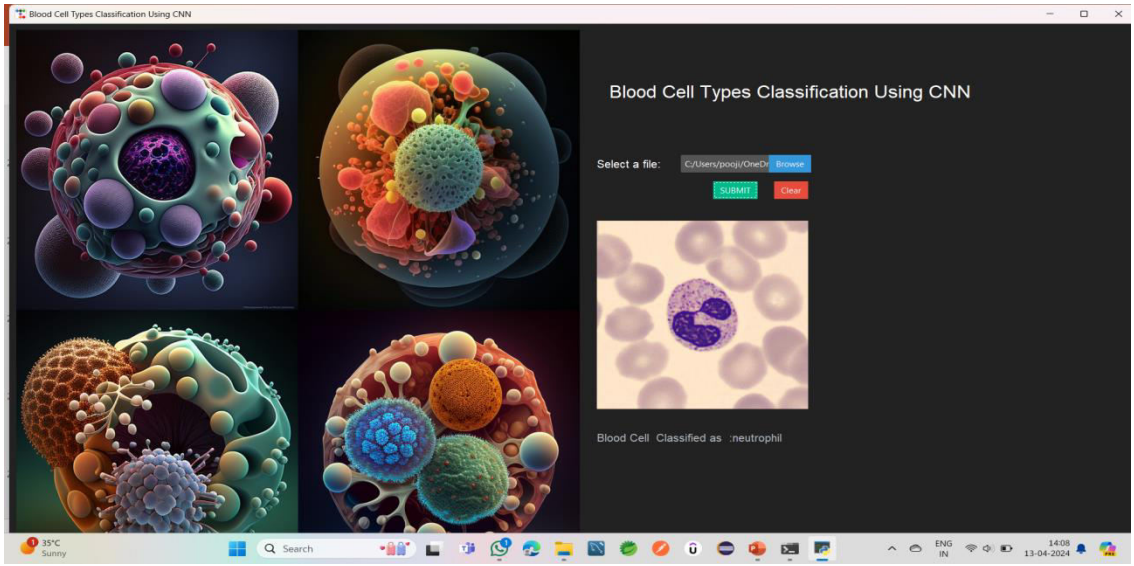
Cell is classified as Basophil.

OUTPUT2:



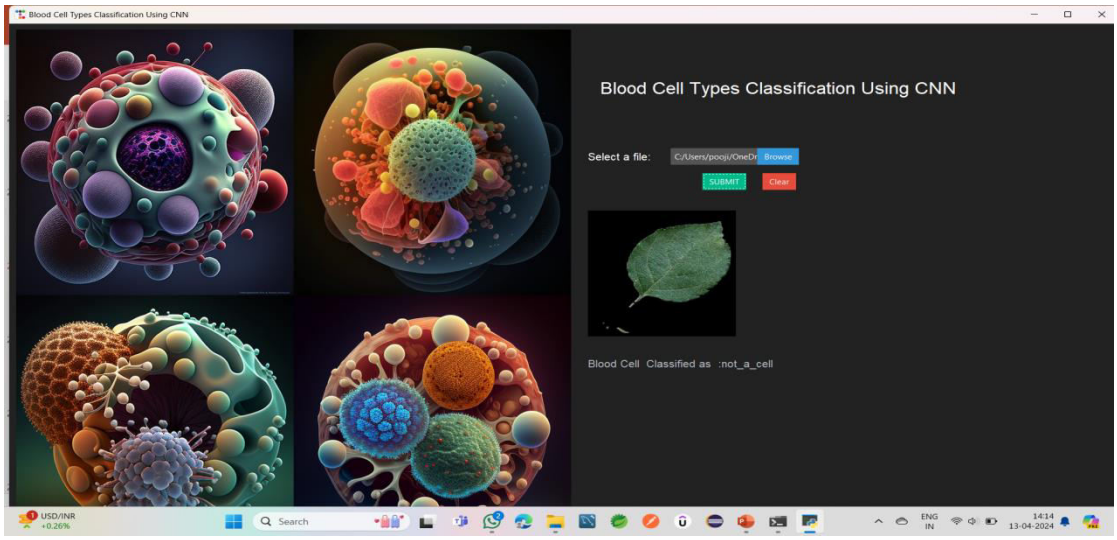
Above blood cell is classified as Eosinophil

OUTPUT3:



Above cell is classified as Neutrophil

OUTPUT4:



Above cell is defined as not a cell

5.CONCLUSION

Introducing a groundbreaking Non-Invasive Blood Typing System, this project revolutionizes conventional blood typing methods by eliminating the need for needles and syringes, making it ideal for domestic use. Through image-based classification using the Gray Level Co-occurrence Matrix (GLCM), texture features are extracted from resized images to accurately identify blood types, including O+, A+, B+, AB+, O-, A-, B-, and AB-. The system incorporates the presence or absence of the Rhesus (Rh) antigen for positive or negative classifications. Trained on hospital datasets, this system delivers swift and accurate results, contributing to disease prevention, particularly for individuals wary of needles, while ensuring affordability and accessibility for widespread adoption. By combining advanced image processing techniques with machine learning algorithms, this innovative approach empowers individuals to manage their healthcare needs conveniently and confidently, safeguarding public health through early detection and prevention of blood-transmitted diseases.

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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

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