iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 8 **Issue:** V **Month of publication:** May 2020

**DOI:** http://doi.org/10.22214/ijraset.2020.5334

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 8 Issue V May 2020- Available at www.ijraset.com*

# Fused Convolutional Neural Network for White Blood Cell Detection

J. Karthiyayini[1], Dhanya Shree[2], Simran Killedar[3], Ummadi Pavan Kumar[4], Kishan Kumar[5]
[1]*Senior Assistant Professor,* [2, 3, 4, 5]*Student, New Horizon College of Engineering, Karnataka, India*

***Abstract:*** ***Fused convolutional neural network for white blood cell detection helps us to detect white blood cells including their subtypes by using Convolutional neural networks and deep learning algorithms.Deep Learning has already shown power in many application fields, and is accepted by more and more people as a better approach than the traditional machine learning models. In particular, the implementation of deep learning algorithms, especially Convolutional Neural Networks (CNN), brings huge benefits to the medical field, where a huge number of images are to be processed and analysed. This paper aims to develop a deep learning model to address the white blood cell classification problem, which is one of the most challenging problems in blood diagnosis. A CNN-based framework is built to automatically classify the white blood cell images into subtypes of the cells. Experiments are conducted on a dataset of 13k images of white blood cells with their subtypes, and the results show that our proposed model provide better results in terms of evaluation parameters.***

## I. INTRODUCTION

The blood test plays imperative part in recognizing infections. It gives the points of interest approximately the common state of a person's prosperity conditions. Based on information from blood test pros, they select the treatment for the quite required. White blood cells (WBC) are an imperative component of blood framework. It is fundamental for great wellbeing and security against malady. WBC contains in a general sense five parts and depends on its assortment of measure, number and shape. Based on variety in these highlights there can happen numerous illnesses. Blood passes on basic substance to all standard of the body, it could be a transporting fluid. The white blood cell accepts basic portion in immunity of the body. The white blood cell is something else called leukocytes which are nucleated cell conveyed from bone marrow. The major obligation of WBC is to battle disease and cancer. Monocytes, neutrophils, basophils, eosinophil's, lymphocytes are basically kinds of leukocytes. Each kind of leukocyte has there on properties for ID like tally, shape, morphological changes. When a person's advice with master for check-up or sickness concern you've got, your master may approach critical information from your blood test. About 90 percent of the data within the normal therapeutic chart comes from research facility information. Within the occasion of developments and distinctive perilous maladies, blood tests deliver strong signs around how the body is working. To recognizing the contaminations, take more noteworthiness of blood testing is legitimately basic. Pros see the total blood tally for tall or moo tallies of diverse blood cells additionally for irregular blood cells. For recognizable confirmation of sicknesses most commonly utilized two frameworks, they include WBC check and check of each kind of WBC, which is known as differential number or diff test. WBC number can be discovered by utilizing manual strategy and laser-based cytometer. The main aim of the project is to provide an easy platform for the blood cells classification and recognize the infected or normal. The project work focuses on the blood cell using image processing. Previously, the classification is done manually. The manual process takes lot of time and it does not give accurate results. We are designing a system to overcome them. To classify the blood cells and it provides results with more accuracy. It gives the classification of blood cells. The count of the blood cell is provided long with that. This can be affordable for everyone.

## II. RELATED WORK

Computerized strategies to recognize and arrange platelet subtypes have significant therapeutic applications. Intertwined CNN model which combines the element maps of Convolutional layers to bolster into completely associated Neural Network (NN) model to arrange the WBC picture. WBC contains on a very basic level five sections and depends on its assortment of size, check, shape. In light of variety in these highlights there can happen numerous illnesses. By and by, we have stood up to numerous issues in blood testing. One normal issue is that a one of a kind bloods was getting a substitute and unprecedented estimation of cell check from the assorted lab professional. The vast majority of the research center pursues the manual checking method, which is extremely monotonous and less exact. The proposed structures help to characterization of every sort of white platelets using multi class bolster vector machine arrangement and convolutional neural systems (CNN).

©IJRASET: All Rights are Reserved

Recognizing the Neutrophils, Lymphocytes, Monocytes, Eosinophil and Basophils variety can be distinguished utilizing profound learning for finding infections. In like manner, find the degree of threatening cell in blood and leukocytes for various age area. A traditional cell classification process that is characterized by manually segmented cytoplasm/nuclei. In contrast, our method can adaptively learn the feature of the input image and is therefore not limited by the cell segmentation or feature design. The traditional method of cell classification is greatly affected by the balance of the sample, which causes the classifier to predict more cell abnormalities.

*A. Disadvantages*

*1)* This approach has the drawback of having intermediary blood cells which may lead to ambiguity in training.
*2)* Performance is not worthy.
*3)* It is some time consumption.

## III. PROPOSED SYSTEM

The proposed model can adaptively learn the characteristics of the white blood cell images; thereby avoiding manual feature extraction (no cytoplasmic/nuclear segmentation is needed). Moreover, we used of CNN models to classify blood cells. In particular, we use the transfer learning method to migrate the weight parameters pre-trained on the ImageNet dataset to the CNN branch, thereby enhancing the robustness of the combined model and accelerating the convergence of the model.

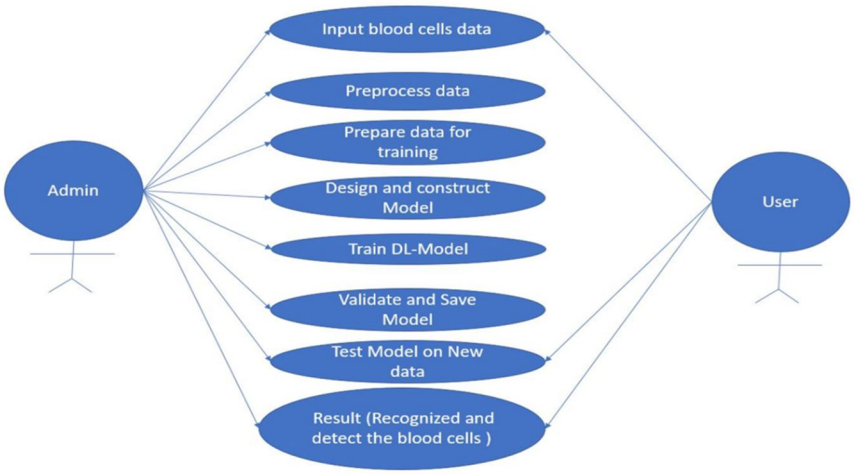
Combination model uses the characteristics of the neural network to use CNN classify cells. This method enables our model to take into account the spatiotemporal characteristics of the information contained in the image, and can effectively learn the structural characteristics of white blood cell images, which will result in higher classification accuracy.

Our method with Xception and achieved a good classification effect in the experiment. As is well-known, the Xception structure is a linear stack of depth wise separable convolution layers with residual connections. Unlike Inception, Xception does not divide the input data into several compressed data blocks, but instead maps the spatial correlation for each output channel and then performs a 1×1 depth convolution to obtain a cross-channel correlation. Xception introduces a deeply separable convolution, which basically does not increase the complexity of the network under the premise of improving the model. Therefore, our combined model also has the same features as Xception. In addition, the neural network attention mechanism we introduce incorporates features from the CNN branch, allowing the model to be more focused on finding useful information in the input data that is relevant to the current output, and thereby improving the quality of the output. The experiment confirmed the validity of our proposal.

In addition, compared with some classical neural network models (ResNet, GoogleNet, etc.), our combined model can make full use of the spatiotemporal information of image features. Therefore, our new method has great application potential in the field of white blood cell image classification.

*A. Advantages*

*1)* The main advantage we can take of previous training and use a relatively small training set.
*2)* The proposed method performed well compared to all the existing methods.
*3)* Execution time is less.




Flowchart of proposed system

©IJRASET: All Rights are Reserved

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 8 Issue V May 2020- Available at www.ijraset.com*

## IV. IMPLEMENTATION

### *A. Region Proposals*

Various recent proposals have provided methods to produce independent categorical zone recommendations. These methods include examples such as the object of image windows, selective Search of white blood cell object recognition, independent category object proposals, object segmentation, Multi scale combinational grouping, etc. These methods establish cell by implementing convolution neural network (CNN) with square cuts.

### *B. Convolutional Neural Network for extraction of Features*

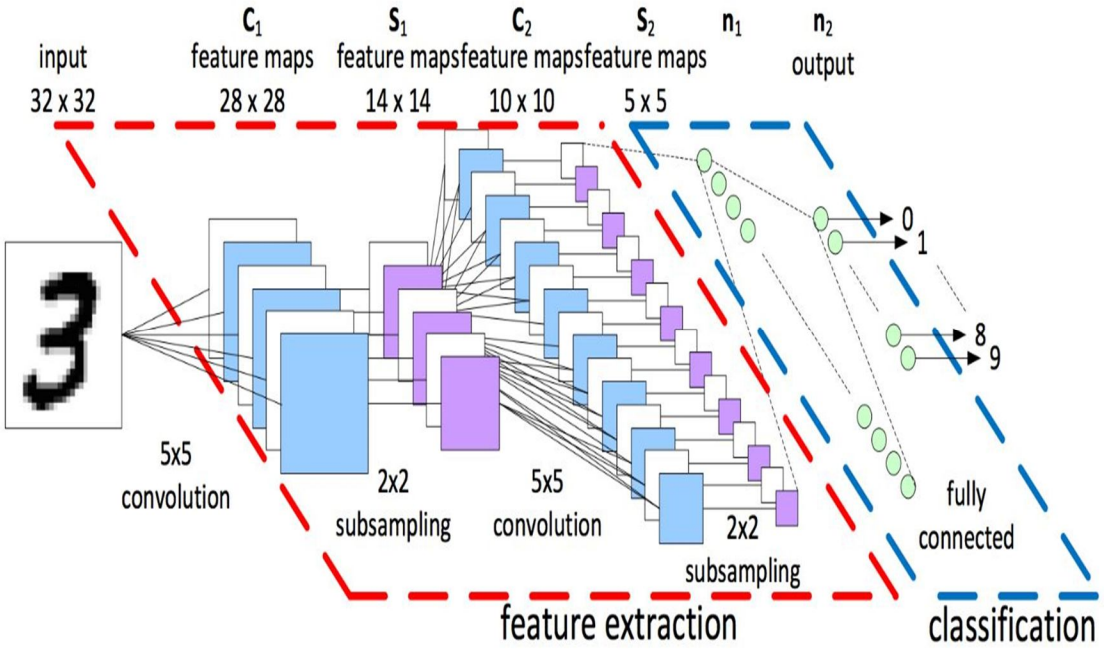
In this study, a feature vector of size 4086 was extracted from each regional proposal with Caffe deep-learning framework. Features were calculated by forwarding the average output 227x227 red, green and blue image with 5 convolution layers and two completely max pooling layers. To calculate an attribute in a regional proposal, the image dataset is first converted to a form that is compatible with CNN. In this study, fixed entrances of 227*227 pixels in size are used. The simplest of the possible transformations of the random shaped regions was selected. Here, all the pixels in a tight bounding box around the candidate area are resolved into the required size, regardless of the aspect ratio or size. Before dissolving, the tight bounding box around the candidate area was expanded to provide b pixels skewed picture content around the box at the skewed dimension (b = 16 was used). In addition to this, a simple bounding box regression is used to expand the localization performance within the application.

### *C. CNN training*

CNN is trained on a large auxiliary data set know as White Blood Cells classification using only image-level tags. CNN is trained on data set (CNN_train.hdf5) using only tags. This training is carried out using Caffe deep learning framework.

### *D. Object Category Classifiers:*

Here, binary classifier training is used to perceive blood cells. It is an example of an image area in which a blood cell is tightly enclosed in a box is a positive example. In a similar way, a negative example is a background region that is not interested in blood cells. It is not clear as to how a partially overlapping region of the blood cells has be labeled. This is solved by specifying an overlap threshold value. Areas above the threshold value as positive and those below this threshold value are negative. The overlap threshold 0.3 is chosen by performing a grid search on the verification set. Once the features are removed and the training tags are applied, Convolutional neural network is applied optimally to all classes.




CNN architecture

©IJRASET: All Rights are Reserved

## V. RESULT AND FUTURE ENHANCEMENT

### *A. Result*

We presented an approach to real-time blood cells image classification using deep learning. Our proposed deep learning model based on CNN was able to perform with 88 % accuracy on our test dataset. We are developing a system that classifies the blood cells. We have achieved main advantages we propose a depth neural network architecture that combines the features of convolutional neural networks (Xception). We then implement the CNN framework for white blood cell image classification. Our model preserves the temporal and spatial information of image features and can learn structured information of image features. Unlike previous manual feature extraction methods, which rely on cytoplasmic/nuclear segmentation, our method can automatically extract and classify the deep features embedded in cell image patches. Compared with the previous existing methods, our proposed technique achieved the highest performance in terms of classification based on the blood cell dataset.

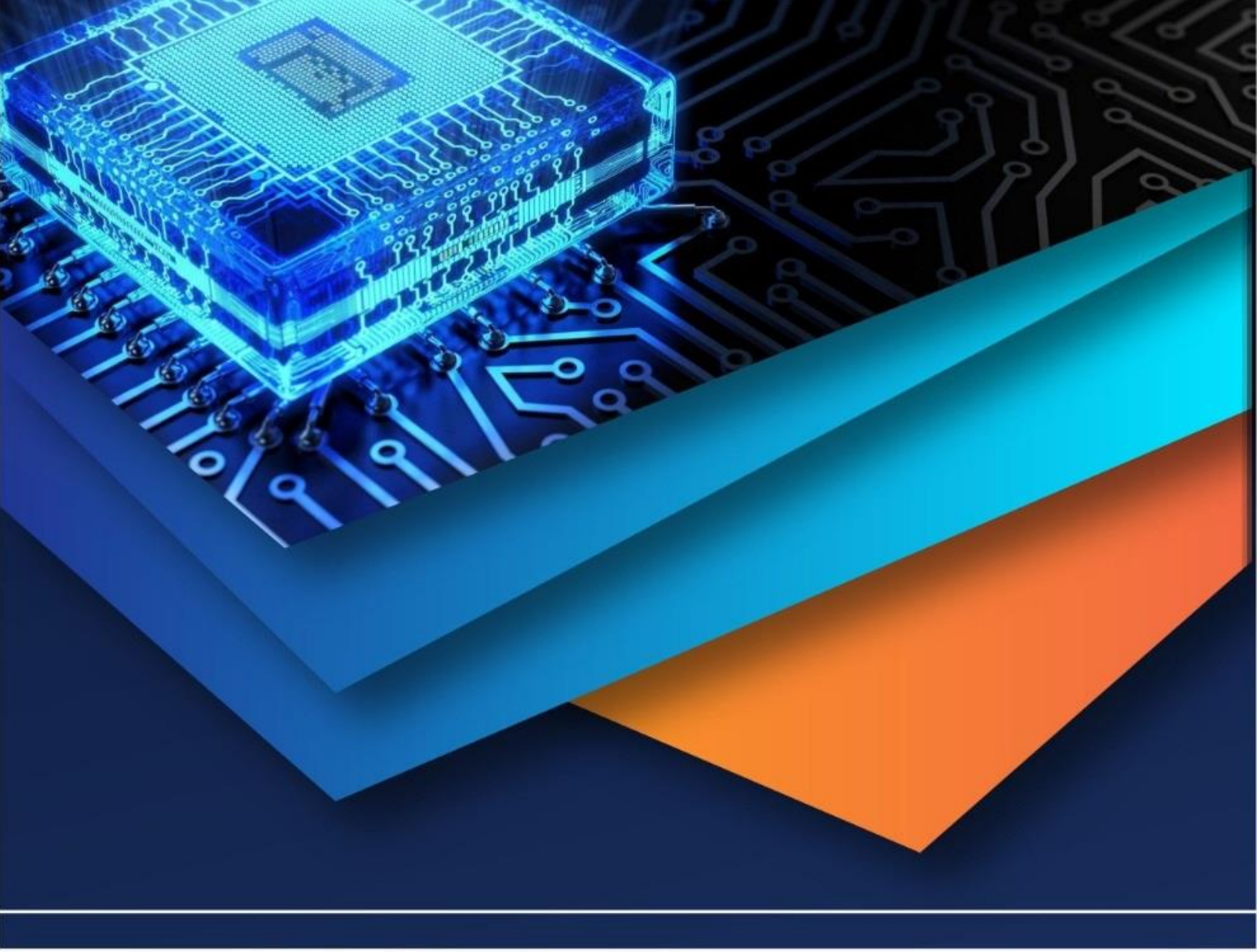
### *B. Future Work*

Future study may extend our work to accept training using deep learning with Tensorflow GPU (Graphics: Nvidia-Geforce-GTX) is high configuration to well prediction in classify the blood cell. We hope that this segmentation-free, highly accurate white blood cell classification method can be used to develop medical-aided diagnostic systems for blood-related diseases in the future.

## REFERENCES

[1] N. Sinha and A. G. Ramakrishnan, "Automation of differential blood count," Conference on Convergent Technologies for Asia-Pacific Region (TENCON), pp. 547-551, 2003.
[2] M. Ghosh et al., "Statistical pattern analysis of white blood cell nuclei morphometry", IEEE Students Technology Symposium (TechSym), pp. 59-66, 2010.
[3] S. H. Rezatofighi and H. Soltanian-Zadeh, "Automatic recognition of five types of white blood cells in peripheral blood", in Comput. Med. Imag. Graph., vol. 35, no. 4, pp. 333-343, 2011.
[4] S. F. Bikhet, A. M. Darwish, H. A. Tolba, and S. I. Shaheen, "Segmentation and classification of white blood cells," IEEE International Conference on Acoustics, Speech, and Signal Processing, pp. 2259-2261, June 2000.
[5] P. Szolovits, Artificial Intelligence In Medicine. Taylor & Francis, 2019.
[6] A. P. Sahastrabuddhe, "Counting of RBC and WBC using image processing: A review," International Journal of Research in Engineering and Technology, vol. 05, no. 05, pp. 356–360, 2016.
[7] D. Cruz, C. Jennifer, Valiente, L. C. Castor, C. M. T. Mendoza, B. A. Jay, L. S. C. Jane, and P. T. B. Brian, "Determination of blood components (WBCs, RBCs, and Platelets) count in microscopic images using image processing and analysis," in IEEEInternational Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM'17), Manila, Philippines, December 2017.
[8] V. D. Dvanesh, P. S. Lakshmi, K. Reddy, and A. S. Vasavi, "Blood cell count using digital image processing," in International Conference on Current Trends towards Converging Technologies (ICCTCT'18), Coimbatore, India, March 2018.
[9] V. Aparna, T. V. Sarath, and K. I. Ramachandran, "Simulation model for anemia detection using RBC counting algorithms and watershed transform," in International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT'17), Kannur, India, July 2017.
[10] S. S. Savkare, A. S. Narote, and S. P. Narote, "Automatic blood cell segmentation using K-mean clustering from microscopic thin blood images," in ACM Proceedings of the Third International Symposium on Computer Vision and the Internet (VisionNet'16), Jaipur, India, July 2016.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)