IJFANS International Journal of Food and Nutritional Sciences

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

An innovative CNN framework for classifying RBC images

Teja Sreenu Tadivaka[1],

[1]Department of Electrical and Electronics Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Andhra Pradesh, India, 522302.

tejasreenu.tadivaka@kluniversity.in

Sunandana Reddy Machireddy[2],

[2]Department of Civil Engineering, Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal, Andhra Pradesh, India, 518501.

V NAGA SIVA RAMA MURTHY[3]

[3]Department of Electrical and Electronics Engineering Ramachandra College of Engineering, Eluru, Andhra Pradesh, India, 534007.

M Srikanth[4].

[4]Department of Electrical and Electronics Engineering Vasireddy Venkatadri Institute of Technology, Guntur, Andhra Pradesh, India. 522508.

Abstract.

The proposed research aims to revolutionize the categorization of RBC (Red Blood Cell) images by implementing a criteria-based classification system. It strives to enhance classification precision by harnessing the potential of Deep Convolutional Neural Networks (DCNs) compared to traditional CNNs. Utilizing a dataset comprising 790 images as the benchmark, a specifically tailored Deep Convolutional Neural Network is employed for analysis. The research presents a novel deep learning approach geared towards refining the accuracy of RBC image classification by contrasting the performance of Convolutional Neural Networks against Deep Convolutional Neural Networks. Through the utilization of G power, a sample size of 27 per group was determined for experimentation. The outcomes illustrate that the Deep Convolutional Neural Network exhibits superior performance, achieving a classification accuracy of 93.8%, with the lowest mean error, in contrast to the Convolutional Neural Network's accuracy of 85.8%. Notably, a significant difference of p=0.005 is observed between these two classifiers. In summary, this study conclusively demonstrates that for the classification of blood cell images, the Deep Convolutional Neural Network surpasses the

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

Conventional Neural Network, showcasing its remarkable efficacy and potential for advancement in this domain

Keywords: *Novel Criterion Based Image Classification, Image Segmentation, Deep Convolutional Neural Network, Conventional Neural Network, Deep Learning Algorithms.*

INTRODUCTION

Cells in human blood are three sorts: White platelets, red platelets and Blood Platelets. White platelets assume a critical part in the resistant arrangement of the human body. Red blood cells (RBC) transport oxygen, and platelets actuate blood thickening in harmed tissues [1]. The size, shape and surface of RBC contrasts in view of the ailment. Exact characterization of RBC pictures will be useful in finding of different infections.

Red platelets convey oxygen all around the body and are generally essential to human wellbeing. Frailty may be caused by a variety of factors, including abnormal RBC formation, pregnancy-induced water retention, a decline in erythropoietin age, a lack of iron material intake, and blood misfortunes during the time [2]. There are a few significant specialized difficulties for programmed cell grouping: RBC pictures cross-over in the picture space, which makes it hard to order into bunches. The RBC area and the foundation might have low differentiation in the power, Boundaries of RBC might be foggy because of the impact of imaging technique, very mind boggling and heterogeneous states of RBCs are available in Sickle cell sickness (SCD), lastly, on the grounds that RBCs come up short on core, strategies using the cores according to an evident creator for cell counting and location are not pertinent [3]. Convolutional neural networks are used in the Profound Learning technique to learn from images and develop important components via multiplayer design. These highlights are then used to perceive the example applicable to the order issue [4]. The total blood include assumes a significant part in diagnostics and the board of various sicknesses. Though change has been broadly utilized as an apparatus for division of blood smear pictures to count platelets [5]. Since the administrator is invariant against any monotonic shift in the dark scale, it is highly hearty. The tiniest examination of blood spreads provides information on the health and well-being of people. The differential blood count results reveal a broad range of serious haematological conditions. It is common practise for experienced administrators to carry out the differential blood count [6]. Already our group has a rich involvement with chipping away at different examination projects across numerous disciplines [7].

The examination hole distinguished from the writing overview is that arrangement models embracing ordinary CNN don't encode the position and direction of the item into their expectations. They lose all their inside information about the posture and the direction of the item and they course all the data to the very neurons that will be unable to manage this sort of data. This prompts unfortunate characterization exactness. The point of this review is to ad lib the order exactness with ideal assets by joining profound CNN.

MATERIALS AND METHODS

There is an intel i3 CPU, 50 gigabytes of hard drive space, 4 gigabytes of RAM, and a Windows OS and Matlab necessary for this study. An information ace dataset of 7043 entries was used for the project. A total of two blood collections were evaluated for order accuracy. To improve accuracy, a total of ten cycles were run on each collection. An ace photo dataset collected from Kaggle is used in the study.

Convolutional Neural Network (CNN)

A CNN is a profound learning calculation which can take the info picture, allocate significance to different perspectives in the picture and have the option to separate one from the other. The pre-processing expected in a Convent is a lot of lower when contrasted with other Classification calculations. Figure 1. shows structure of CNN.

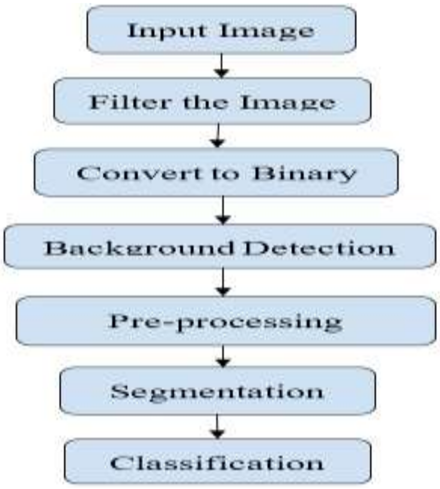

Figure 1. Flowchart for Convolutional Neural Network Algorithm

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

Deep Convolutional Neural Network

For grouping, powerful CNN are used, while GPU innovation is put to use for equitable treatment. The information is convolutionally processed using convolutional layers. The next layer receives the data from this layer. In the next layer, a single neuron is created by combining the output of many clusters of neurons. All neurons in one layer are connected to all neurons in the next by completely related layers. Platelet images may be analysed using a Deep CNN, as seen in Figure 2. The Deep CNN pseudocode is provided below.

Step 1: Increase capsule layer count.

Step 2: Increase the count of capsules in the main capsule layer.

Step 3: Assemble various models and take the average.

Step 4: Set the reconstruction loss scaling factor.

Step 5: Add more ConvLayer.

Step 6: Examine more activation functions.

Step 7: Perform analysis on the quality using the average values of the features extracted.

Step 8: Classify the sample for the type and grade based on the analysis

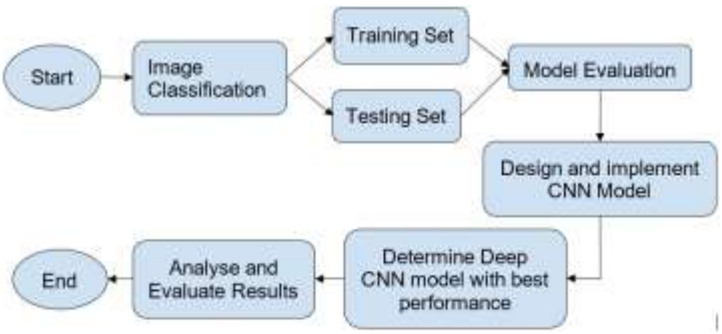

Figure 2. The Framework of the Deep CNN

STATISTICAL ANALYSIS

For quantifiable research, the SPSS factual programming was used in the examination. On the exploratory results, bunch measurements and autonomous example t-tests were conducted, and the diagram was done for two gatherings with two borders under evaluation.

RESULTS AND DISCUSSION

The proposed calculation DCNN and existing calculation CNN were run at a time in MATLAB 2014. As the example sets are executed for various cycles the exactness and responsiveness upsides of CNN and DCNN classifiers fluctuate for arrangement of platelets as

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

displayed in Table 1. Investigation of the general characterization of platelets by CNN and DCNN models are finished. DCNN shows better exactness (93.8%) than CNN (85.8%). The factual investigation for the boundaries of exactness and awareness in light of the quantity of cycles were finished. The Standard mistake is likewise less in CNN in contrast with DCNN as displayed in Table 2. Examination of the importance level for DCNN and CNN calculations were investigated with esteem p = 0.05. Both DCNN and CNN have an importance level under 0.05 with a 95% certainty span as in Table 3. Figure 3. and Figure 4. shows the correlation of mean exactness and mean responsiveness of CNN and DCNN.

Table 1. Comparison of Accuracy and Sensitivity achieved during the evaluation of DCNN and CNN models for classification with different iterations.

Algorithm	Accuracy	Sensitivity
CNN	85%	80%
CNN	87%	79%
CNN	86%	80%
CNN	85%	76%
CNN	86%	75%
DCNN	95%	85%
DCNN	94%	84%
DCNN	95%	85%
DCNN	93%	83%
DCNN	92%	82%

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

Table 2. Statistical Analysis of Mean, Standard Deviation, and Standard Error of DCNN and CNN Sensitivity. There is a statistically significant variation in the algorithms' Accuracy and Sensitivity values. When compared to CNN, DCNN had the greatest Accuracy (93.8%) and Sensitivity (83.8%). In addition, CNN has a lower standard error than DCNN.

Algorithm		N	Std. Deviation	Std. Error Mean	Mean
Accuracy	CNN	5	.83666	.37417	85.8000
	DCNN	5	1.30384	.58310	93.8000
Sensitivity	CNN	5	2.34521	1.04881	78.0000
	DCNN	5	1.30384	.58310	83.8000

Table 3. The significance level for the DCNN and CNN algorithms with a value of p = 0.05 is compared. In terms of accuracy, both DCNN and CNN have a significance level of less than 0.05 with a 95 % confidence interval.

	Levene's Test for Equality of Variances		T-test for Equality of means						
	F	Sig.	t	df	Sig(2-tailed)	Mean Difference	Std. Error Difference	95% confidence interval of the Difference	
								Lower	Upper
Accuracy	1.49	.25	-	8	.000	-8.0000	.69282	-	-

IJFANS International Journal of Food and Nutritional Sciences

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

	3	7	11.547 -11.547	6.817	.000	-8.0000	.69282	9.59765 -9.64724	6.40235 -6.35276
Sensitivity	5.434	.048	-4.833 -4.833	8 6.257	.001 .003	-5.8000 -5.8000	1.20000 1.20000	-8.56720 -8.70730	-3.03280 -2.89270

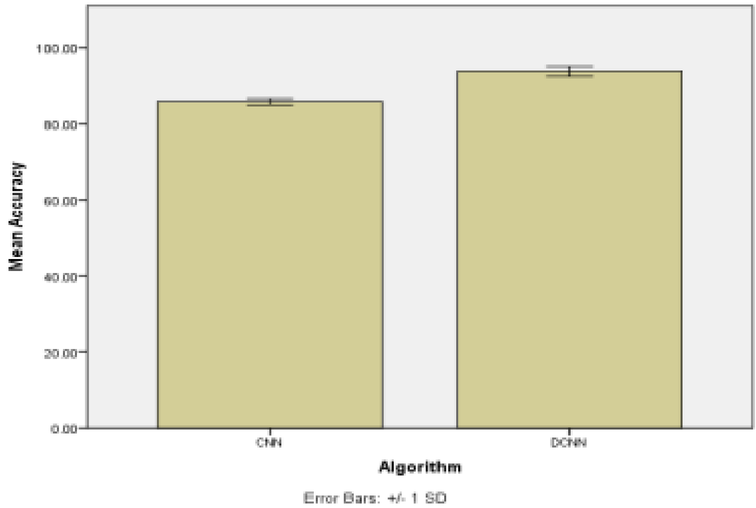

Figure 3. The mean accuracy of the CNN and DCNN algorithms are compared. Compared with DCNN, CNN seems to have a lower standard error. DCNN tends to provide more reliable findings that are also more accurate than other methods. CNN versus DCNN Algorithm: X-Axis. Y-Axis: Mean detection accuracy +/-1 SD.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019

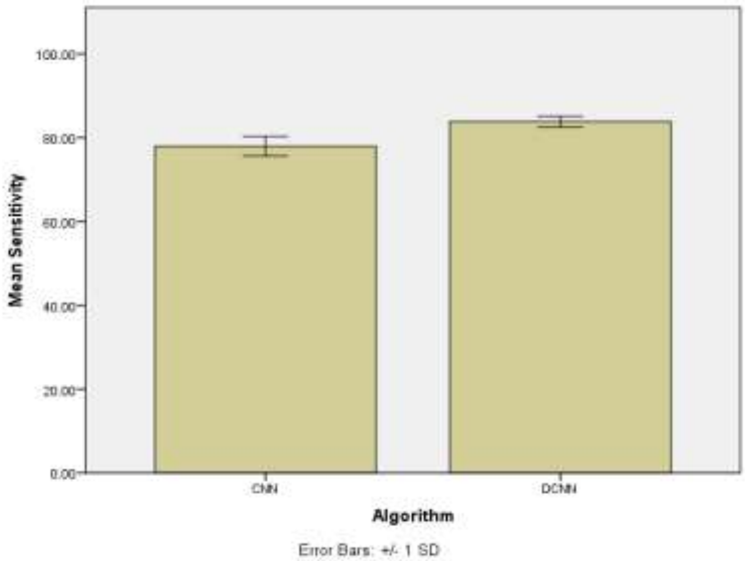

Figure 4. The mean sensitivity of the CNN and DCNN algorithms are compared. Compared with DCNN, CNN seems to have a lower standard error. It indicates that DCNN is more reliable and has a greater degree of sensitivity. CNN versus DCNN Algorithm: X-Axis. Slope: The standard deviation of the average detection rate, shown as the Y-Axis.

Tests were led among the review bunches CNN and DCNN by changing example size. From the tests, it is seen that proposed DCNN provides better performance as far as characterization of platelets by accomplishing better precision and less blunder rate contrasted with the CNN calculation.

The CNN would be of an incredible worth to clinical indicative framework used to distinguish illness in platelets. The Deep Convolutional Neural Network is a discovery and grouping of white platelets through profound learning procedures, a productive strategy for picture characterization since it disposes of the greater part of the means utilized in the conventional picture arrangement methods [8]. The past discoveries of this review demonstrate that the characterization of the RBC can permit us to analyse various illnesses. Researcher [9] proposed CNN calculation can separate the element of each fragmented RBC picture and arrange it into 9 different sorts. The advantages of involving the Deep Convolutional Neural Network in platelet picture order demonstrate that the Convolutional Neural Network is a promising choice for characterization of platelet pictures [10]. The advantages of involving the Deep CNN in platelet picture grouping is to track down better exactness and awareness. The Hybrid methodology effectively consolidates two significant focuses of AI: high precision and little element number [11]. The suggested DCNN shown the finest display in WBC order for low-goal and noisy informative indexes with exact element extraction and enhanced network loads. It might be used as an alternative approach in therapeutic applications [12]. Researcher [13] utilized a profound learning approach for characterization of veins. The model orders white platelets as Polynuclear or Mononuclear with a precision of 98% on picked dataset. The model can be additionally improved via preparing on more information and utilizing huge models. This can be kept away from assuming that it tends to be prepared with extremely profound models. However, an enormous volume of information is expected to grow such models [14]. Our group has broad information and examination experience that has convert into great distributions [15].

Albeit the proposed technique accomplished acceptable outcomes, the restriction in the proposed approach is that there should be further developed location of covering cells. In future this can be wiped out by utilizing powerful picture division methods alongside Deep CNN.

CONCLUSION

The outcomes show that the proposed DCNN beats CNN as far as Accuracy and Sensitivity for RBC grouping. The proposed DCNN demonstrated with better exactness (93.8%) when contrasted and CNN for platelet picture grouping.

REFERENCES

1. Singh, I. et al. ‘Blood Cell Types Classification Using CNN’, Bioinformatics and Biomedical Engineering, pp. 727–738. doi:10.1007/978-3-030-45385-5_65 (2019).
2. Alzubaidi, L. et al. ‘Deep Learning Models for Classification of Red Blood Cells in Microscopy Images to Aid in Sickle Cell Anemia Diagnosis’, Electronics, p. 427. doi:10.3390/electronics9030427 (2014).
3. Xu, M. et al. ‘A deep convolutional neural network for classification of red blood cells in sickle cell anemia’, PLoS computational biology, 13(10), p. e1005746 (2017).
4. Pansombut, T. et al. ‘Convolutional Neural Networks for Recognition of Lymphoblast Cell Images’, Computational intelligence and neuroscience, 2019, p. 7519603 (2019).
5. Maspiyanti, F. et al. ‘Plasmodium falciparum stages classification on red blood cell image using region property’, 2016 1st International Conference on Information Technology, Information Systems and Electrical Engineering (ICITISEE) [Preprint]. doi:10.1109/icitisee.2016.7803056 (2016).

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, **UGC CARE Listed (Group -I) Journal Volume 8, Issue 1, 2019**

6. G. Charankumar, P. Raju, Abhishek Dasore, B.V. Appa Rao, An empirical study on modified second order response surface and Taguchi designs for optimizing the process parameters, J. Math. Comput. Sci., 10 (2019), 3065-3073.
7. Rathod, N.J., Chopra, M.K., Chaurasiya, P.K. et al. Optimization on the Turning Process Parameters of SS 304 Using Taguchi and TOPSIS. Ann. Data. Sci. (2017). https://doi.org/10.1007/s40745-021-00369-2.
8. El-Seoud, S.A., Siala, M.H. and McKee, G. 'Detection and Classification of White Blood Cells through Deep Learning Techniques', International Journal of Online and Biomedical Engineering (iJOE), p. 94. doi:10.3991/ijoe.v16i15.15481 (2012).
9. Mohan, S. et al. 'An approach to forecast impact of Covid-19 using supervised machine learning model', Software: practice & experience [Preprint]. doi:10.1002/spe.2969 (2014).
10. Acevedo, A. et al. 'Recognition of peripheral blood cell images using convolutional neural networks', Computer methods and programs in biomedicine, 180, p. 105020 (2019).
11. Sahlol, A.T., Kollmannsberger, P. and Ewees, A.A. 'Efficient Classification of White Blood Cell Leukemia with Improved Swarm Optimization of Deep Features', Scientific reports, 10(1), p. 2536 (2018).
12. Mr. Bhushan Bandre, Ms. Rashmi Khalatkar. Impact of Data Mining Technique in Education Institutions. International Journal of New Practices in Management and Engineering, 4(02), 01–07, (2015).
13. Parab, M.A. and Mehendale, N.D. 'Red blood cell classification using image processing and CNN'. doi:10.1101/2020.05.16.087239.
14. Mrs. Ritika Dhabliya. Obstacle Detection and Text Recognition for Visually Impaired Person Based on Raspberry Pi. International Journal of New Practices in Management and Engineering, 9(02), 01–07, (2017).
15. Anitha, K. et al. 'Hyperbolic Hopfield neural networks for image classification in content-based image retrieval', International Journal of Wavelets, Multiresolution and Information Processing, 19(01), p. 2050059 (2016).