ISSN: 0974-5823 Vol. 7 (Special Issue, Jan.-Mar. 2022)

International Journal of Mechanical Engineering

A Novel Object Identification Machine Learning Algorithm using RCNN with CNN

V.Bhavani Shankar Lakshmi Deepak[1], B.Aishwarya[2*]

[1]Project Scholar, Department of Computer Science and Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamilnadu. India. Pincode: 602105.

[2]Research Supervisor, Corresponding Author, Department of Computer Science and Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamilnadu. India. Pincode: 602105.

***Corresponding Author:** B.Aishwarya

ABSTRACT

Aim: To detect the flower and to print caption its name on the same image by using RCNN Compared With CNN. **Materials and Methods:** A total of 1360 images has been collected from the 17flower's dataset available in VGP (Visual Geometry Group) of the University of oxford. Classification is performed by CNN and RCNN methods as group 1 and group 2 respectively with sample size of (N=5) each. Jupyter notebook is the tool used for application of this paper. Accuracy values are calculated to quantify the performance of the RCNN G power value is 80% algorithm against CNN. **Results:** Average accuracy of 81% is recorded for RCNN Classifier and 71.46% for CNN. Significant difference between RCNN and CNN ($p<0.0132$). **Discussions and Conclusion:** In this study we found that RCNN is (mean=81.60) significantly better than CNN (mean=71.46) for classification of flowers

Keywords*:* Character Recognition, Object Identification, Classification, Novel Machine learning algorithm, RCNN, CNN.

INTRODUCTION

Classification of images plays a vital role in the detection process. The proposed system is to classify images based on features and the input images hold different features. As the features are extracted from each image it will convert the input image into matrix form [1]The filtering of data is done with an activation layer[2]. Negative values are terminated by applying this activation layer. Image classification is used to identify deep classification in medical purposes for disease prediction [3]. This involves many layers for detecting the key features to predict the best solution for the problem. It is also used for automating tasks, like filtering the fruits and other things based on structure [4] and the pattern of the things. Object's caption detection is inextricably linked to other similar computer vision techniques like image recognition and image Novel Machine learning algorithm segmentation, in that it helps us understand and analyze scenes in images or video [2]. Object's caption detection used for Artificial Intelligence applications and subset computer vision.

Object detection is a key technology behind advanced driver assistance systems (ADAS) that enable cars to detect driving lanes or perform pedestrian detection to improve road safety. Object detection is also [2] useful in applications such as video surveillance or image retrieval systems. 3D printing systems have unique vulnerabilities presented by the ability to affect the infill [3] without affecting the exterior. In order to detect malicious infill defects in the 3D printing process, [4] The images are captured layer by layer from the top view of the software simulation preview. Previously our team has a rich experience in working on various research projects across multiple disciplines[5]–[15]

There are 74 research articles published in pubmed and around 1183 articles found in Science Direct. The research gap is to improve the collection of flower dataset. In recent times surveys of machine learning algorithms for image classification explored mostly as they predicted % of output accuracy. The aim of the study is to identify the dataset of (Visual Geometry Group). This article [4] is cited 4 times. An application can be made for predicting flower classification. If numerous objects are identified in the image the object detection may fail and the accuracy falls instantly and training data must be very accurate to get the best of the algorithm**.**

MATERIALS AND METHODS

The research work is carried out in our esteemed Institution Saveetha School of Engineering, SIMATS,Chennai. The laboratory is utilized for experimenting the classification of images from an open dataset available in VGP (Visual Geometry Group) of the University of oxford. Group 1 is the CNN algorithm and group 2 is the RCNN character recognition algorithm. The sample size is taken as 5 and 5 with 1360 images as existing and proposed two groups [2]. The computation is performed using G-power and the obtained G-power is 0% with a confidence interval at 95%.

The dataset is 17flower's from VGP (Visual Geometry Group) of university of oxford that is available as open source.Images of 17 different flowers totalling 1360 images with unique features. Features like color, structure,and pattern. The complete image data of flowers is being extracted from VGP (Visual Geometry Group).

Jupyter Notebook is required for executing the proposed work. Algorithms are compatible with 64-bit, the System should Novel Machine learning algorithm support a minimum of 8GB RAM and 256GB ROM for processing the data, and Intel i5 Processor. Python language has been used for executing each cell in the proposed system.

RCNN

RCNN is a deep neural network aimed to unravel instance segmentation drawbacks in machine learning or laptop vision. In different words, it will separate Object Identification completely from different objects in an exceedingly large image or a video. You provide it an image, it offers you the item bounding boxes, categories.

There square measures 2 stages of RCNN. First, it generates proposals regarding the regions wherever there may be an object supporting the input image. Second, it predicts the category of the item, refines the bounding box and generates a character recognition mask in the pel level of the item supporting the primary stage proposal. each stage square measure connected to the backbone structure.RCNN is done by following order.

Convolution layers

In these layers we train filters to extract the appropriate features of the image. For example, let's say that we are going to train those filters with a Novel Machine learning algorithm to extract the appropriate features for a flower, then those filters are going to learn through training shapes and colors.Convolution networks are generally composed of Convolution layers, pooling layers and a last component which is the fully connected or another extended thing that will be used for an appropriate task like classification or detection.

Region Proposal Network (RPN)

RPN is a small neural network sliding on the last feature map of the convolution layers and predicts whether there is an object or not and also character recognition Object Identification predicts the bounding box of those objects.

Classes and Bounding Boxes prediction

Now we use another Fully connected neural network that takes as an inpt the regions proposed by the RPN and predict object class (classification) and Bounding boxes (Regression).

Dataset preparation

For, analyzing the accurate Flowers17 dataset` has been used, this is downloaded from the university of oxford, It consists of a 17 category flower dataset with 80 images for each class.

The classes are:

Bluebell	Buttercup	Coltsfoot
Cowslip	crocus	daffodil
Daisy	dandelion	fritillary
Iris	lilyvalley	pansy
Snowdrop	sunflower	tigerlily
Tulip	windflower	

Then the data is again reformed into 70%, 69%, 68%, 65% and 67% training datasets. 30%, 31%, 32%, 35% and 33% as testing datasets.The accuracy has been calculated through a package in sklearn the formula used for calculation of accuracy in equation (1),

$$\square\square\square\square\square\square\square\square = \frac{\square\square+\square\square}{\square\square+\square\square+\square\square+\square\square} \quad (1)$$

Statistical Analysis

Statistical Software used for our study is the IBM SPSS. In SPSS, the datasets are prepared using 5 as sample size for dependent variables RCNN and CNN. GroupID is given as a character recognition grouping dependent variable and accuracy is given as the CNN Independent Sample T-Test testing variable. GroupID independent variable is given as 1 for CNN and 2 as RCNN. Descriptive Statistics is applied for the dataset in SPSS.

RESULTS

The accuracy of RCNN with 81% is significantly higher when compared to CNN with 71% as shown in Table 1. It also represents the sample size (N=5),Mean, Standard deviation and Standard error mean are classified based on the color, pattern, and structure for training accuracy and loss of the data.

The RCNN Standard Error Mean and CNN Independent Sample T-Test are applied for the data set fixing confidence interval as 95 % and level of significance as 0.05.There is significant difference in Accuracy (P=0.013) as shown in Table 2.

The accuracy of RCNN is 81% and CNN is 71%.RCNN has significantly performed better when compared to CNN.RCNN appears to Table 3, produce the most consistent results with its standard deviation ranging from the lower 80's to higher 83's.Naive Bayes appears to produce the most variable results with its standard deviation character recognition ranging from the lower 65's to the upper 79's. There is a significant difference between RCNN and CNN ($p<0.5$) Independent sample test). Fig. 1, represents the comparison of mean accuracy of RCNN and CNN. The comparison of accuracy gained. In this study we observed that the RCNN classifier has better significant accuracy than CNN. The analysis below Table 4, represents the comparison of both the classifiers.

DISCUSSION

The statistical values obtained by the proposed system (RCNN) have high accuracy value with 81% and significance value less with 0.0132 when compared (CNN) with accuracy value 71%. Implementation of traffic sign detection on small size sign boards. Small sign character recognition boards may have false assumptions as the large sign can be detected from a longer distance. Using pattern and HSV recognition, the small sign boards can be identified from a longer distance also.

They have used color recognition, for separation of flowers. This is done based on feature extraction of all images trained. This research work depends on color, structure, pattern, image size of images and pixel size [16]. [4] Implemented multiple classification on unmanned aerial vehicles. It classifies all possible images. The image independent variable labeling is a Novel Machine learning algorithm done in training data to obtain the best prediction and this prediction is based on feature extraction of patterns [1]Color recognition Object Identification methods and image pixels methodology is utilized in research work Novel Machine learning algorithm and filtering layers are applied for independent variable detection of structure and pattern of image. The accuracy of previous work appears to be 71% compared with the accuracy of proposed [1]) work of 81%. Compared to previous studies, [4] the current work achieves higher accuracy for effective classification. Resolution of image, need of users and the image scale are the important factors affecting the study of research work. The need of users helps in determining the classification nature. Extraction of features is based on size of image.Increase in size and pixels of image results in increase of matrix value, this mathematical value will perform feature extraction [17].

The system was trained using the 17 flower's dataset, and the model is taught to recognize 17 different types of flowers which are limited. In the future, the model can be improved by taking a wide range of flowers that were not present in the training set. Accuracy also can be improved by taking a wide dataset. Large-scale classification can be used for classifying disease and can predict main affected regions. Automated classification of images can be done in autonomous cars for identification of traffic signs.

CONCLUSION

In this research, the planned RCNN shows a significant accuracy than CNN. RCNN will primarily reduce the effort of physically gathering ready data for arrangement.the accuracy is increased about 10%.The outcomes demonstrate that the characterization precision of CNN was moderately low in this examination and RCNN has shown a better significant accuracy.

DECLARATIONS

Conflict of Interests

No conflict of interest in this manuscript.

Author Contribution

Author VLD was involved in data collection, data analysis, manuscript writing. Author BA was involved in conceptualization, guidance and critical review of manuscript.

Acknowledgements

The authors would like to express their gratitude towards Saveetha School of engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this work successfully.

Funding

We thank the following organizations for providing financial support that enabled us to complete the study.

1. Conjucture Consulting Pvt. Ltd
2. Saveetha University
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of engineering

REFERENCES

[1] F. Kiani, “Image classification using concatenated of co-occurrence matrix features and local ternary patterns.” doi: 10.14293/s2199-1006.1.sor-.pplmncj.v1.

[2] J. Kolluri and S. Razia, “Text classification using Naïve Bayes classifier,” *Materials Today: Proceedings*. 2020. doi: 10.1016/j.matpr.2020.10.058.

[3] Y. M. Oo, Department of Information Technology, Pyay Technological University, N. C. Htun, Department of Information Technology, and Pyay Technological University, “Plant Leaf Disease Detection and Classification using Image Processing,” *International Journal of Research and Engineering*, vol. 5, no. 9. pp. 516–523, 2018. doi: 10.21276/ijre.2018.5.9.4.

[4] M. Prados-Privado, J. García Villalón, A. Blázquez Torres, C. H. Martínez-Martínez, and C. Ivorra, “A Convolutional Neural Network for Automatic Tooth Numbering in Panoramic Images,” *Biomed Res. Int.*, vol. 2021, p. 3625386, Dec. 2021.

[5] D. Ezhilarasan, T. Lakshmi, M. Subha, V. Deepak Nallasamy, and S. Raghunandhakumar, “The ambiguous role of sirtuins in head and neck squamous cell carcinoma,” *Oral Dis.*, Feb. 2021, doi: 10.1111/odi.13798.

[6] R. Balachandar *et al.*, “Enriched pressmud vermicompost production with green manure plants using Eudrilus eugeniae,” *Bioresour. Technol.*, vol. 299, p. 122578, Mar. 2020.

[7] S. Muthukrishnan, H. Krishnaswamy, S. Thanikodi, D. Sundaresan, and V. Venkatraman, “Support vector machine for modelling and simulation of heat exchangers,” *Therm. Sci.*, vol. 24, no. 1 Part B, pp. 499–503, 2020.

[8] A. Kavarthapu and K. Gurumoorthy, “Linking chronic periodontitis and oral cancer: A review,” *Oral Oncol.*, p. 105375, Jun. 2021.

[9] S. C. Sarode, S. Gondivkar, G. S. Sarode, A. Gadbail, and M. Yuwanati, “Hybrid oral potentially malignant disorder: A neglected fact in oral submucous fibrosis,” *Oral Oncol.*, p. 105390, Jun. 2021.

[10] Hannah R, P. Ramani, WM Tilakaratne, G. Sukumaran, A. Ramasubramanian, and R. P. Krishnan, “Author response for ‘Critical appraisal of different triggering pathways for the pathobiology of pemphigus vulgaris—A review.’” Wiley, May 07, 2021. doi: 10.1111/odi.13937/v2/response1.

[11] D. Sekar, D. Nallaswamy, and G. Lakshmanan, “Decoding the functional role of long noncoding RNAs (lncRNAs) in hypertension progression,” *Hypertension research: official journal of the Japanese Society of Hypertension*, vol. 43, no. 7. pp. 724–725, Jul. 2020.

[12] P. Appavu, V. Ramanan M, J. Jayaraman, and H. Venu, “NOx emission reduction techniques in biodiesel-fuelled CI engine: a review,” *Australian Journal of Mechanical Engineering*, vol. 19, no. 2, pp. 210–220, Mar. 2021.

[13] S. Menon, H. Agarwal, S. Rajeshkumar, P. Jacquline Rosy, and V. K. Shanmugam, “Investigating the Antimicrobial Activities of the Biosynthesized Selenium Nanoparticles and Its Statistical Analysis,” *Bionanoscience*, vol. 10, no. 1, pp. 122–135, Mar. 2020.

[14] R. Gopalakrishnan, V. M. Sounthararajan, A. Mohan, and M. Tholkapiyan, “The strength and durability of fly ash and quarry dust light weight foam concrete,” *Materials Today: Proceedings*, vol. 22, pp. 1117–1124, Jan. 2020.

[15] V. R. Arun Prakash, J. F. Xavier, G. Ramesh, T. Maridurai, K. S. Kumar, and R. B. S. Raj, “Mechanical, thermal and fatigue behaviour of surface-treated novel Caryota urens fibre–reinforced epoxy composite,” *Biomass Conversion and Biorefinery*, Aug. 2020, doi: 10.1007/s13399-020-00938-0.

[16] C. Narvekar and M. Rao, “Flower classification using CNN and transfer learning in CNN- Agriculture Perspective,” *2020 3rd International Conference on Intelligent Sustainable Systems (ICISS)*. 2020. doi: 10.1109/iciss49785.2020.9316030.

[17] B. R. Mete and T. Ensari, “Flower Classification with Deep CNN and Machine Learning Algorithms,” *2019 3rd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)*. 2019. doi: 10.1109/ismsit.2019.8932908.

TABLES AND FIGURES

Table 1. Accuracy values of CNN for different Sample Sizes (N=5).

SI.No	GroupID	ACCURACY
1	1	66.7
2	1	68.4
3	1	66.2
4	1	79
5	1	78

Table 2. Accuracy values of RCNN for different Sample Sizes(N=5).

SI.No	GroupID	ACCURACY
1	2	81
2	2	82
3	2	82
4	2	83
5	2	80

Table 3. T-Test comparison RCNN has higher accuracy than CNN.Descriptive Statistics minimum, maximum, mean and standard deviation of two groups RCNN and CNN. 5 sample sizes are taken for both proposed and existing work.

ALGORITHM		n	mean	std.Deviation	Std.Error Mean
ACCURACY	CNN	5	71.46	6.51614	2.91411
	RCNN	5	81.60	1.00	0.51021

Table 4. Group Statistics T-Test for RCNN Standard Error Mean and CNN Independent Sample T-Test is applied for the data set fixing confidence interval as 95 % and level of significance as 0.05.There is significant difference in Accuracy (P=0.013).

ACCURACY	Levene's test for equality of Means		T-test for equality of Means			t-test for Equality of Means95% Confidence Interval of the Differenc	
	F	Sig	t	Sig (2tailed)	df	lower	upper
Equal variance assumed	1.859	132	-3.427	0.0265	8	-16.92	-3.0706
Equal variance not assumed	1.547	134	-3.427	0.0265	6.759	-16.92	-3.0706

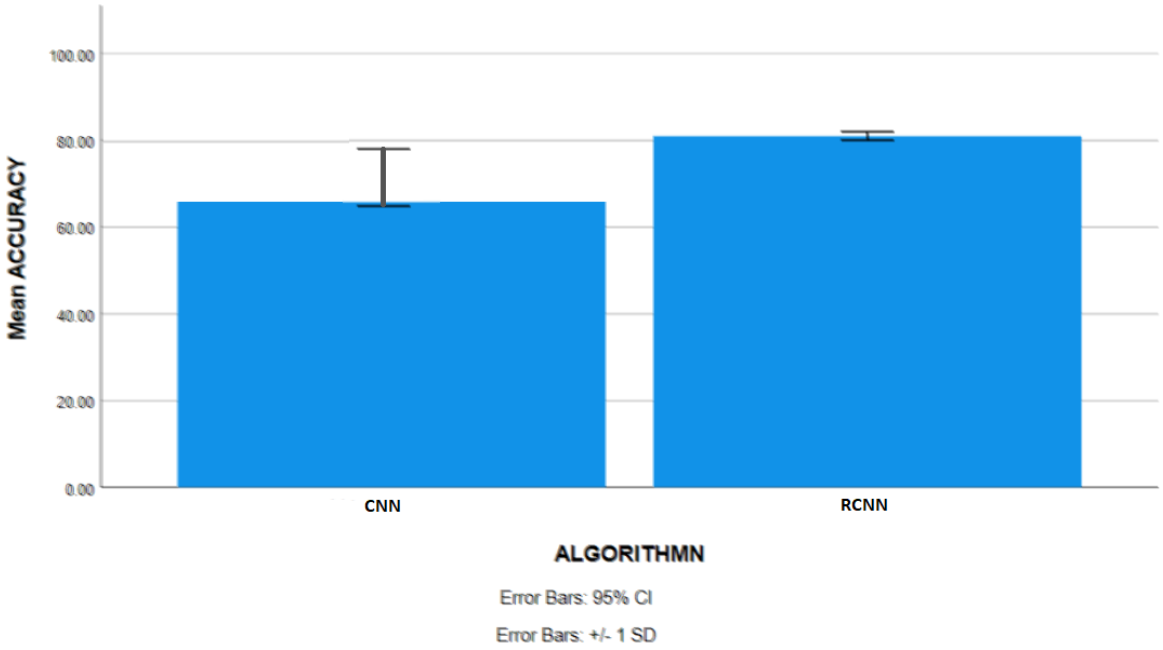

Fig. 1. Bar chart representing the comparison of Mean Accuracy of RCNN and CNN. The mean accuracy of RCNN is better than CNN and the standard deviation of RCNN is better than CNN. X-axis:RCNN vs CNN algorithm. Y-axis: Mean accuracy of detection ±1 SD