iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34415

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 9 Issue V May 2021- Available at www.ijraset.com

Recognition of Dry Fruits using Deep Convolutional Neural Network

Roohi Jan[1], Haneet Kour[2], Jatinder Manhas[3], Vinod Sharma[4]
[1, 2, 4]*Department of Computer Science and IT, University of Jammu, India*
[3]*Department of Computer Science and IT, Bhaderwah Campus, University of Jammu, India*

Abstract: ***Deep Convolutional Neural Network (CNN) with a unique structure for combining the feature extraction and classification stages has been considered to be a state-of-the-art computer vision technique for classification tasks. Though there is much technical advancement, Dry fruit recognition is still a difficult task in daily market. The CNN with deep layers has a tremendous achievement in many image classification applications. In this research work, a novel method has been presented for dry fruits recognition. This model was trained and tested on a primary Dry Fruit image dataset containing a total of 800 images belonging to 4 different classes of Dry fruits. The CNN model performs Dry fruit recognition and was able to achieve an overall classification accuracy of 94%.***

Keywords: Deep CNN, Dry Fruits, Computer Vision, Recognition.

I. INTRODUCTION

India being an agricultural country, agriculture forms the backbone of Indian Economy. India's export in primary sector during 2013 was about $38 billion worth of agricultural products, making it seventh largest agricultural exporter across the world and the sixth largest net exporter [**1**].

Currently, India is the world's second largest producer of several dry fruits. Dry fruits possess a lot of medicinal properties because of the adequate amount of nutrients that are present in them. Although the dry fruits are really expensive and are regarded as delicacies, but the health benefits makes them worth of their price [**2**].

Therefore, accurate and efficient Dry fruit recognition is of great importance in the field of robotic harvesting of agricultural products and thereby increasing countries exporting rate of Dry fruits. In this paper, the emphasis is given on the classification of Dry fruits by using deep learning convolutional Neural Network (CNN) due to wide recognition in terms of performance and reliability of the outcomes achieved. For the current study, four different classes of Dry fruits have been considered .This model has been implemented with deep learning CNN.

The rest of the paper is organized as: Section 2 throws light upon the literature related to the current study, Section 3 presents the materials and methodology adopted in this work, Section 4 discusses the experimental results and Section 5 explains the conclusion of this study.

II. LITERATURE REVIEW

A number of machine learning based approaches have been introduced recently about fruit classification by applying image processing and classification techniques. Researchers also applied deep neural network in the domain of vegetable and fruit classification. These approaches have been found to be efficient in automatic classification of vegetables and fruits.

Sunoj et al. [**3**] presented cashews whole and splits classification using a novel machine vision approach. The base of the study involved a novel idea of using surface grayscale-intensity-profile for split-up cashews and object shadows for split-down and whole cashews. An accuracy of 100% was achieved by the presented approach.

Halac et al. [**4**] proposed Almonds classification using supervised learning methods namely multi-class support vector machines and artificial neural networks in order to perform classification of different types of almonds. In the process of defining the feature vectors, study relied on the principal component analysis to identify the most significant shape and color parameters. The comparative analysis of classification algorithms predicted that higher level of accuracy in almond classification was attained by support vector machine as compared to artificial neural networks.

Siyaranjani et al. [**5**] implemented an approach for computer vision based cashew grading system using deep CNN. The presented study used the computer vision based grading system and also deep Convolution Neural Network (CNN).

Nasiri et al. [**6**] developed an image-based deep learning automated system for sorting of date fruit in order to distinguish healthy date fruit (cv. Shahani) from defective ones. With the use of deep CNN, this method was able to predict the ripening stage of the healthy dates.

VGG-16 architecture was used to construct the proposed CNN model which was followed by max-pooling, dropout, batch normalization, and dense layers.

Training and Testing of this model was based on an image dataset containing four classes, namely Khalal, Rutab, Tamar, and defective date. This CNN model achieved an overall classification accuracy of 96.98%.

Dheir et al. [**7**] introduced a technique based on CNN for classifying nuts types. The proposed work aimed to classify five types of Nuts with a dataset of 2868 images. The trained model achieved an accuracy of 98% on a held-out test set.

Gupta et al. [**8**] presented a detailed overview of fruit classification and grading using soft computing techniques. Various extraction methods like Speeded Up Robust Features (SURF), Histogram of Oriented Gradient (HOG) and Local Binary Pattern (LBP) along with the common features of fruits like color, size, shape and texture have been reviewed. Machine learning algorithms like K-nearest Neighbor (KNN), Support Vector Machine (SVM), Artificial Neural Networks (ANN) and Convolution Neural Networks (CNN) were also discussed.

Zhang et al. **[9]** implemented 13-layer deep convolutional neural network for image based fruit category classification. This study applied 13-layer convolutional neural network (CNN) to the dataset of 173 fruit images with background realistically complicated. To train the CNN, stochastic gradient descent with momentum was used. The overall accuracy of method achieved was 94.94%.

III. METHODOLOGY

This study presents the classification of Dry Fruits based on Deep Convolutional Neural Network. The experimental study has been carried out on *Python* platform using *Jupyter Notebook* interface. The primary Dry fruit dataset has been collected. In this study, the Dry fruits of four different classes have been considered.

The collected dataset comprised of a total of 800 images, belonging to 4 different classes of Dry fruits. Figure 1 presents sample of Dry fruit Dataset.

The four classes of Dry fruits comprised of *Apricot*, *Almond*, *Cashew*, and *Date* each having 200 images. The overall collected dataset was divided into two sets in the ratio 85:15 into *Train Image Set* and *Test Image Set* images respectively. The overall methodology for the proposed work is presented in figure 2.

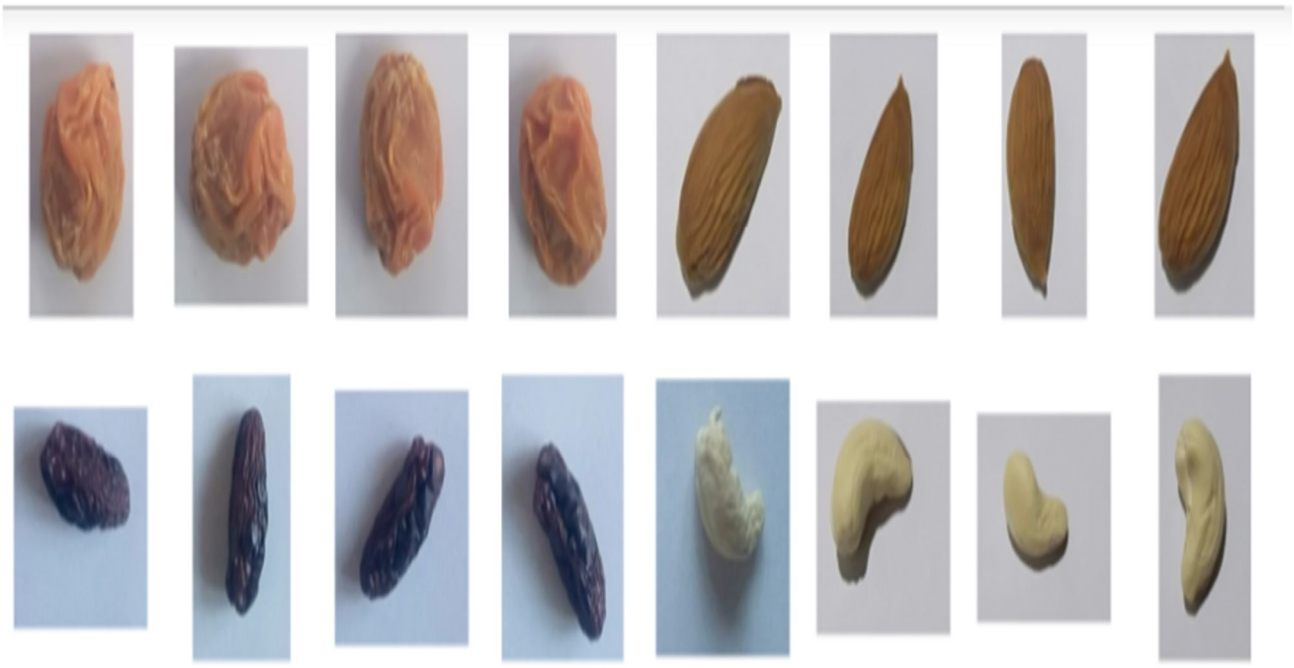


Fig. 1: Sample of Dry Fruit Dataset

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

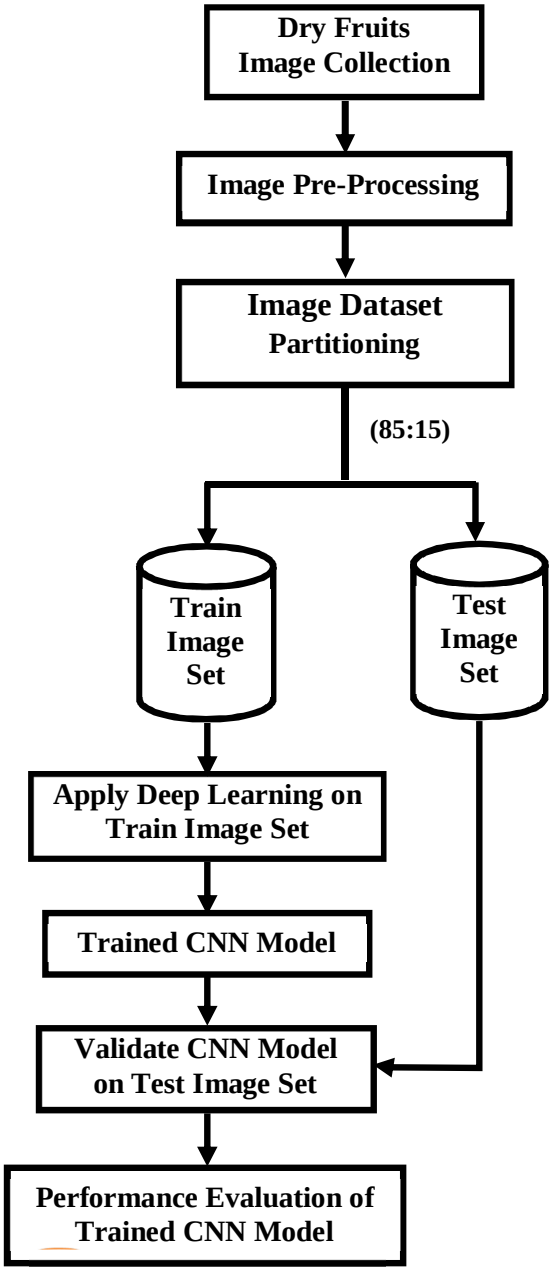


Fig. 2: Methodology of the current work

In this study, primary image dataset for Dry Fruits was collected. It consists of images of four different dry fruits. These collected images have been pre-processed. Pre-processing steps involved *filtering* and *resizing* each image to 100×100 pixels .The pre-processed image dataset was then partitioned into *Train Image Set* and *Test Image Set* in the ratio of 85:15. After dataset splitting, Deep neural network was trained using convolutional *neural Network* algorithm. The CNN model was implemented by setting *three hidden convolutional layers*, each of them followed by *max pooling* layers, *one flatten layer* and *two fully connected dense layers*; and the model training was run for 50 epochs with a mini batch size of 32. In order to avoid overfitting, *data augmentation* has been used. This technique has been done through image processing methods such as flipping horizontally or vertically the input images. The trained CNN model was validated on test image set by computing various performance metrics such as accuracy, recall, precision and f-score. Finally, model performance was evaluated based on experimental results.

IV. RESULT AND DISCUSSION

In this study, convolutional neural network has been implemented for dry fruits classification. CNN model was built on the primary dataset of dry fruits in order to find the classification performance of the network. For determining the overall classification accuracies, four different classes have been taken. From experimental results, it has been found out that CNN architecture can be effectively used for dry fruit classification. The presented CNN model achieved *training accuracy* of *99.7%* and validation *accuracy* of *98.85%*. The performance of the classifier was evaluated based on some measures such as *accuracy*, *precision*, *recall* and *F1-score*. Finally, the overall accuracy of 94% was achieved by the model on test image set. Table 1 depicts the experimental results achieved by CNN model for dry fruit recognition. The presented model predicted the best performance in case of *apricot* class with f-score of 1.0.

Table 1.Experimental Results of Convolutional Neural Network for Dry Fruit recognition

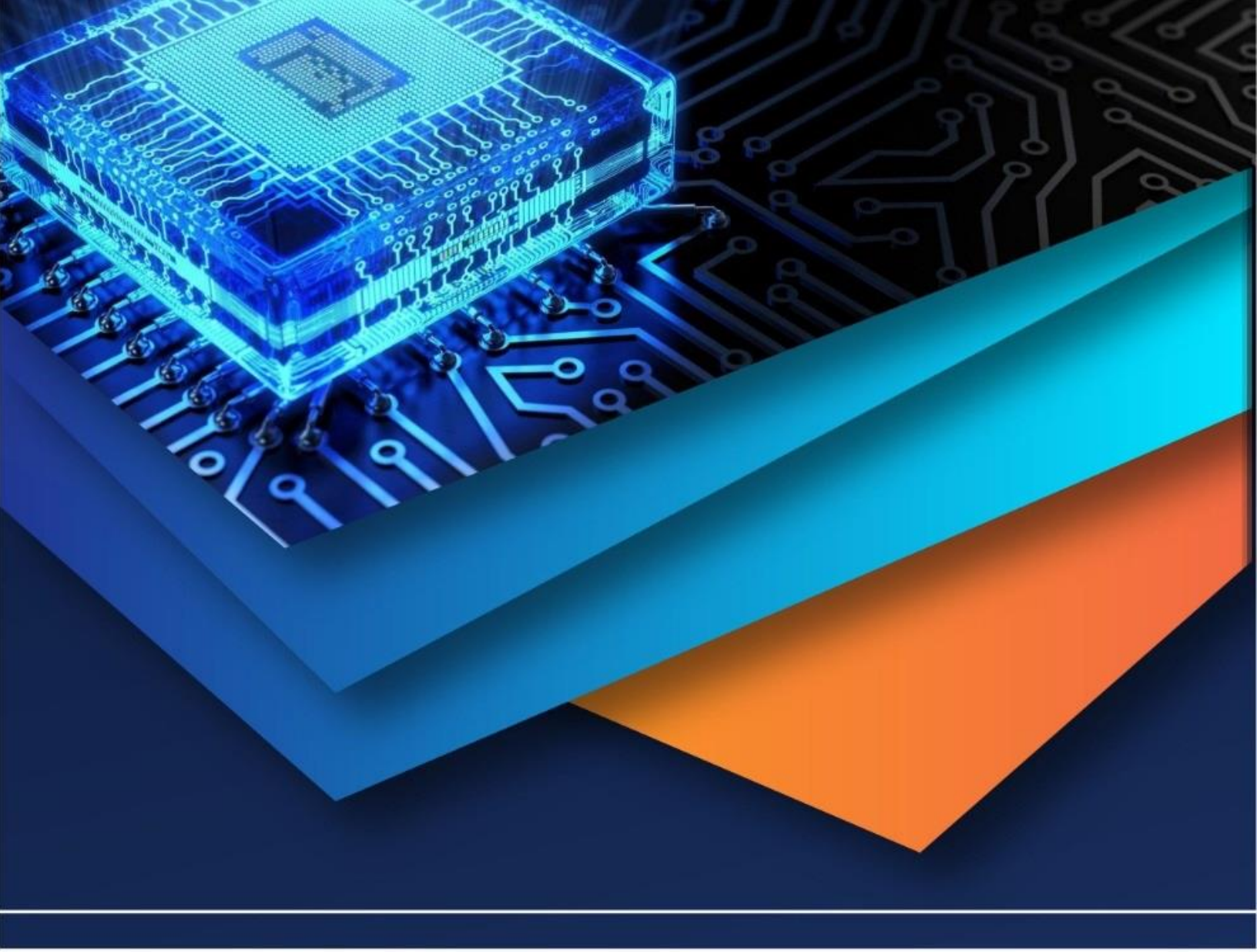
Class	Precision	Recall	F1 score
Apricot	100%	100%	1.00
Almond	90%	100%	0.95
Cashew	100%	97%	0.98
Date	87%	86%	0.87

V. CONCLUSION

This paper explores Dry Fruits recognition classifier based on CNN algorithm.The model achieved the best test accuracy of 94%. This type of higher accuracy will cooperate to stimulate the overall performance of the machine more adequately in Dry Fruits recognition. The current study is limited to four classes of Dry fruits. In future, this work will be extended to include other different varieties of Dry fruits belonging to different regions.

REFRENCES

[1] Agriculture in India, https://en.wikipedia.org/wiki/Agriculture_in_India. [Accessed Online]
[2] Dry Fruits and Its types, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3257681/. [Accessed Online]
[3] S. Sunoj, C. Igathinathane and S. Jenicka, “Cashews Whole and Splits Classification using a Novel Machine Vision Approach”, Journal of Postharvest Biology and Technology, 2017. https://doi.org/10.1016/j.postharvbio.2017.12.006
[4] D. Halac, E. Sokic and E. Turajlic, “Almonds Classification using Supervised Learning Methods”, in Proc. International Conference on Information, Communication and Automation Technologies, 2017. https://doi.org/10.1109/ICAT.2017.8171603
[5] A. Sivaranjani, B. A. Kumar and S. Senthilrani, “An Improvised Algorithm for Computer Vision based Cashew Grading System using Deep CNN”, Journal of Postharvest Biology and Technology, vol. 138, 2018. https://doi.org/10.1016/j.postharvbio.2017.12.006
[6] A. Nasiri, A. Taheri-Garavand and Y. D. Zhang, “Image-based Deep Learning Automated Sorting of Date Fruit”, Journal of Postharvest Biology and Technology, 2019. https://doi.org/10.1016/j.postharvbio.2019.04.003
[7] I. M. Dheir, A. S. Mettleq, A. A. Elsharif and S. S. Abu-Naser ,“Classifying Nuts Types using Convolutional Neural Network”, International Journal of Academic Information Systems Research, vol. 3 no. 12, 2019.
[8] A. Gupta, R. Kushwaha and K. Patidar, “A Survey: Fruit Classification using Machine Learning”, International Journal of Engineering Technology and Applied Science, vol. 5, no. 7, 2019.
[9] Y. D. Zhang, Z. Dong, X. Chen, W. Jia, S. Du, M. Khan and S. H. Wang, “Image based Fruit Category Classification by 13-Layer Deep Convolutional Neural Network and Data Augmentation”, Multimedia Tools and Applications, vol. 78, pp. 3613–3632, 2019. https://doi.org/10.1007/s11042-017-5243-3



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY