e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

6381 907 438 6381 907 438 ijmrset@gmail.com www.ijmrset.com

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 6, Issue 4, April 2023 |

| DOI:10.15680/IJMRSET.2023.0604025 |

Fruit Ripeness Detection Using Deep Convolutional Neural Network (DCNN)

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ABSTRACT: Automatic classification of fruit freshness plays an important role in agriculture industry. Fruit ripeness detection is an important task in the fruit industry to ensure timely harvesting, storage, and distribution. Traditional methods of ripeness detection involve visual inspection by experts, which can be time-consuming and expensive. In recent years, deep learning techniques have been applied to automate this task, with promising results. In this paper, we propose a deep convolutional neural network (DCNN) for fruit ripeness detection. The DCNN model is trained on a large dataset of fruit images with corresponding ripeness labels. The proposed model achieved high accuracy in detecting fruit ripeness levels, which can significantly reduce the manual effort required in the fruit industry. We also evaluated the proposed model on a publicly available dataset of fruit images and achieved competitive results compared to state-of-the-art methods. Our approach shows the potential of deep learning techniques in fruit ripeness detection and can be extended to her fruit quality control applications. ot

KEYWORDS: DCNN, Agriculture.

I. INTRODUCTION

Using deep learning, the Deep Convolution Neural Network (DCNN) is a classifier. When given images as input, a deep CNN adjusts weights and biases based on different objects so that the model can identify those classes. This classifier stands out in that it requires much less image preparation than other classifiers. A deep CNN often has the capacity to teach and train model features. Images' spatial and temporal features are extracted using a convolution neural network. CNN multiplies the input picture values with bias and weights using a linear calculation. The input images are run through a series of filters by a CNN, and the filtered results are then sent to an activation function. During model training, numerous convolution filters are applied at a defined number of epochs, and the combined results produce an activation map.

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. Deep Convolutional neural networks are deep learning algorithms that are very powerful for the analysis of images. This article will explain to you how to construct, train and evaluate deep

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convolutional neural networks. You will also learn how to improve their ability to learn from data, and how to interpret the results of the training. Deep Learning has various applications like image processing, natural language processing, etc. It is also used in Agriculture, Media & Entertainment, Autonomous Cars, etc.

Machine learning is a branch of artificial intelligence that enables computers to “self-learn” from training data and improve over time, without being explicitly programmed. Machine learning algorithms are able to detect patterns in data and learn from them, in order to make their ownpredictions. Machine learning has been extensively used in recent years in day-to-day organizational operations. Major applications include driverless vehicles, video surveillance analysis, virtual assistants, and many others. Some of these applications, however, have a more subtle impact on some firms' core business activities. The categorizing of fruits and vegetables is one of these less obvious uses. Machine learning applications for fruit classification have received a lot of attention, with the major uses being fruit identification and grading or categorization.

This study will utilize a comprehensive dataset of fruit images using DCNN, including ResNet-50,ResNet-100 and VGG-19 models along with corresponding clinical data. The trained models will then be tested on an independent dataset to evaluate their performance and compare them with existing diagnostic methods.

Paper is organized as follows. Section II describes some of the studies related to use of machine and deep learning techniques and image inference for the identification and assessment of Fruit Ripeness levels. The identified techniques are then explained in the Section III. Implementation and experimental results are presented in Section IV. Finally, Section V presents a conclusion.

II. RELATED WORK

Several studies have explored the use of machine learning techniques and image inference for the identification and assessment of liver fibrosis. [1]. “Measuring the Ripeness of Fruit with Hyperspectral Imaging and Deep Learning”. Authors : Leon Amadeus Varga., Jan Makowski., Andreas Zell., 2021. [2]. “AI assisted device for identifying artificially ripened climacteric fruits”.Authors: Sreeraj M.,Jestin Joy., Alphonsa Kuriakose., Sujith M R., Vishnu P K., Haritha Unni.,2020. [3]. “Design and Implementation of IoT based Sensor Module for Real Time Monitoring of Fruit Maturity in Crop Field and in Storage”. Nitin Kothari., and Sunil Joshi,. 2019. [4]“Predicting the ripening of papaya fruit with digital imaging and random forests”. Authors: Pereira, L.F.S., Barbon, S., Valous, N.A., Barbin, D.F., 2018. [5].“Electronic eye for the prediction of parameters related to grape ripening”. Authors: Orlandi,G., Calvini, R., Pigani, L., Foca, G., Simone, G.V., Antonelli, A., Ulrici, A., 2018.

These studies collectively showcase the potential of Deep learning techniques along with image inference, for the identification and staging of liver fibrosis. The integration of diverse imaging models, such as ResNet-50,ResNet-100 and VGG-19 along with clinical data, has shown promising results in improving the classification of fruit levels and performance analysis.

III. METHODOLOGY

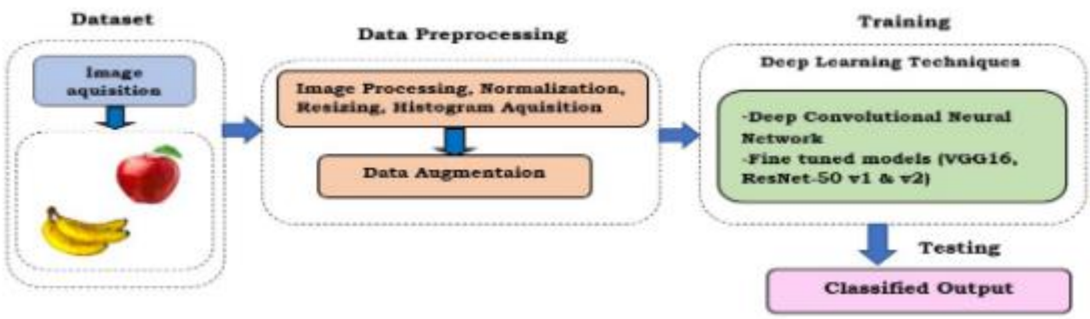

Fig 3.1: Block Diagram of Fruit Ripeness Detection System Using DCNN Models

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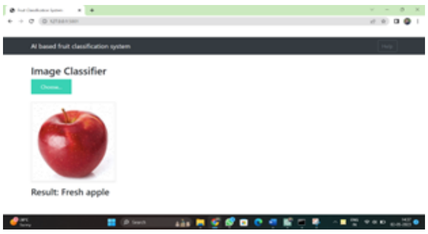
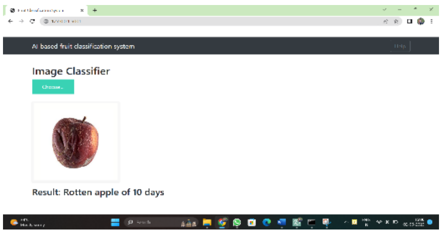
This Block diagram shows various steps being followed in our project. Since it is Deep learning based project. First step we need to collect image data set using any standard camera when we capture image thye will be not in uniform size therefore we need to reduce into a identical shape is called Pre-processing The collected data set should be trained using convolution neural network algorithm. It extract feauturs of image data set and trains our model. Using deep learning, the Deep Convolution Neural Network (DCNN) is a classifier. When given images as input, a Deep CNN adjusts weights and biases based on different objects so that the model can identify those classes. This classifier stands out in that it requires much less image preparation than other classifiers. A deep CNN often has the capacity to teach and train model features. Images' spatial and temporal features are extracted using a convolution neural network. DCNN multiplies the input picture values with bias and weights using a linear calculation. The input images are run through a series of filters by a DCNN, and the filtered results are then sent to an activation function. During model training, numerous convolution filters are applied at a defined number of epochs, and the combined results produce an activation map. In Neural network model there are three layers are they are Input Layer-we will feed the image information, Hidden layer-we will put some Neurons extract the feature of the images, Output Layer-we will give number of neurons which represents the number of probabilities should be displayed. After training we get trained model that should be export for further purpose, we can get the classified output After building the model we can get the performance of the model using some performance matrix libraries which gives the accuracy of the model. The idea of transfer learning served as the foundation for the suggested framework. The pre-trained model needs to be taken into consideration for transfer learning. The pre-trained models taken into account in this framework include several DCNN architectures, including VGG- 19, ResNet-50 and ResNet-100.

IV. EXPERIMENTAL RESULTS

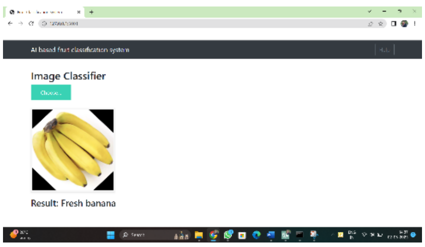
Figures shows the results of identification of liver fibrosis by using the algorithms. Fig 1 (a) shows the Fresh Apple. (b) shows the Rotten Apple. (c) shows the Fresh Banana. (d) shows the Rotten Banana. (e) shows the Fresh Orange. (f) Shows the Rotten Orange.



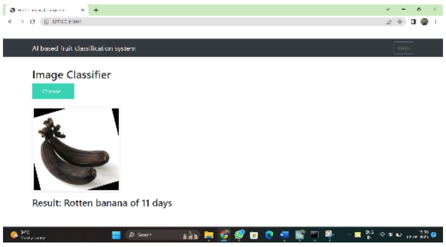
(a)



(b)



(c)



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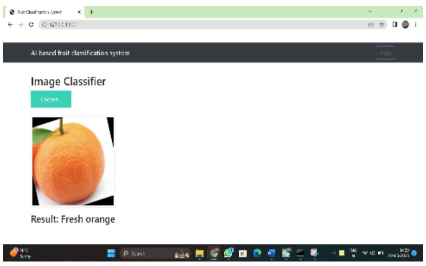
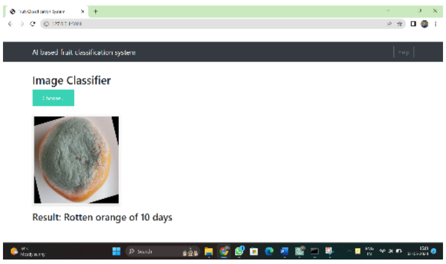


(e)



(f)

Fig. 2 (a)this shows graph displaying the ResNet-50 train loss. (b) this shows graph displaying the ResNet-50 train accuracy.

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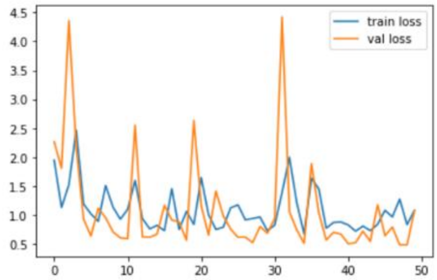
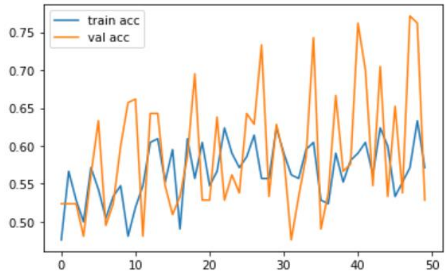


(a)



(b)

V. CONCLUSION

The proposed project is aimed to automate the process of detecting quality of fruits using AI and deep learning techniques. The most current and successful research on improving model performance with a short and quick training period is transfer learning. Hence we are planning to implement transfer learning technique to classification of fruits whose image is captured using mobile app and/or web cam and predict the result using pre trained model. At the project's conclusion, all of the goals were met, including creating a DCNN model to categories fruits by fruit type, creating DCNN models for each individual fruit to categories them according to their fresh and rotten, and creating a web application that can load in these models to enable users of the application to perform fruits freshness inspection.

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