Implementation of Deep Learning Methods to Identify Rotten Fruits

Project Report

Submitted by

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DECLARATION

I hereby declare that the project entitled "**Implementation of Deep Learning Methods to Identify Rotten Fruits**" submitted for the B. Tech. (CSE) degree is my original work and the project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

Signature of the Student

Place:

Date:

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Acknowledgement

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We would also like to express our special gratitude and thanks to University persons for giving us such attention and time.

Anuj Vishwakarma (191b321)

Executive Summary

The project is aimed at developing an online platform for predicting and Identifying Rotten Fruits through a Convolutional Neural Network. Recognizing rotten fruits has been crucial, especially in the agricultural industry.

Humans are often used to classify fresh and rotten fruits, which is useless for fruit. Growers. People get tired after performing the same task repeatedly, yet but robots don't. The study thus suggested a procedure for minimising labour requirements, manufacturing costs, and duration reducing manufacturing time by spotting flaws in farm produce.

If flaws go undetected, infected fruits might spread disease. The fruitful ones. Consequently, we suggested a model to stop the proliferation of evil. The output fruit photos from the suggested paradigm divides fruit into fresh and rotten categories. When using in this experiment, three different fruit varieties—apple, banana, and oranges.

Using a convolutional neural network, the features from the input fruit photographs are gathered, and the images are then classified using the Max pooling, Average pooling, and MobileNetV2 architecture.

On a Kaggle dataset, the suggested model's performance is evaluated, and by using MobileNetV2, it gets the greatest accuracy in training data (99.46%) and validation set (99.61%). The Max pooling has a validation accuracy of 94.97% and a training accuracy of 94.49%.

Additionally, the Average Pooling obtained 93.72% Validation Accuracy and 93.06% Training Accuracy. According to the results, the suggested CNN model can tell the difference between fresh and rotten apples.

1. INTRODUCTION

1. Problem Definition

Image classification problems have become more effective thanks to computer vision techniques, especially in the disciplines of machine learning and deep learning. Among the primary Agricultural field issues include the identification of faulty fruit and the distinction between fresh and spoiled fruits. If not incorrectly categorised, which can potentially have an impact on productivity Fresh fruit can harm other fresh fruit. The classification is time-consuming, generally done by hard-working guys and unsuccessful. Additionally, production costs are frequently increased. We also require a comprehensive system that minimises Human efforts boost productivity while lowering production. Costs and duration of production.

2. Project Overview/Specifications

For feature extraction from an input image of fruits that are orange, apple, and banana, a CNN model is suggested. A Softmax classifier is applied to the images for classification. VGG16, VGG19, Xception, and MobileNet transfer learning models are used to evaluate the accuracy with the proposed model, demonstrating that it is more accurate.
To identify rotten fruits, K. Roy et al. presented a method that uses the segmentation methodology. After the image data is transformed to greyscale, edge detection techniques, marker-based segmentation, color-based segmentation, and thresholding are used to decrease noise. Fruit that is rotting is identified and noted in the output.

Using uNet and En-Unet deep learning architecture, the authors of the research suggested a semantic segmentation technique to identify rotting in fruit using picture data. Prior to training, the raw RGB image is transformed to greyscale, and the data is then masked using thresholding and inverse binarization. The resultant masked binary picture is then taught using deep learning techniques.

In order to determine whether fruits are fresh or rotten, the publication proposes a method that uses segmentation. By identifying the foreground in the "YcbCr" colour space, the image of the fruits is corrected. 'L*a*b*' colour space and KNN clustering method are utilised to separate out the crucial portion of the image.

3. Research Methodology

The agriculture industry in Bangladesh is the most important. In Bangladesh, the agricultural sector contributes for 14.2% of the country's GDP and employs 42.7% of the labour force. To increase the average lifespan of humans, it is important to eradicate the possibility of foodborne illness. Fruits and vegetables are primarily consumed by residents of dangerous neighbourhoods. Therefore, to ensure their security, it is crucial to tell rotten fruits from healthy ones.

Nowadays, automation technology is a necessary component of existence. Bangladesh is a country that depends heavily on agriculture.

They primarily derive their money from agriculture. Fresh fruit is increasingly being sold on a daily basis. Only healthy, high-quality raw fruits are chosen by health-conscious individuals.

Fruit and food production industries are becoming more dynamic in the twenty-first century. The closeness between exporters and importers is determined by global trade and the flow of demand for fruits and vegetables. A lengthy and time-consuming shipping technique is used to import bad goods, which obstructs the quality control of a huge variety of fruits. As a result, it is anticipated that global fruit production and commerce would decline more than in past years. Other major factors contributing to the reduction in trade are unstable environmental trends, climate change, and temperature rise, in addition to all other difficulties.

Aside from the export and import of fresh fruits, the food business has also been severely hampered by the monitoring of the decaying fruit's characteristics.

2. DESCRIPTION OF INTERNSHIP

2.1.About Organization

Malaviya National Institute of Technology Jaipur **(MNIT or NIT Jaipur)** is a public technical university located in Jaipur, India with an emphasis on science, engineering and management. Formerly known as Malaviya Regional Engineering College (MREC) Jaipur, it assumed its present name in 2002 and was recognised as an Institute of National Importance in 2007.
It was founded in 1963 with only 2 engineering branches and now comprises fourteen departments, a school of management and allied centres The institute is fully funded by the Ministry of Human Resource Development (MHRD), Government of India and is governed by a Senate as per NIT Statutes.

2.2.Research and Consultancy

A large number of R&D activities are being carried out by faculty members and students in several cutting-edge science and technology areas. However, most of these research outcomes do not get translated into commercial products, benefiting the society in general, due to several reasons including lack of interest in the industry in commercializing new and futuristic technologies and restriction on the Institute's employees to start entrepreneurship. Towards this end, MNIT Jaipur, in line with the best practices of other institutes of higher learning across the world, encourages interested faculty members to incorporate companies to engage in the businesses, that are direct result of the research and development activities of the faculty member of MNIT Jaipur, be on the board of such companies in the capacity of a Director, Chairman, Promoter or any such role, subject to the terms and conditions of this Policy. The document draws from practices adopted by The National Innovation and Startup Policy 2019, Ministry of Education (MOE) Government of India.

2.3. Internship Activities

The Training & Placement Cell, MNIT Jaipur welcomes recruiters for participation in the SUMMER INTERNS RECRUITMENT PROGRAMME for the B.Tech Pre-Final Year students, M.Tech Pre-Final Year Students and MBA Pre-Final Year Students.

- Period of Internship:

1) 6-8 weeks (1st June-24thJuly, 2022): Summer
2) Six Months: B. Tech. 7th /8thSem (Normally succeeding summer internship); M.Tech 3rd (July-Dec, 2022)/4thSem (Jan-June,2023) 3) One Year: M. Tech. (3rd& 4thSem) (July, 2022 -June,2023)

- Selection Process:
  - o Option I: You may plan a selection visit to the Campus. We would facilitate the process and host your stay at the Guest House of the Institute.
  - O Option II: You let us know of your eligibility requirements and number of interns. The Training & Placement cell shall do the screening and send you the resumes. Further screening process may be done at your end.

The SUMMER INTERNS RECRUITMENT PROGRAMME, organized every year while the students are in the fifth/ sixth semester has successfully met the needs of leading recruiters. It not only helps the students in making the right choices but also enables the recruiters in 'catching them young' through Pre-Placement Offers.
The rigor of study at MNIT Jaipur, coupled with lab practice and balanced exposure to the industry as well as extracurricular activities on campus through a range of student clubs and societies, brings out the best of the students and prepares them well for challenging leadership roles. Summer Internship adds value to our students and we would like to offer the best talent to you through this process.

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3. LITERATURE SURVEY

In the recent years there has been tremendous research done on the CNN. With the help of literature survey, we realized that the basic steps in image recognition are: -

- Dataset Collection
- Pre-processing and augmentation of Data
- Proposed Convolution Neural Network (CNN) architecture
-

3.1 Data collection:

We used a dataset from 10aggle.com for this study. At first, the dataset is fresh fruits and rotten fruits for classification (https://www.kaggle.com/sriramr/fruits-fresh-and-rotten-forclassification). The data set is divided into 6 categories, as follows:

- Fresh Apples
- Fresh Oranges
- Fresh Bananas
- Rotten Apples
- Rotten Oranges
- Rotten Bananas

The dataset contains 13599 images that were used for validation and training.

3.2 Pre-processing and augmentation of Data:

The images in the dataset are not all the same size, so pre-processing was needed for this study. Deep learning models require a significant amount of data for training rather than machine learning .We used Kera's' Image Data Generator tool to resize all of the images to 256 x 256 pixels. We normalized both images after transforming them to 256 X 256. For faster calculation, images are converted to NumPy arrays. The volume of data may be increased by rotating, zooming, shearing, and flipping horizontally. Photos are obtained as well. The photos are then reshaped into 128 x 128 pixels for passing into the second convolution layer, and then down to 64 x 64 pixels for passing into the third convolution layer.

3.3 Proposed CNN Architecture:

For classification and image recognition, CNN is used. One or two convolution layers compose a CNN. Rather than dealing with the entire picture, CNN tries to identify elements that are useful inside it. There are several hidden layers in CNN, as well as an input layer and an output layer. In this study, we used a deep CNN with three convolution layers. Convolution is a technique for merging two mathematical functions to create a single one

4. RESULTS AND OUTPUT

```
fig = show_data(5,4)
fig.tight_layout()
```

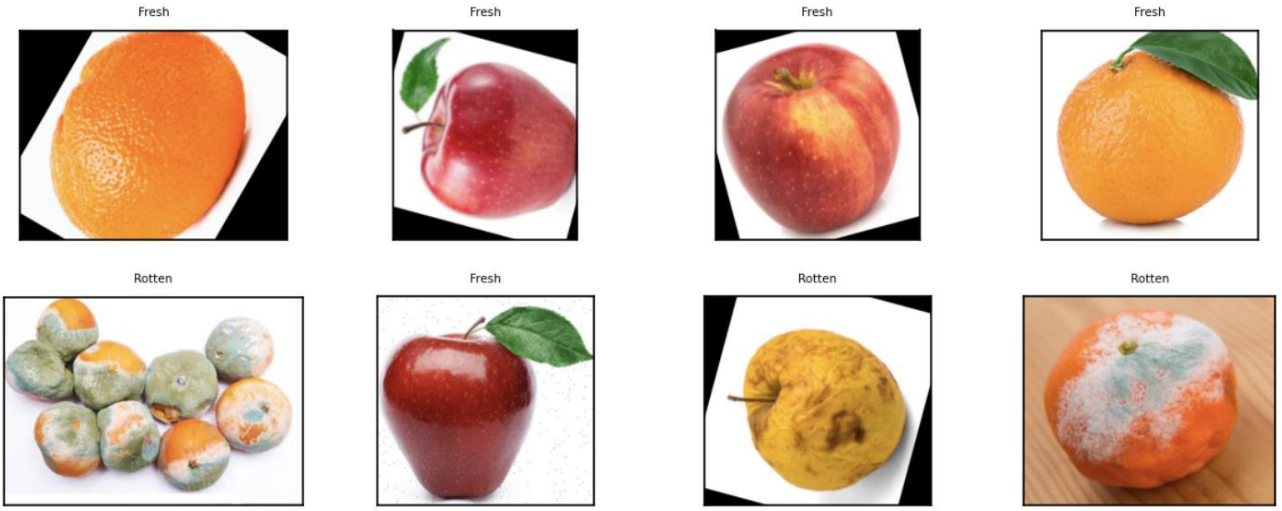

Fig: 1. Training Data

```
fig = show_data(5,4,is_train=False)
fig.tight_layout()
```

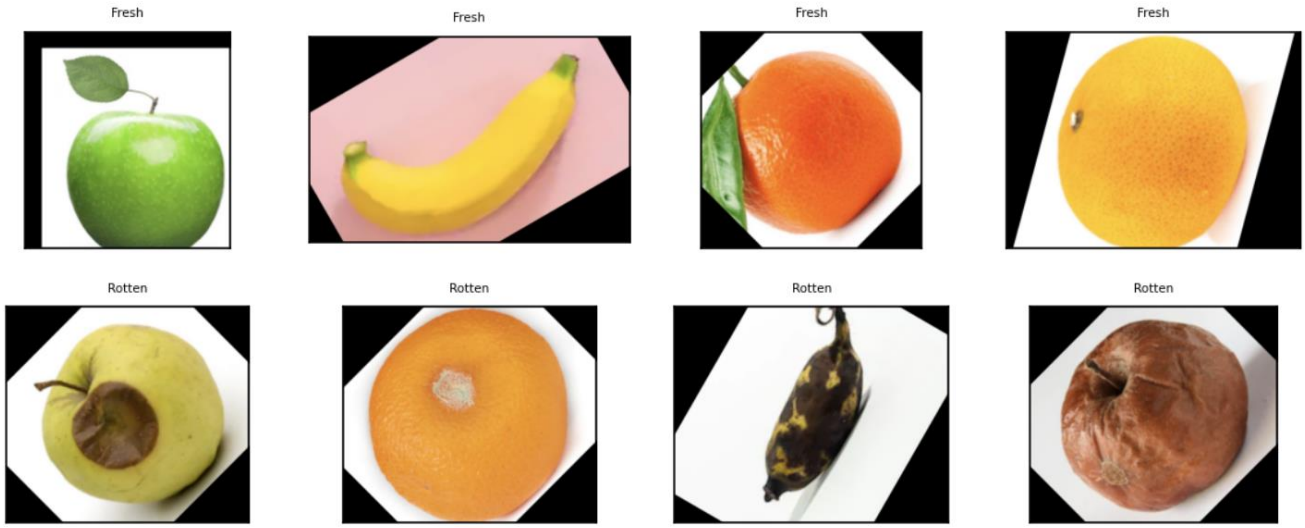

Fig: 2. Test Data

5. CONCLUSION AND FUTURE WORK

In the fruit processing industry, computer vision has a broad variety of uses, enabling processes to be automated. For the industry manufacturing unit to produce the highest quality finished food products and the finest quality raw fruits to be able to be sold in the sector, classification of fruit quality and thus grading of the same is very necessary.

In this study, we used two deep CNN architectures and one CNN-based MobilenetV2 architecture in this study. Our main goal was to propose a suitable model with high accuracy such that fruit detection could be simplified in the agricultural sector.

In order to assess performance with a wider dataset, we can attempt to add further models to compare with Mobilenetv2. In the future, we will integrate this model with IoT to detect rotten fruits automatically by AI and IoT.

6. REFERENCES

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