Fruit Quality Detection Using CNN

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ABSTRACT

In todays world where our daily diet mainly consist of junk food, consumption of good quality fruits have become a necessity. Rather than consuming fruits , our main focus must be towards the quality of the fruits. So here comes the importance of a sytem ,which can sort fruits based on its quality , as sorting fruits by human labour is time consuming and also chance of causing error are more comparing to a machine. Therefore we have devised a model to classify fruits based on their appearances to good/bad. The model mainly make use of Machine Vision Techniques[1] to identify the images of fruits. Processing the outer appearance is the primary step. Then the captured image is preprocessed where the important features like the colour or any black spots or any formation of mould or funguses are detected. The captured images are normalized and the data is also augmented in this step. The image preprocessing[2] helps in classification and comparison of image during both training and testing. The model that we selected is Convolutional Neural Network(CNN)[3] Model. This model comes under Deep Learning[4].

KEYWORDS: Machine Vision [1], Deep Learning [4] , Image Processing [2], Machine Learning [7], Normalization [6], Convolutional Neural Network (CNN) [11].

1.INTRODUCTION

Ensuring the quality of fruits is very important for the consumers as well as for the producers. Consumers can save a lot of money and can also improve their health if they buy high quality fruits . For producers, it helps to maximize their profit and also to reduce post harvest waste. In the market, consumers are attracted by high quality fruits. So producers focus on selling high quality fruits which improves the financial growth of their business. For exporting and international trade, high quality fruits must be given importance . Markets are getting very competitive day by day , so inorder to compete with them we should improve the quality of our fruits.

Bad quality fruits may contain bacteria, pesticides and many more chemicals which can lead to certain health related issues and diseases. Inorder to avoid these issues , we should promote more and more healthy and high quality fruits which will help us to lead a healthy life .Bad quality fruits can lead to wastage which can have a negative impact on our environment and also to our society. Many people suffer from poverty and hunger, so it is important to reduce wastage due to bad fruit and we should promote quality fruits. For producers and farmers, post harvest wastage will reduce their profit .It also affects the money and labour that they have invested on its production and sale.

So classification of fruits is important. Generally fruits are classified by manual labour. But it can lead to high labour cost. Sorting fruits by human labour has a lot of disadvantages. It takes a lot of time to sort and chance of mistakes are more compared to a machine. So a fruit quality detector system is in need of great use ,as it saves a lot of time and we can reduce the labour cost. A machine can be used by everyone including farmers ,producers and also by the consumers. So they can immediately upload a photo and can check the quality in less time, which is more efficient comparing to human labour.

This system helps to classify fruit based on their quality. It uses Conventional Neural Network to classify fruits as good or bad based on their outer appearences such as textures , patterns and spots . Manual sorting requires a lot of time and chances of error are more .This system provides automated sorting where it saves labour cost .This system can detect the quality of fruits more efficiently compared to human beings . As sustainable farming practices are becoming more popular nowadays, this project contributes to more sustainable practices by reducing spoilage and waste . This system predicts the quality of fruits with an accuracy of 92.75%. By using computer vision techniques [8] and machine learning [7]

,this project addresses the current issues of agriculture such as food wastage, high labour cost, labour shortages and also lack of inconsistent quality.

2.LITERATURE SURVEY

1) [11] Himanshu B. Patel and Nitin J. Patil described fruit quality detection using Convolution Neural Network and Stacked Sparse Denoising Auto Encoder Support Vector Machine. Here Spatial Pyramid Pooling is used to get fixed size outputs of images regardless of the input size of images and Back propagation is used to speed up the training and reduce error. Optimum Finite impulse Response wiener filter preprocess the images and CNN extracts color , shape and texture . SSDAE-SVM extracts features , classify and detect quality of fruits. SSDAE prevents overfitting and SVM grades quality of the fruit.
Advantages are it provides an accuracy of 97.25%.It provides fast and efficient image processing. SSDAE-SVM extracts features efficiently which improves the performance, it also prevents overfitting. SVM efficiently helps in the grading of fruits based on the quality.

[12] Swapnil Jadhav et al. described a system that uses Convolutional Neural Network with pretrained model RESNET-50 for classifying fruit quality. RESNET-50 classify the fruits into good quality , bad quality and mixed quality. RESNET-50 is used for resolving the vanishing gradient problem. It introduces skip connection method to resolve the vanishing gradient problem. Also this model reduce the image dimension preserving key features.
Advantages are , it provides high accuracy. It uses pretrained model RESNET-50 , which improves the accuracy of the system. This system is scalable ,which means we can add more fruits according to our need. It uses computer vision techniques and Tensor flow which can be used for object detection.

2) [13] T Thomas Leonid et al. detected the quality of fruits by IoT devices and used Tensorflow for designing the model. Here IoT devices are used to identify chemicals in fruits. Raspberry Pi serves as the controller and coordinates other hardware parts like lcd display , gas sensor , temperature sensor , wifi module and power supply. Convolutional Neural Network acts as the backbone of the model. With Tensorflow an open source deep learning framework which provides tools for machine model training and Keras a high level API on top of tensorflow , makes designing of neural network simpler and more user friendly.
Advantages are, it is scalable. It also has high adaptability. It uses computer vision techniques ,image processing and also machine learning , which improves the accuracy of the model. It is simple and efficient. It is more user friendly, where user can easily interact with the system.

3) [14] Chaitra Sajjan et al. use image processing techniques for fruit quality detection. The image is first captured and given as an input to the model, then image is preprocessed. Preprocess part helps in reducing noise and correct the lens distortion. Then the image is segmented ,that is the fruit is separated from the background. Then the features like color , shape and texture is extracted and the quality of fruits are classified using Convolutional Neural Network. With the help of machine vision and deep learning fruit quality is detected automatically and outperforms traditional methods.
Advantages are , this system uses image processing for extracting the features of the fruit which helps in the easy classification of the fruit.Easy claasificationn improves the accuracy and performance of the system.

3.METHODOLOGY

MACHINE VISION TECHNIQUES: It is a method or a type of technique for automatic decision making based on visual images.This technique is mainly used in robotic guidance or automatic inspections and industrial sectors where reduction of manual labour and increase in production efficiency is mainly focused without compromising the quality of output produced. This process starts by having the exact idea about the requirements and training the machine to find the solution for the difficulties we are facing.

This process is done by capturing the image and extracting the important features and using this said features for finding the solution. Machine vision techniques can vary from the usage such as simple image or by using infrared images and even ultrasound features with other external devices. In this project we made use of simple images and created a model using machine vision techniques [1] for classification of fruits . We used a deep learning model called Convolutional Neural Network(CNN) to further enhance the image classification and feature extraction process. In this deep learning model , the image is passed through several neurons or layers where each process is done in each layer which makes the automatic feature extraction easy and efficient. Machine vision techniques [1] are being widely implemented for remote sensing, surveillance and in various industrial sectors like agriculture for classification of the produced yield.

4.ARCHITECTURE DIAGRAM

The architecture diagram we have used shows how a fruit quality detection model works using an image as an input. The end result shows whether the tested fruit is of good or bad quality.
The detailed explanation for the steps are given below:

1.START:-
The structure initializes the process.

2.CAPTURE IMAGE:-

This is the first and one of the most important step .We give image of the fruit as the input to the system. So the image should be clear and of high resolution. It should be taken in a proper lighting and background as the system detect the quality of the fruit based on spots and patterns seen on the fruit. CNN model works better if the input is clear. Image can be captured using a camera or even with a mobile phone. We can also capture the image in different angles to detect the spots correctly which inturn improve the accuracy of the system.

3.PRE-PROCESSING-:

Before providing the image to the CNN model [3] , it should preprocessed. A preprocessed model can improve the accuracy of the system, as the CNN model depends on the image quality. CNN works better if the image is preprocessed properly. Preprocessing step includes resizing the image if there are images of multiple size. It also includes noise removal and smoothing of the image. The spots and patterns of the image should be enhanced .This step mainly focusses to improve the quality of the image so that the model can detect the quality as good or bad based on the pattern ,spots and textures seen on the image.

4.QUALITY ASSESSMENT:-

Quality of a fruit can be assessed based on its outer appearance. This system takes the image of the fruit as the input and it will detect the quality based on any patterns ,textures or any spots seen on the image. CNN model is used to detect the patterns and textures. It takes a preprocessed image and detect the quality based on its outer appearance . It will provide the output as good or bad.

5.SEPERATOR:-

This is a decision making step where the system classify the image of the fruit as good or bad based on the outer appearance. Image of fruit is taken as the input and then it processes the image. CNN model then classifies the image as good or bad by detecting the patterns, textures or any spots.

6.BAD FRUIT:-

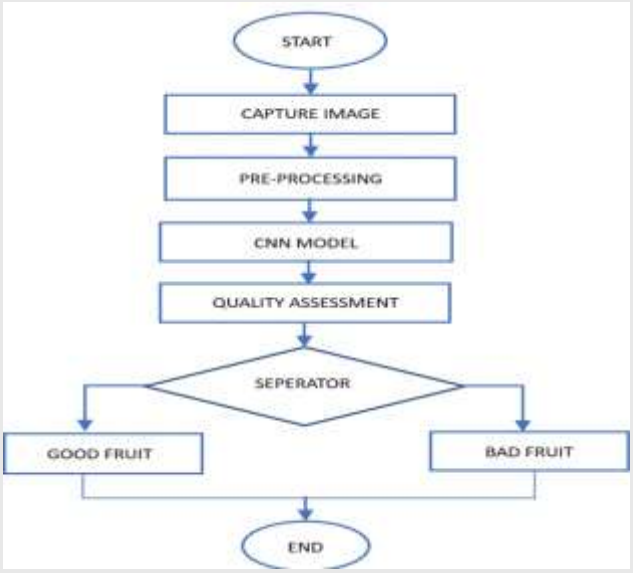
If there are any spots or patterns seen on the image it will be classified as bad fruit.

7.GOOD FRUIT:-

If the fruit is fresh and does not have any spots or patterns will be classified as good fruit.

8.END:-

This workflow stops here after classifying the fruit as good or bad.



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5.RESULT

This system is trained to detect the quality of six fruits which are Apple, Orange, Pomegranate, Guava ,Banana and Mango. This system provides an accuracy of 92.75 %. It is simple and efficient. It is user friendly, as user can easily interact with the system by uploading the image of the fruit and can get the quality in less time.

6.CONCLUSIONS

We know that fruits used to be just a means of dessert that came with a bunch of vitamins and minerals as a bonus ,but this fact has become a thing of the past. We are living in an era where treating fruits as just a means of dessert have become a luxury that could be afforded by a small number of people because of our lifestyle. So along with consuming fruits , equal importance should also be given to the quality of the fruit. Because consuming good quality fruit will improve the health of the person consuming it. So this system will make sure that only good quality fruits will be consumed . This system classifies fruits based on its outer appearance into good or bad so that we can directly eliminate those fruits which are labelled as bad by the system. This system uses Conventional Neural Network for the classification by analyzing its outer appearance by identifying any spots or patterns . Fruits with any patterns or spots can be directly classified as bad . This system can be used in agriculture department as farmers can use this for the classification and can therefore reduce manual sorting . We can also use this system in our daily life when we purchase fruits . So we can say that we can integrate this system in different fields.

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