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FRUIT GRADE CLASSIFICATION USING IMPROVED CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT- Machine learning is the recent research topic which attracts the attention of researchers worldwide. Automation of fruit grading and fruit detection system lays a vital role in field of agriculture and also in the consumer end too. This can be achieved by implementing the image processing techniques and data mining techniques. The image datasets are collected from various online resources. The datasets are collected and examined based on the size, shape, texture and color of the fruit. This system supports in automation of fruit detection and fruit grading process.

Keywords: [Fruit,NeuralNetwork,ConvolutionNeuralNetwork(CNN), KNN, SVM.]

1. INTRODUCTION

In agriculture industry machine learning application for automating the task of fruit classification is the recent focus in research by scholars worldwide. Having this focus in concentration the current research has been developed using image processing and data mining techniques. This classification can be can be used in various areas where grading of fruit is required. In the beginning we have included about 10 fruits for classification. This proposeresearch is beneficial for farmers, fruit vendors to grade the fruit type and variety.

Among the food supplements in day to day life, fruits play an important role in providing nutrition supply for human beings.The nutrition supply provided by fruits act as very good supplement for body. The nutrition provided by fruits when consumed on daily basis reduced the risk of major chronic diseases. On the other hand not all fruits are equal in providing nutrition for body there are differences in it. Also it is to be noted that not everyone are aware of the benefits if consuming certain fruits. The proposed research with the support of advanced machine learning techniques like image processing and artificial intelligence has provided a support system with dataset of fruits.

The proposed system helps the consumer by giving the option of selecting fruits that are more appropriate for him or her. It also gives the details of various characteristics of the fruit. This proposed method can also be used for education purpose also. It helps students to become aware of various fruits and their benefits. Another attractive feature about this system is it acts as the support system for educating the machines i.e robots to improvise

its AI feature. It can be very useful for in the sector which uses machines in automated industries. Application of this system is not only limited to industries it can be used at domestic level too. Example, of automated detection at domestic level is related to smart fridges which is going to very common in very homes.

As it is well known to everyone that health is more type of fruit sold, in stock and also to identify the most wanted fruit by the customers. E-commerce sites can these types of system not only for fruits but also other types of products too. To carry out these tasks at the fullest advanced fruit detection and grading system is required. The proposed system servers the purposes.

2. METHODOLOGY

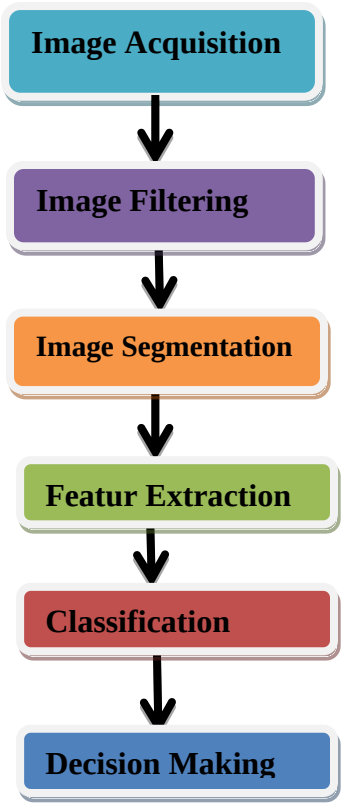


Figure.1: Flow of proposed fruit classification process

Phase: I Dataset used in research

To carry out the proposed research wide range of sample datasets were taken into account. The dataset includes the images from 3268 various sites and real time images were also collected from different fruits markets. Among these dataset 680 images aere taken for testing and remaining were taken for training. Among 3268 images 326 red apple images, 326 green apple images, 326 mango images, 326 orange images, 326 strawberry images, 326 blue berry images, 326 banana images, 326 pine apple images, 326 musk melon, 326 water melon were taken into account for training and testing.

Phase: II Image Pre-processing

The next phase of the propose method is to remove the noise from the images that were acquired from various resources. In this phase the noise in image is removed by sharpening the images details without losing the image details. This process is carriedby converting the RGB image into grey scale image so as the image doesn't lose any fine details of the image. This process is common and preliminary step in image processing.

Phase: III Image Segmentation

After the removing the noises that are present in the image the image is classified into number of small segments for which they can be processed in further. Segmenting the image into number of small parts makes the task of analyzing the image much easier. Images after segmenting are analyzed based on the similarity and the continuity of data in it. These data can be analyzed in two methods as discontinuity based on discontinuity based to implement these methods boundary based and region based are used respectively.

Phase: IV Feature Extraction

In continuation of segmentation process feature extraction is the next step to be carried out. The most important features from the image are extracted for processing. These features help in finding the related data from the image. While extracting the features from image details like colour, shape, texture, size are extracted from it. This information gives accurate information about the fruit data. With

the help of these details it becomes easier for the detection system to identify the data.

Phase: V and VI: Classification and Decision Making

The extracted details from the feature extraction step are passed as input to the classification process. In this step the data are compared with the already defined classification rule. The classification rule is determined based on the already available dataset for classification. The physical features are compared with the universal dataset. In the proposed system comparison and decision making process are carried out using the convolutional neural network. This CNN is a multi-layer process.

3. DATASET

The dataset were collected from various sources are used for both training and testing the proposed CNN model. The dataset was collected from databases like fruits 360 dataset, this data set is available for public access in Kaggle website. The dataset taken from study contain 3268 images from the database. The dataset includes the details of 10 fruit varieties. The dataset chosen are red apple, green apple, oranges, pineapples, strawberry blueberry, banana, musk melon, water melon, and mangoes. Each class of the dataset contains 326 images approximately. These datasets are stored under common folder for easy access of dataset. The images are initially resized into 256X256 image after removing the image background. The image dataset is of common colour format i.e RGB. Amon the dataset tha tare collected from the database almost 80% of data reused for training and remaining 20% is used for testing. The following table shows the data set variety.

Fruit	Training	Testing
Red Apple	**2908**	**360**
Green Apple	**2908**	**360**
Banana	**2908**	**360**
Strawberry	**2908**	**360**
Blue Berry	**2908**	**360**
Mangoes	**2908**	**360**
Pineapple	**2908**	**360**
Musk Melon	**2908**	**360**
Water Melon	**2908**	**360**
Oranges	**2908**	**360**

Table: 1 Fruit dataset

4. CONVOLUTION ALNEURAL NETWORK (CNN)

Convolutional neural Network is a multi-layered network. It works based on both Feed Forward Neural Network and on Back propagation Neural network. The combination of both FFNN and BPNN improves the accuracy and covers all the out layers in the dataset. This multi layered CNN helps in making the task of image analysis, image recognition and image segmentation much effective and easier. For CNN to be made very effective larger dataset is used in it. The dataset can be acquired from the online databases like Kaggle and so on. CNN are the combination of multiple neurons that are very similar to the human brain. These neurons are inter-connected to on another. These neurons form a network in multiple layers. These layers include input layer, hidden layer and output layer. These neurons can be trained by passing the dataset and retrieve the required dataset.

Dataset Properties

1. Trainingdataset size:3268images
2. Validationsetsize:360 images
3. Numberofclasses:10
4. Imagesize:256*256Pixels

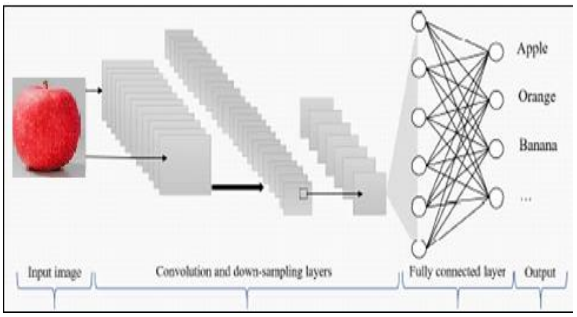


Figure1: CNN Model-proposed2

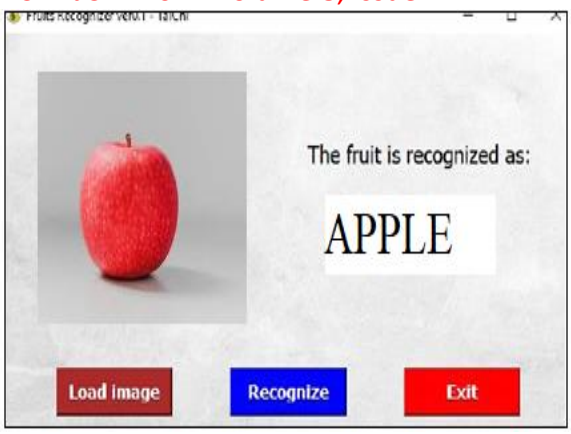
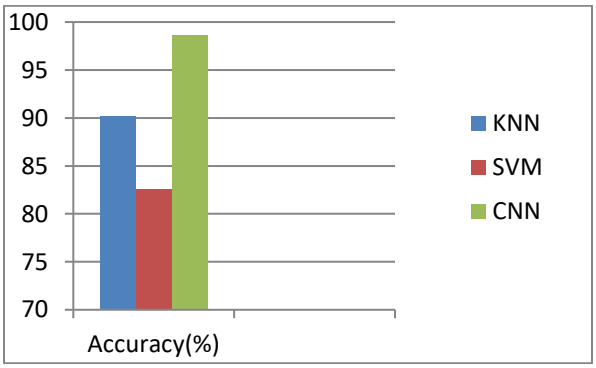


Figure: 2 Process Screen of proposed model

Methods	Accuracy
KNN	90.2%
SVM	82.565
Proposed CNN	98.6%

Table: 2 Accuracy Comparison



Chart; 1 Accuracy comparison

The above chart shows the details description of performance comparison of the dataset in proposed method and also in the existing methods.

CONCLUSION AND FUTURE WORK

The proposed is evidenced to produce higher performance when compared with the other existing methods like KNN and SVM. proposed method shows 98.6%. The proposed method is executed in MATLAB. The same can be experimented by enhancing the dataset and many more class of fruits.

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