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APPLICATION OF DIGITAL IMAGE PROCESSING IN RETAIL AUTOMATED SYSTEM FOR TRANSFER OF VEGETABLES BETWEEN STORES AND WAREHOUSES

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ABSTRACT

Retail industry is growing very fast and it is all about having the right product, at the right place, in the right time, in right quantity and price. In Retail industry each company has stores and warehouses, where the goods are transferred between each other for smooth process. The main objective of the Retail Automated system is to automate the transfer of the vegetables from one place to other places like Store to Store, Store to Warehouse, Warehouse to Store, Warehouse to Warehouse. In this paper, we proposed a system that uses the RGB(Red, Green and Blue) and HSV (Hue, Saturation and Intensity) color features and three shaping attributes. The mean and range color features are used to identify and transfer of the vegetables used in retail industry. The identification range is between 82% to 100% for six types of vegetables. The vegetables used are tomato, onion, brinjal, potato, capsicum and ladies finger.

Keywords: Color features, Mean, Range, Retail, Store, Warehouse

INTRODUCTION

Computer vision is related with the theory for building artificial system. The artificial systems take the information from images. Application of the computer vision can be applied to the retail industry.

In retail industry the stores and warehouses are defined by brand, geography, country or other grouping defined by the company. These stores and warehouses are grouped based on geographical area.

The biggest challenge a retailer faces at stores is caused by out of stock positions, because the warehouse associated was unable to transfer the item. Retailers create their own zones, in which nearby stores and warehouses are associated.
Warehouses transfer the items to the nearby stores and warehouses of same region. Manufactured goods are supplied to the warehouses by suppliers, from warehouses the goods are transferred to the stores. Each warehouse is associated with the number of stores to which it transfers the goods. Whenever the goods are out of stocks, transfer process should happen immediately.

The application of digital image processing can be applied to the transfer of items from one location to the other. In the proposed paper, we have taken non-leafy vegetable transfers from warehouse to store, store to warehouse, warehouse to warehouse or store to store.

The human being use vegetables as food. In the field of agriculture, vegetables are grown in almost all parts of the world. Different varieties of leafy and non-leafy vegetables are grown. The types of vegetables vary across the

countries as well as within the country. Vegetables are sold in the retail supermarket or in the open market.

Human beings recognize the vegetables by the shape, plant structure, color and other attributes. The color features and shape attributes are used in the system to identify six types of vegetables. These vegetables are commonly used in retail stores.

LITERATURE SURVEY

We have carried out the literature survey to know about the developments in the area of automatic recognition of vegetables, the following works are cited:

Ajit Danti, Manohar M and Basavaraj S. Anami, (2012) has represented Mean and Range Color Features Based Identification of Common Indian Leafy Vegetables [1].

Rocha and Goldenstein, (2007) has presented an approach to establish image categories automatically using histograms, colors and shape descriptors with an unsupervised learning method [2].

METHODOLOGY

In the proposed work, the knowledge based method is applied on extracted color features and shape attributes of the input vegetable Images.

PROPOSED WORK

The proposed work aims at solutions to the major issues in automatic recognition of six Indian non-leafy vegetables used in the retail industry which helps in automating the transfer of vegetables between store and warehouse.

Architecture of proposed work is given in figure 1. Mainly it consists of two phases namely Training Phase and Testing Phase. In training phase, we train the system with the help of sample vegetable images. The training phase consists of following stages:

1. Vegetable Image Acquisition
2. Pre-processing of Images
3. Feature extraction
4. Recognition model
5. Classification of Vegetables

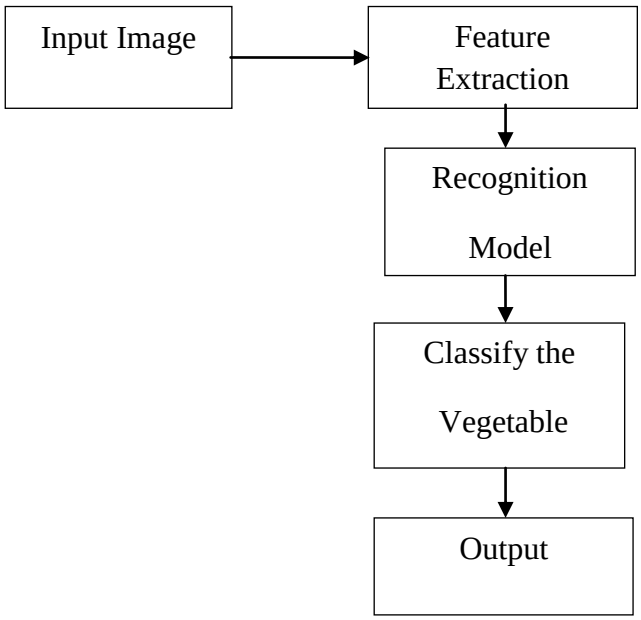

Figure 1. Architecture of the proposed work

The functions of each stage are detailed as follows:

- **Vegetable Image Acquisition**: Sample images are created for the proposed system. These vegetable samples are photographed with certain object distance and light intensity both natural and artificial. The images are likely to have a high resolution so as to yield better results. A digital camera is used with a resolution of 10 mega pixels. We resized these images to the standard size of 100 by 100 size.
- **Pre-processing of Images**: Images that are obtained during image acquisition may not be suitable for recognition because of the shadows and non uniform distribution of light. Hence it is required to highlight certain features of an image. The image-enhancement algorithms are deployed to emphasize, sharpen or smoothen image features for further analysis.
- **Feature extraction**: Non-leafy vegetables have different shapes, sizes and colors. Identifying these kind of vegetables, development of a database is essential and is major part of the proposed work. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors. Color features and shape attributes are extracted from the image.
- **Recognition model:** The Knowledge based methodology is adopted to recognize and classify the vegetables. While extracting the features of the input image, the following equations[4] are used:

i) Color Features

Mean: Mean for the colors is calculated using the equation 1.

Mean=mean2(image) .....…(1)

Standard deviation: Standard deviation is calculated for the colors using the equation 2 :

Stddev = std2(image) .....(2)

Variance: Variance can be calculated by the equation 3:

Variance = stddev*stddev .....(3)

ii) Shape Attributes

Area: One of the attribute of shape is area. So area is calculated for the shape using equation 4:

Area=pi*r*r .....(4)

Where,

pi= 3.142

r= radius

Diameter: Another attribute of the shape is diameter. Diameter is calculated using the equation 5:

Diameter = Sqrt(4*area/pi).....(5)

Where,

Area= pi*r*r

Radius: Another attribute of the shape is Radius. Radius is calculated for the shape using the equation 6:

Radius=Diameter/2 .....(6)

V. RESULT ANALYSIS

From the results it is observed that the identified vegetables have the following accuracy.

Table 1.Accuracy of Retail Automated System

Sl.No.	VEGETABLE	ACCURACY
1.	Brinjal	92%
2.	Capsicum	91%
3.	Potato	85%
4.	Onion	91%
5.	Ladies finger	98%
6.	Tomato	82%

Accuracy is calculated by testing the 50 images against trained images. Each vegetable is tested with 50 testing images for brinjal, capsicum, potato, onion, Ladies finger and Tomato.

The accuracy of each vegetable is given in the figure 2. The accuracy is calculated by extracting the color features and shape attributes of testing image.

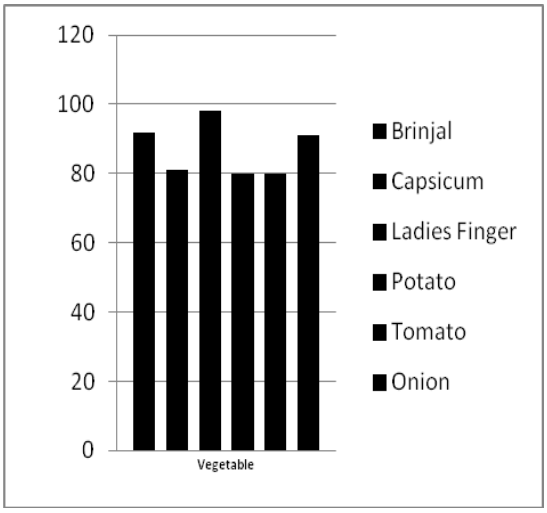

Figure 2. Comparison Graph.

During training phase, 50 images of each vegetable are used to train the system and then 50 images are used to test the accuracy of a vegetable.

System identifies the vegetable during transfer process and detail is stored in the system. The system helps to make the transfer of vegetable that are in good condition.

During the transfer process, the Retail Automated system identifies the six types of vegetables.

VI. Conclusion

The Retail Automated System makes the transfer process easy by identifying the six types of commonly used vegetables in retail stores and warehouse. System finds application in all stores and warehouses of retail industry. The majority of human activities in the real world will be carried out automatically. One such application is proposed wherein the automatic recognition of vegetables of non-leafy are considered in retail industry. The work finds applications in agriculture production Market Corporation and super market.

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