Soft Computing Fuzzy Technique for Fruit Assessment on Basis of Various Tags

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ABSTRACT: Recognition and classifications of two dimensional (2D) fruit images depend on color-based and shape-based analysis methods. However, different fruit images may have similar or identical color and shape values. Hence, using color or shape features analysis methods are still not robust and effective enough to identify and distinguish fruits images. Therefore, a recognition approach for 2D fruit images is proposed, which combines color-based, shape-based, and size based and with combination of fuzzy logics methods in order to increase the accuracy of the recognition result. Fruit detection using improved multiple features based algorithm has been very popular. Color and shape analysis was utilized to segment the images of different fruits. Quality of agricultural products is often associated with their Color and Size. In this paper fuzzy logic is used to detect shape, size and colour of fruit and hybrid of these three and the results obtained are very promising.

I. INTRODUCTION

Agriculture and Horticulture is in great boom . Farmers are trying their best to take care of their crop. A lot of time is wasted in the fields for checking the quality of the crops. Thus there arises a requirement of a fully automated system by which the quality of the fruits or vegetables can easily be checked and also the speed of the process be controlled according to the quality identified**.** In this Paper, an economic and safe way to analyze the fruit or vegetable quality which is based on color, and to control the speed of the grinder according to the quality of the product is proposed. Fruits should be tested via non-destructive techniques because these are delicate materials. The most important physical property is fruit size while color resembles visual property. Hence, classification of fruit is necessary in evaluating agricultural produce, meeting quality standards and increasing market value. It is also helpful in planning, packaging, transportation and marketing operations. If the classification and grading is done through manual techniques, the process will be too slow and sometimes it will be error prone. The labors classify based on color, size, etc. if these quality measures are mapped into automated system by using using suitable programming language then the work will be faster and error free. In recent years, computer machine vision and image processing techniques have been found increasingly useful in the fruit industry, especially for applications in quality inspection and shape sorting.[5]Two main characteristics are decisive for visual inspection and classification of fruits: color and shape. Inefficient autonomous system for fruit sorting must be able to adequately identify both parameters. Fruit's shape can easily be obtained from a digital image using classical techniques for image processing. However, although apparently immediatefor humans, color identification involves many physical and psychological concepts, asking it difficult to properly model and process color in an image. There are wide varieties of color systems present for the grading of fruits based on colors. There are some techniques like Fuzzy logic, Neural Network, Based on Color Histogram, Genetic algorithm etc.[4]
The proposed automated classification and grading system is designed to combine three processes such as feature extraction, sorting and grading. Software development is highly important in this color classification system. The entire system is designed over Matlab software to inspect the color and size of the fruit. Color of the fruit is very important in classification but since due to the similarity of colors between some fruits, the size also helps in solving this kind of problems. The color and size based classification involves extracting the useful information from the fruit surface and classify it to the respective type

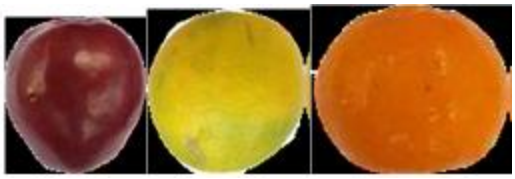


Fig 1: Set of fruits

Based on the fruit's color and length, the fruit is classified to its class. The fruit's area determines its grade and Fuzzy Logic determines width of fruit. Fuzzy logic is a logical system, which is an extension of multivalued logic that allows intermediate values to be defined between conventional evaluations like true/false, yes/no, high/low, etc. Notions like rather tall or very fast can be formulated mathematically and processed by computers, in order to apply a more human-like way of thinking in the programming of computers. Fuzzy Logic has emerged as a profitable tool for the controlling and steering of of systems and complex industrial processes [5].

SYSTEM DESIGN :
In system design, modules, constraints and components are to be considered. The purpose of design phase is planned solution of problem specified by the requirements document. This phase is first step in moving from the problem domain to the solution domain. The output of this phase is design documents. The architectural design is concerned with establishing a basic structure of a system.
Classified and graded output

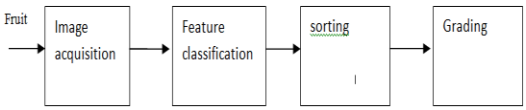


Fig 2: flow chart of sorting and grading process

II. FEATURE EXTRACTION

Matlab image processing toolbox is used in feature extraction process. In this process original image is converted into gray image and then binary image.Feature extraction is the process ofmeasuring or calculating the features from the image samples such that which are sufficient to distinguish between one type of image from another type.Certain fruits can be easily identified by color and size

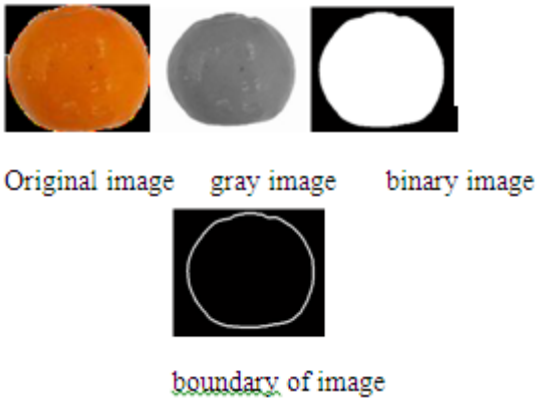


Figure:3

Actual length and width of a fruit is represented by major and minor axis length. This measurement together with the area, determines the size of a fruit. Area is just count of pixel in the region. The major axis length of the fruit is the length (in pixels) of the major axis of the ellipse while the minor axis length is the length of the minor axis of the ellipse.For finding the actual measurements of the sample a reference object of known dimensions is used.

III. SORTING AND GRADING

Fruit sorting system recognize the size and color of an object. A technique for recognizing the fruit shape is proposed here. Fuzzy logic has been used to sort the fruits to their respective classes. The fuzzy logic consists of

1. FIS Editor
2. Membership Function Editor
3. Rule Editor
4. Rule Viewer
5. Surface Viewer

The fuzzy inference system is shown:

1. FIS editor *:*

The FIS Editor handles the high-level issues for the system,their input and output variables,their names. There is no limit of number of inputs in fuzzy logic toolbox software. However, the number of inputs may be limited by the available memory of your machine. If the number of inputs is too large, or the number of membership functions is too big, then it may also be difficult to analyze the FIS using the other GUI tools.

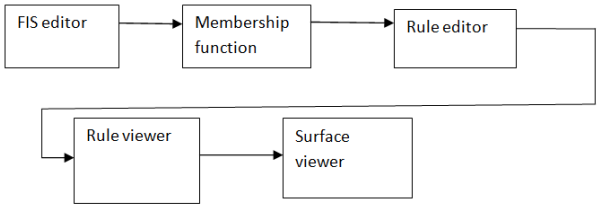


Fig 4. Fuzzy inference system

2. Membership Function Editor *:*

The Membership Function Editor defines shapes of all the membership functions associated with each variable.

IV. IMPLEMENTATION

In this process, fruit samples are captured using regular digital camera with white background with the help of a stand. The image is loaded into matlab for processing. The features such as color content and minor axis are extracted for sorting and parameters such as area and major axis length are extracted for grading the sample image. There are different modules which will perform different operations on the image being loaded. The modules are :

Boundary extraction, Geometric features extraction, Color features extraction ,Classify the sample ,Grade the sample..

1. Image Capture:

By using any digital camera or any mobile phone camera, an image is captured.This image is loaded into the matlab by using the function „imread. This function reads the image from the specified path. The image is stored in the matrix form of rows and columns. If is a gray scale image, then it is stored as an M-by-N array. If the file contains a true color image or RGB image, then it is stored as an M-by-N-by-3 array.

1. *Rule Editor :*The Rule Editor edits the list of rules that defines the behavior of the system.
2. *Rule Viewer :*Rule viewer is used to view the fuzzy inference diagram.
3. *Surface Viewer :*To view the dependency of one of the outputs on any one or two of the inputs—that is, it generates and plots an output surface map for the system.

2. *Boundary extraction*:

Colored input is converted to grayscale by function „rgb2gray(image)" and the syntax is

*I=rgb2gray(RG B).*which converts the truecolor image RGB to the grayscale intensity image I. and then the image is converted to binary before it is used for further processing in which image consists of only two colors namely black and white.

3. *Geometric features extraction*: This module begins with the extracted boundary of the object. The function used to trace the features is „regionprops". The main features extracted are Area, Majoraxis and Minoraxis.
4. *Color features extraction* : Red, green and yellow colors are used for classification as there is a difference between the fruit's skin based on these colors. Hence these colors are helpful for sorting out the fruits. The red and green component is calculated by counting pixel values corresponding the red and green colors and yellow component is calculated by first converting the RGB image to CMY by using the function.

5. *Sorting the samples* :

Separating one kind of sample from another,classification method is used. In this case, one kind of fruit is separated from the other set of fruits by using fuzzy logic.
Mamdani-type inference, as defined for the toolbox, expects the output membership functions to be fuzzy sets. After the aggregation process, there is a fuzzy set for each output variable that needs defuzzification.

6. *Grading the samples :*

Extracting the size of the fruit is called grading. Size is an important criterion related to the market value of the fruit. Hence grading the fruit is important for the farmers before they sell their produce. In this paper, fruit is graded to low or high based on the geometric features of the fruit namely area and major axis.

V. RESULTS

Rresults are based on different dimensions like,size,shape,height,width. Figure shows fuzzy rules used for testing the samples. And provides beeter results than existing systems

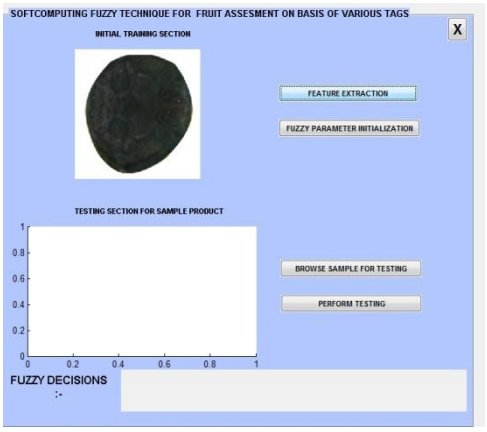


Figure. 5. Initial Sample selection for Training

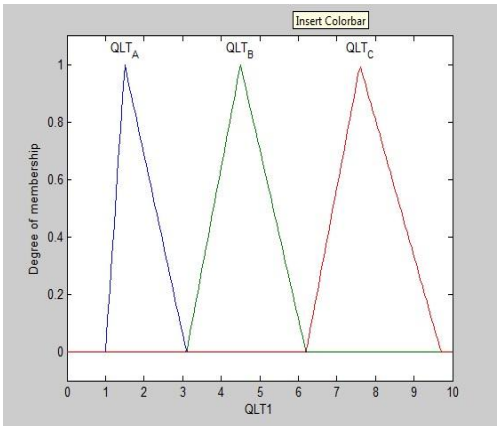


Fig. 6. Membership function diagram for fuzzy section

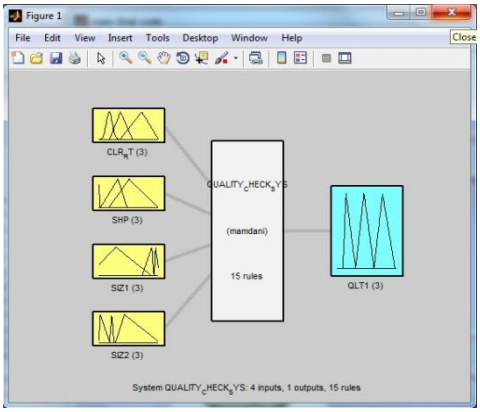
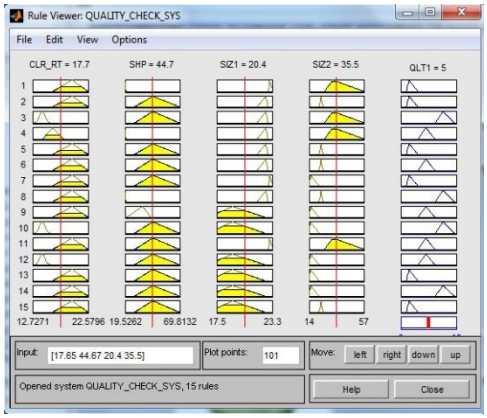


Fig.7. Fuzzy System Designed For Proposed System



System Fig. 8. Rule decleration for inputs and output of fuzzy

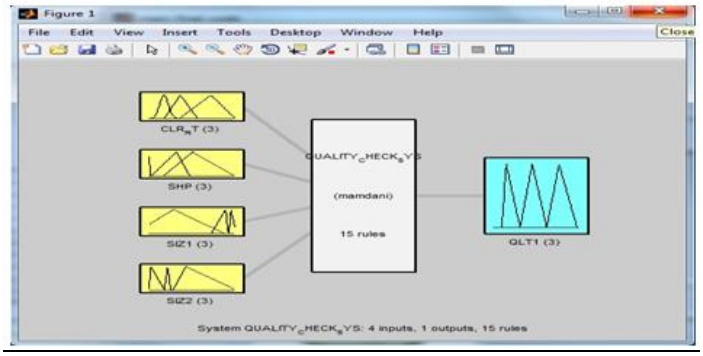


Fig. 9. Fuzzy System Designed For Proposed System

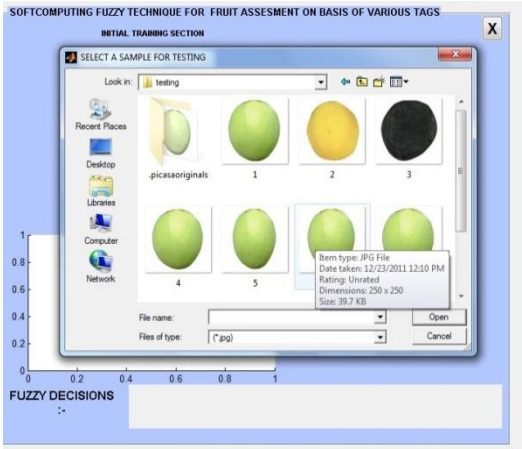


Fig.10. Sample selection for testing

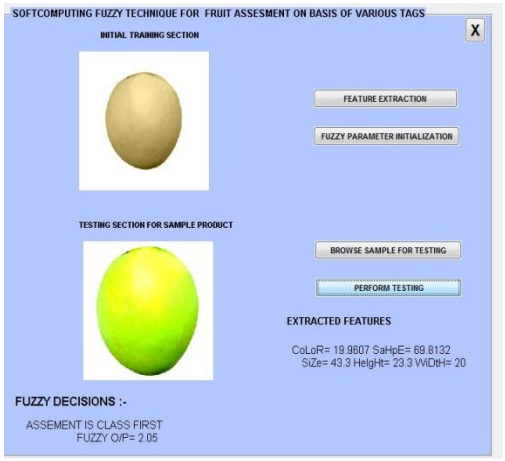


Fig.11. final results for sample given for testing

VI. CONCLUSION

FL was successfully applied to serve as a decision support technique in grading fruits. Grading results obtained from FL showed a good general agreement with the results from the human expert, providing good flexibility in reflecting the expert's expectations and grading standards into the results. It was also seen that color, size,shape,height and width are important criteria in fruit classification. In future studies, the performance of classification based on FL should be compared with other mechanical and automated sorting techniques in addition to manual sorting. Moreover, the shape of the membership functions may be predicted by applying cluster or statistical analysis techniques to the sub-samples of the data to be sorted.

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