A Completion on Fruit Recognition System Using K-Nearest Neighbors Algorithm

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Abstract— Recognition of several fruit images is major challenges for the computers. Mostly fruit recognition techniques which combine different analysis method like color-based, shaped-based, size-based and texture-based. Different fruit images color and shape values are same, but not robust and effective to recognize and identify the images. We introduce new fruits recognition techniques. This combines four features analysis method shape, size and color, texture based method to increase accuracy of recognition. Proposed method used is nearest neighbor classification algorithm. These methods classify and recognize the fruit images from the nearest training fruit example. In this paper it takes the fruit images as input and then recognition system shows the fruit name. Proposed fruit recognition system analyses, classifies and identifies the Fruit recognition system improves the educational learning purpose sharply for small kids and used grocery store to automate labeling and computing the price.

Index Terms— K-Nearest Neighbor, Texture, Classification, Feature Extraction, color.

1 INTRODUCTION

Recognition system has emerged as a 'grand challenge' for computer vision, with the longer term aim of being able to achieve near human levels of recognition for tens of thousands of categories under a wide variety of conditions. Recognition system is the most essential field of computer science. Recognition system is the different criteria. For example visual recognition, sound recognition, voice recognition, handwriting recognition text recognition etc.[3].Face recognition system automatic recognize the input face images from digital image processing. Handwriting recognition technique for postal code , text classification to recognize the different type of text for example spam or non spam email [2].A number of agriculture images techniques used to apply the fruits images for recognition purposes.

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2. FRUIT RECOGNITION APPROACHES

Various fruit recognition approaches are defined briefly:

This paper proposed method used in artificial vision system using ultraviolet near infrareds spectral system. We watched Inspection of the internal and external quality of fruits and vegetables [4].

This paper proposed method used in designed the combination of three different feature color, shape, and size to perform sequential pattern classification. But this method problem is other object classification and recognition problem [5].

This paper proposed method used in texture properties and color data vision based data algorithm the system to perform automatic recognition of the kind of fruit or vegetables using the images from the camera. The process of color classification involves extraction of useful information [6].

This paper proposed method used in KNN Euclidean distance metric to measure the distance between the attributes of the unknown fruit with the stored fruit examples. Then the algorithms find out the nearest or closest examples to unknown fruit. Store fruit example should be consist of various color, shape and size and capture in different angle and position so the system is robust enough and able to recognize the input fruit image [1].

This paper proposed method used in extract Multiple features weight of features .This method is calculating the weight for features likes color ,orientation ,edge ,intensity of the input images. This method is robust & complex of different binary map .This method are not recognize RGB camera images [7].

Automatic image processing is used in the field of agriculture .A number of application of images processing techniques has been developed for agriculture operation. These operations perform the camera based hardware system or color scanner for inputting the images. This technology used to recognize the fruit. [8].

This proposed method used in species and vegetable detection of Fruit and vegetable from image used method in ISADH method. This feature based on sum and difference of intensity values of the neighboring pixel of the color images. The experimental result shows that accurate fruit and vegetable recognition and perform the other texture feature. [9].

3. METHODOLOGY

Methodology is the type of algorithm that being used to develop a system. The proposed methodology in this paper, to perform the analysis for image features extract using steps.

1. Select the fruit image.
2. Crop the area of fruit.
3. Calculate mean value for RGB component.
4. Calculate shape by threshold segmentation (remove noises, morphological operations).
5. Calculate geometrical properties (Area and perimeter).
6. Calculate the roundness value.
7. Calculate entropy values.
8. Use nearest neighbor classification algorithm and their parameter to classify 3, 4, 5, 6,7 of image.
9. Output is the result.

3.1 K-Nearest Neighbors Algorithm

The k-nearest neighbor algorithm is the methodology that has been used to develop the fruit recognition system.KNN Algorithm perform fruit classification by using the distance between the feature value of unknown fruit with the feature value of stored fruit examples after that algorithm will find out the nearest examples to unknown fruit. KNN classifier classify to fruit mean color value; shape roundness value, area and perimeter values.

3.1.1 Crop the area of fruit image

Crop the area of fruit in the fruit images. The area of a binary object is found by the counting the number between the no. of pixels in binary object. The area of fruit can be counting the total no. of pixels that are enclosed by the detected area. We have using the imcrop tool provided in the MATLAB.

3.1.2 Mean of RGB color value

User crops the area of fruit in the fruit image because system will compute the mean values for each of red, green, blue Color component. Area calculating on the 3D matrices then stored all of the fruit pixels. Using the mean function computed by the RGB value for each fruit pixels.

3.1.3 Calculate area, perimeter and roundness value

The fruit shape roundness (metric) value can be computed after extract the area and perimeter of fruit by using equation as below.

$$\text{Metric} = 4\pi (\text{Area}/\text{perimeter}2) \quad (1)$$

3.1.4 Calculate entropy value

Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image. We have provided in mat lab function

$$J = \text{entropyfilt}(I) \quad (2)$$

For pixels on the borders of I, entropyfilt uses symmetric padding. In symmetric padding, the values of padding pixels are a mirror reflection of the border pixels in I

$$I = \text{mat2gray}(A, [\min, \max]) \quad (3)$$

I = mat2gray (A) sets the values of amin and amax to the minimum and maximum values in A. We have also provided in mat lab function.

3.2 Training and classification

After training data system, ready to use.KNN find out the shortest distance between the feature values of test fruit Images with feature value training fruit images. While KNN algorithm finds out the closest example to input fruit then allocate the input fruit to the class where majoring of 'K' closest example is form. 'K' is 1 that means classification of test fruit image is based on stored fruit image.

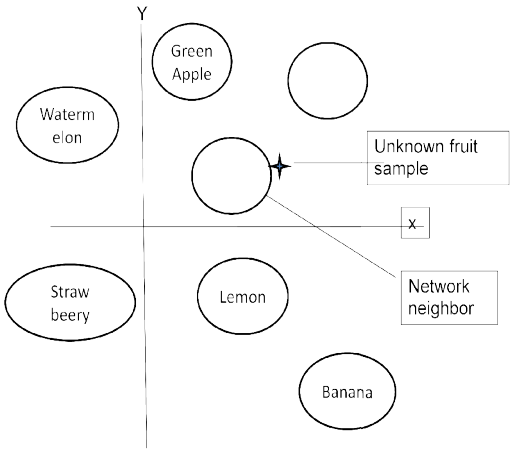

Fig 1: Classification processes of unknown fruit sample and stored fruit sample

The following function to classify the input fruit sample by using the fruit recognition system:-

Class=Knnclassify (sample, training, group)

This function will classify the attributes of input fruit sample with attributes of all other training fruit examples and Find-out the 'K' example then classify the unknown fruit image to the class or group where majoring of the 'K' nearest neighbors is form.

4 EXPERIMENTAL RESULTS AND DISCUSSION

Thirty six fruit images have been collected for fruit recognition system. Twenty four fruit images are used for training purpose and twelve fruit images are used for testing purpose. Table 1, 2, 3 show detail of the color, shape area and perimeter values for each type of fruit in system during training. These stored color values, shape roundness values area and perimeter values are standard features values for classification of input or query fruit image to the system.

Table 1: Stored detail of color (RGB) for each type of fruit in System during training.

Fruit name	Minimum			Maximum		
	R	G	B	R	G	B
Red Apple	32	11	5	255	255	255
Green banana	5	5	0	255	255	255
Green guava	52	60	9	255	449	255
Green melon	0	29	0	254	255	255
Orange	27	13	0	255	255	49
watermelon	19	23	5	255	255	255

Table 2: The minimum and maximum Area and Perimeter and Roundness values for each type of fruit in Fruit Recognition System.

Fruit name	Area		Perimeter		
	Min	Max	Min	Max	Max
Red Apple	**44**	**1270**	**27.0711**	**193.31**	**44**
Green banana	**2437**	**81088**	**468.468**	**1254**	**2437**
Green guava	**33**	**119280**	**2.9394**	**2.9467**	**33**
Green melon	**50450**	**50450**	**904**	**904**	**50450**
Orange	**57**	**139**	**33.21**	**63.01**	**57**
watermelon	**33**	**119280**	**2.9394**	**1254**	**33**

Table 3: The minimum and maximum Entropy values for each type of fruit in Fruit Recognition

Fruit name	Entropy	
	Min	Max
Red Apple	0	6.21639
Green banana	0	6.21639
Green guava	0	6.1917
Green melon	0	6.29047
Orange	0	6.24108
watermelon	0	6.1917

Table 4: Summarizes the recognition result of twelve test fruit images. The results are effect for whole testing fruit set the table listing the fruit name, computed feature value, such as mean RGB color values, shape roundness values, area and perimeter values.

			Red	Green	Blue		Area	
Group	Fruit name	Minimum	Maximum	Minimum	Minimum	Maximum	Minimum	Maximum
1	Red Apple	138	227	34	103	29	73	1269
1	Red Apple	76	255	26	255	29	255	44
2	Banana	5	255	5	255	0	255	81088
2	Banana	41	255	25	255	0	255	2437
3	Guava	85	255	99	255	0	248	119280
3	Guava	84	255	93	255	16	255	69878
4	Green melon	0	226	55	255	0	127	50505
4	Green melon	0	229	38	255	0	212	50505
5	Orange	79	255	34	235	0	205	303
5	Orange	158	255	86	255	0	255	42
5	Orange	118	231	62	157	0	53	71
5	Orange	146	253	108	255	0	255	34

Table 4 (Cont...)

Perimeter		Roundness		Entropy	
Mini mum	Maximum	Minimum	Maximum	Minimum	Maximum
1269	200.10	200.10	0.398239	0.3982	0
44	27.071	27.071	0.754487	0.7544	0
81088	1254	1254	0.6479946	0.6479	2.0
2437	468.46	468.46	0.1395422	0.1395	0
11928	1378	1378	0.7893672	0.7893	0
69878	2946.7	2946.7	0.1011288	0.1011	0
50505	904	904	0.776618	0.7766	0
50505	904	904	0.776618	0.7766	0
303	104.12	104.12	0.351191	0.3511	0
42	23.313	23.313	0.971038	0.9710	0
71	38.627	38.627	0.597967	0.5979	0
34	24.142	24.142	0.733056	0.7330	0

5 CONCLUSION

The proposed method can classify and indentify the fruit images. Which are input and selected to the system based on shape, color, size, texture feature of the fruit. The fruit recognition system has been developed because recognize all the test fruit images. User or tester click the Training Feature Database Creation feature pushbutton, this button is used to extract the feature value of training fruit example after that click the Loading Training Feature Database this button is used to loading the training feature database then click the Load test image pushbutton this button is used to select any test (unknown) fruit image and then Extract Feature of Test Fruit pushbutton this button is used to extract the feature value test fruit image after that click the fruit recognition push button and then recognize the image. The recognition result of the accurate up to 95%.Further the increasing the number of images in the database the recognition result can be increased accurate.

APPENDIX 1: TRAINING IMAGES

Fig 2: Different Position of Red Apple

Fig 3: Different Position of Green Banana

Fig 4: Different Position of Green Guava

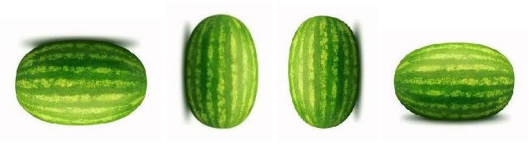

Fig 5: Different Position of Green Melon

Fig 6: Different Position of Orange

Fig 7: Different Position of Green Water Melon

APPENDIX 2: TESTED IMAGES

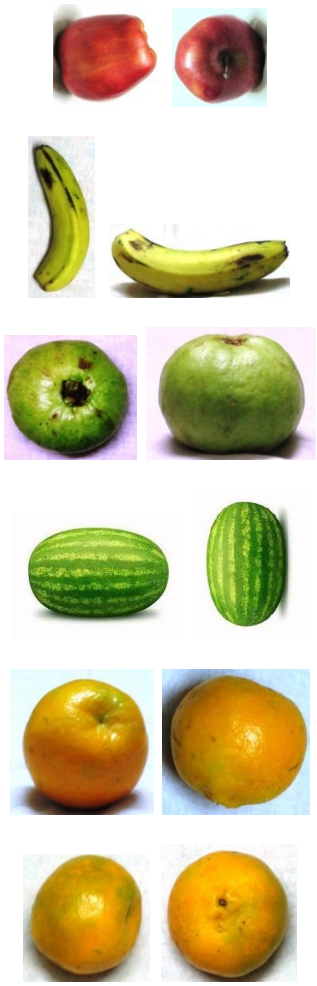

Fig 8: Different fruit images & different Position of tested images

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