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EVALUATION OF GEOMETRIC PARAMETERS FOR ROASTED AND UNROASTED COFFEE BEANS USING IMAGE PROCESSING TECHNIQUE

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Abstract

The geometric parameters along with related physical properties of agricultural material are vital to characterize and describe its quality. The application of image processing technique for this purpose can certainly reduce the human drudgery while ensuring quality. We conducted experiments on both roasted and unroasted coffee beans here in this study. A digital camera was used to capture the images of the twenty beans of roasted and unroasted coffee beans. The beans were placed in two different orientations (longitudinal and lateral) and image processing technique was used to quantify and process the digital images. The results of image analysis were compared with the data obtained with actual measurements using micrometre. A linear relationship was observed between the axial dimensions of beans by manual reading and the pixel value of beans by Image processing

Keywords: Roasted coffee beans, unroasted coffee beans, Image processing.

1. INTRODUCTION

Image based analysis method has many advantages over the traditional one due to its effectiveness, non-subjective and its efficiency. Through such technique, information can be automatically extracted, analysed and stored. In short, using computer vision system can inspect, classify and identify coffee sample quality [4].

Image processing is a rapidly growing area of computer science. Its growth has been fuelled by technological advances in digital imaging, computer processors, and mass storage devices. Fields which traditionally used analog imaging are now switching to digital systems, for their flexibility and affordability[6].

Digital image processing has an expanding area with applications in our daily life. Many image processing and analysis techniques have been developed to aid the interpretation of remote sensing images and to extract as much information as possible from the image [5]. Such a technology is also employed to grade agricultural products.

Image processing techniques has been applied in the area of postharvest handling of agricultural produce to ensure hygiene and quality of fresh and processed food being made available for human consumption. The physical characteristics like size, shape, colour and texture are basic properties that can be exploited to improve and atomize a number of handling activities. Consumer wants agricultural produce to be of uniform size, characteristics shape and equal unit weight. Fully mature, clear and undamaged beans appearance is considered as first index of good quality produce. Quality of agricultural materials is best assessed and cherished by human senses. Among the five senses, vision is the first and foremost to judge the quality. Machine vision technology has the potential to use the characteristics like size and shape, colour and texture to characterize the agricultural produce. The current study is an attempt in this direction.Many studies have applied image processing techniquefor grain identification and quality inspection such as wheat, oats, barley, and corn kernel[1].

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It has been reported that ablack background could provide more effective image processing of coffee beans [2]. Stress cracks and other damage in coffee bean have been detected successfully from their images. The shape features of food have been extracted using machine vision and parameters such as area, length, width, and compactness of beans.Even the beans could be counted usingComputer vision[3].

The objective of the project was to evaluate the geometric parameters of both roasted and unroasted coffee beans through micro meter manually and Image process techniques, also to find the relationship of both the calculations.

2. MATERIAL AND METHODS

Coffee seeds used for all the experiments were obtained from fresh and ripe berries. The normal wet processing method of sorting, cleaning, and drying was followed to remove impurities. Coffee beans will be roasted separately using an oven with direct heating.

The goal of this project is to measure the size of both roasted and unroasted coffee beans using Image processingtoolbox of MATLAB and derive relationship with manual readings from micro meter.
Firstly for all roasted and unroasted beans the length (X), width (Y), thickness (Z), was measured using micro meter of 0.01 mm accuracy X, Y, Z are expressed in mm as shown in figure 1.

Figure 1: micro meter reading.

Secondly the following are the steps executed in image processing with selected coffee beans images

a) Read an image into the MATLAB workspace.
b) Transform RGB image into image with separate R band (Split Bands).
c) Apply filter to image. Threshold the image.
d) Area, major and minor axis length is determined.

3. EXPERIMENTAL PROCEDURES

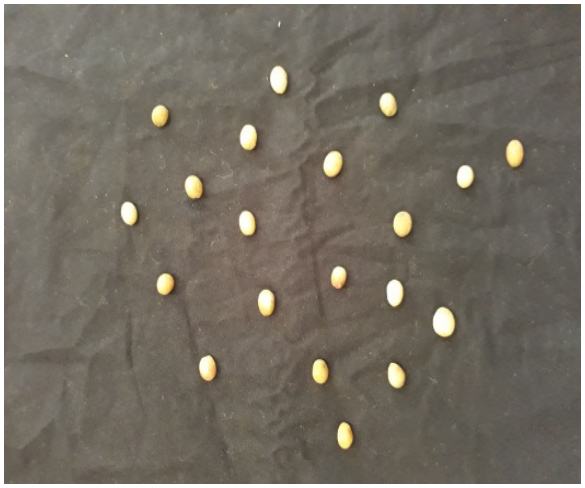
High megapixels camera was used to capture images, On the sheet of black background twenty beans both roasted and unroasted are kept in longitudinal and lateral orientation and images were taken. The pictures of group of twenty beans both roasted and unroasted beans have been taken and analysed as shown in figure 2 and 3.

A

B

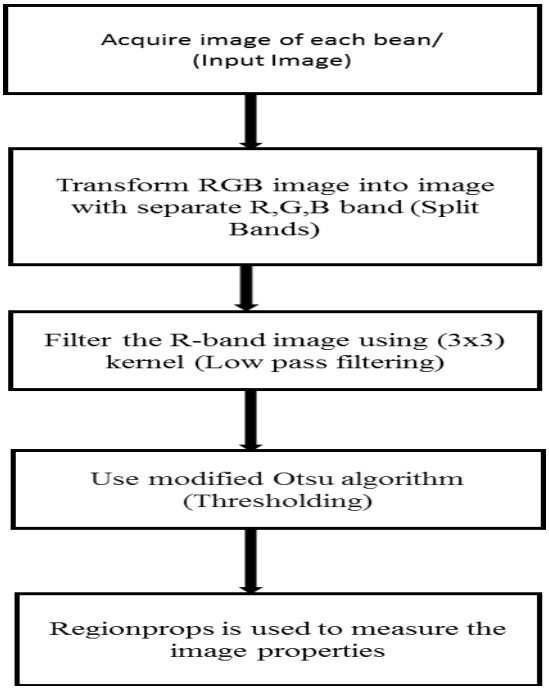
Figure 2(A, B): Roasted coffee beans in lateral and longitudinal view.

A



B

Figure 3 (A, B): Unroasted coffee beans in lateral and longitudinal view.

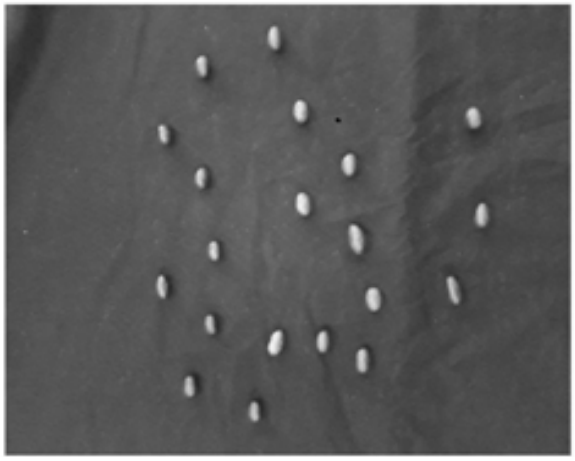


LATERAL ORIENTATION FOR ROASTED COFFEE BEANS

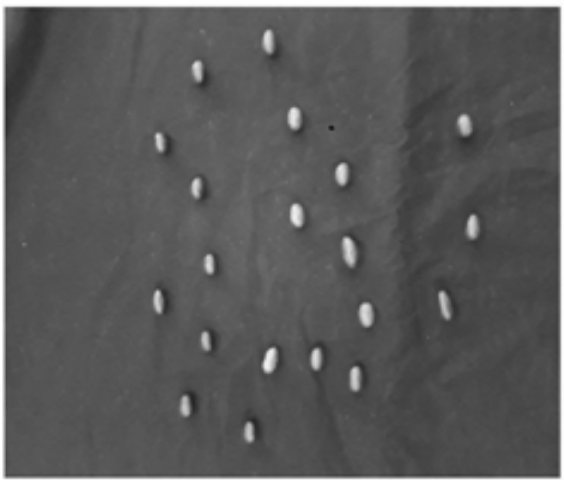
Step 1: Read an image into the workspace.
Display the original image.

Step 2:

Transform RGB image into image with separate R band (Split Bands)



A



B

Step 3(A, B): Create a normalized 3-by-3 pixel averaging filter

Step 5: Threshold the image

Remove background noise.

Step 6: Area, major and minor axis length are determined.

Regionprops function in MATLAB is used to measure the image properties i.e Major axis, Minor axis and Area of each image. The values will be in terms of pixels.

Above procedure is repeated for unroasted coffee seeds in longitudinal and lateral view. Length, width, thickness and area is noted from the outputs of image processing tool box.

4. RESULTS AND DISCUSIONS

A.MANUAL READINGS:

Length, Width, Thickness(mm) is calculated for twenty roasted coffee beans by micrometer details are shown in table1.

Manually Length, Width, Thickness and Area (mm) is calculated for twenty unroasted coffee beans are also taken by micrometer.

Table 1: Readings taken manually for roasted coffee beans

LENGTH(X) mm	WIDTH(Y) mm	THICKNESS(Z) mm
10.960	8.610	5.060
12.090	8.570	6.100
12.380	8.050	7.110
12.500	9.070	5.580
12.170	9.140	5.700
12.820	8.570	5.410
11.230	8.880	5.950
11.740	8.590	5.200
11.980	8.630	5.220
11.570	8.660	5.690
10.980	8.600	5.970
10.300	8.830	5.720
10.650	7.430	6.550
12.470	9.170	5.570
11.140	8.930	5.110
11.470	8.980	4.880
10.900	8.380	4.970
10.950	8.040	5.030
11.830	7.500	6.640
9.660	7.580	6.330

B. IMAGE PROCESSING RESULTS FROM MATLAB

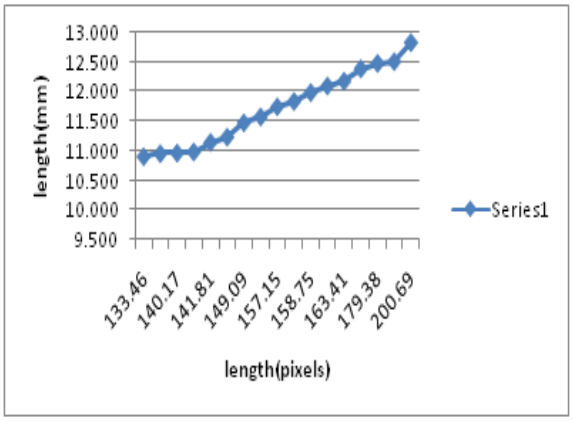
Major axis, Minor axis and Area (pixels) of roasted coffee beans in lateral view was calculated using image processing in Matlab as shown in table 2.

Table 2: Parameters of roasted coffee beans by image processing

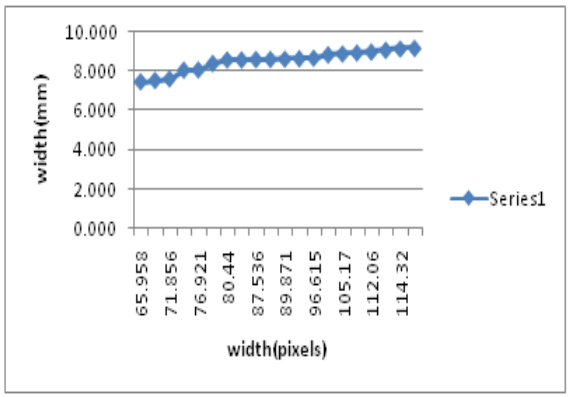
Area	Major Axis Length(pixels)	Minor Axis Length(pixels)
7330	158.75	61.181
6093	129.53	60.665
6918	140.17	64.096
6813	132.05	67.104
8086	141.81	74.08
6061	130.52	60.444
7292	133.46	70.051
6503	136.15	62.301
12644	179.38	91.286
9384	157.15	77.057
11097	149.09	95.552
11996	160.19	95.885
8255	144.36	73.279
10536	149.1	91.151
13915	200.69	89.067
9277	166.94	72.044
12753	163.41	99.981
8501	200.62	56.878
9894	140.23	90.873
9503	157.46	77.471

Similarly image processing is applied for roasted and unroasted coffee beans in both lateral and longitudinal view. From lateral view the major axis is considered as length and minor axis as thickness. In the longitudinal view the major axis is considered as length and minor axis as width.

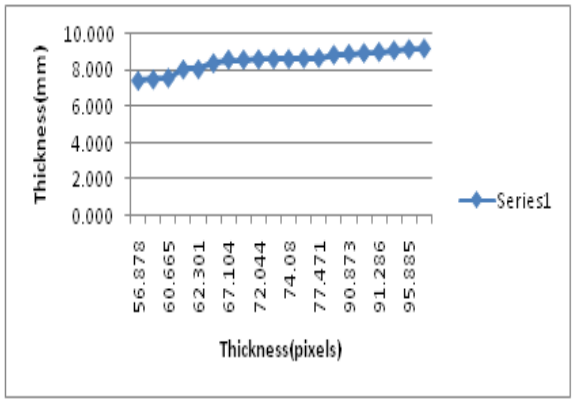
C.GRAPHS OF ROASTED COFFEEBEANS



Graph 1: Relationship derived for length of roasted coffee beans manually calculated and through image processing

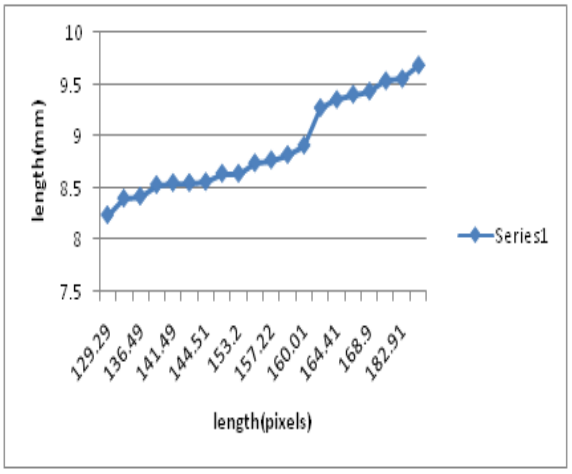


Graph 2: Relationship derived for width of roasted coffee beans manually calculated and through image processing

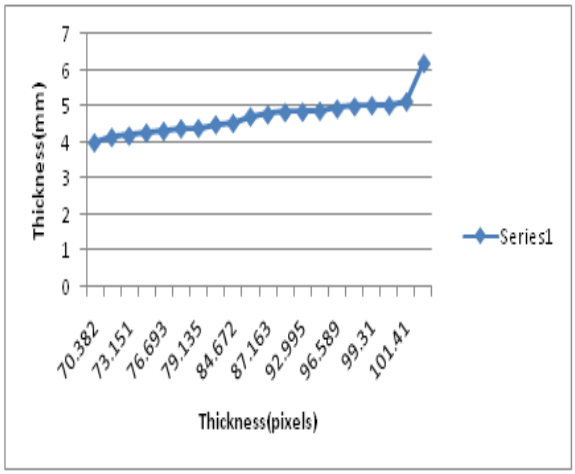


Graph 3:Relationship derived for thickness of roasted coffee beans manually calculated and through image processing

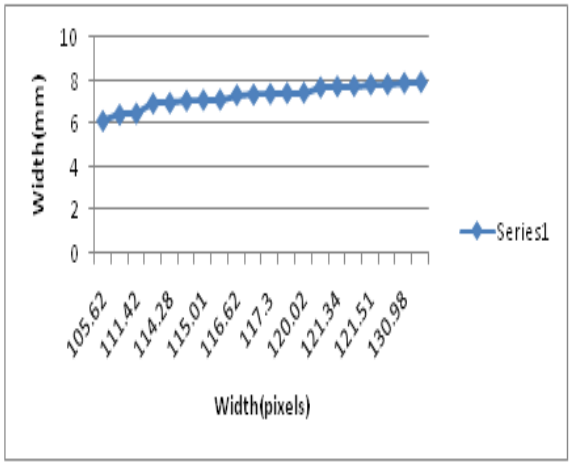
D.GRAPHS OF UNROASTED COFFEEBEANS



Graph 4: Relationship derived for length of unroasted coffee beans manually calculated and through image processing



Graph 5:Relationship derived for thickness of unroasted coffee beans manually calculated and through image processing



Graph 6:Relationship derived for w of unroasted coffee beans manually calculated and through image processing

5. CONCLUSION

- For selected roasted and unroasted beans the length (X), width (Y), thickness (Z), was measured using micro meter of 0.01 mm accuracy.
- Image processing technique has been used to characterize the related geometrical features of roasted and unroasted coffee beans in lateral and longitudinal orientation.
- Direct linear relationship has been found between the physical measurements manually and those found by image analysis. So it is very clear that image processing can be used in the coffee beans analysis to classify using parameters and give the best quality outputs to industry.

REFERENCES

1. H.D. Sapirstein, M. Neuman, E.H. Wright, E. Shwedyk, W.Bushuk, An instrumental system for cereal grain classification using digital image analysis. J. Cereal Sci. 6(1), 3–14 (1987)
2. M.R. Paulsen, W.F. McClure, Illumination for computer vision systems. Trans. ASAE 29(5), 1398–1404 (1986)
3. N.S. Shashidhar, D.S. Jayas, T.G. Crown, N.R. Bulley, Processingof digital images of touching kernels by ellipse fitting. Can.Agric. Eng. 39(2), 139–142 (1997)
4. EndaleAsfaw, 2007. Physical Quality and Grading Systems of Ethiopian Coffee in Demand Supply Chain, Four Decades of Coffee Research and Development in Ethiopia.
5. Pathon, M., Jussoff, K. and Barkatullah, Q., 2011. Implication of image processing algorithm in remote sensing and GIS application. Journal of theoretical and applied information technology, volume34 : No-1, ISSN 1992-8645
6. Seemann, T., 2002. Digital Image Processing using Local Segmentation. PhD Thesis, Monash University, Monash, Australia.
7. Mahesh Kumar • Ganesh Bora • Dongqing Lin, Image processing technique to estimate geometric parameters and volume of selected dry beans, Springer Science+Business Media New York 2013, Food Measure (2013) 7:81–89.
8. SukhvirKaur and DerminderSingh,Geometric Feature Extraction of Selected Rice Grains using Image Processing Techniques,*International Journal of Computer Applications (0975 – 8887) Volume 124 – No.8, August 2015*
9. VidyaPatil, V. S. Malemath, Quality Analysis and Grading of Rice Grain Images, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 6, June 2015.