ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 2, February 2019

Vision based Features in Moisture Content Measurement-A Survey

A.Stephensagayaraj[1], R.Pradeepa[2], P.Suganthi[3], S.Vinothini[4], T.Vishvapriya[5],

Assistant Professor, Department of Electronics and Communication Engineering, Jai Shriram Engineering College, Tirupur, Tamil Nadu, India [1]

UG Scholar, Department of Electronics and Communication Engineering, Jai Shriram Engineering College, Tirupur, Tamil Nadu, India. . [2,3,4,5]

ABSTRACT: The characteristics of fruits are different based on moisture content. The moisture is an important feature that influence on storability of fruits. The drying process leads to change in features of fruits. The shape, color and texture feature are changed under drying process. The samples are dried under different condition at regular interval of time. The geometrical, textural feature and moisture content are measured at regular interval of time. The feature decreased smoothly with drying time. The ANN models are employed to predict the moisture content. The integration of neural network is proper tool to predict the moisture content.

KEYWORDS: Moisture content, Texture Feature, ANN, Drying, neural network.

I. INTRODUCTION

The feature measurement is important characteristic of classification. The normal feature extraction is differing from vision based feature extraction in moisture content measurement. The measurement of textural properties is based on moisture content by drying process of fruits. The moisture content of fruit varies according to the drying condition. Normally the sample is dried under certain condition and image is taken at regular interval of drying time. The textural and shape properties are measured for image taken at regular interval of time. The feature extracted is gradually decreased byincreasing drying time. The ANN model was employed to predict the moisture content. The neural network employed with Visionsystem produces an efficient way to determine the moisture content and to do classification.

II. MACHINE VISION SYSTEM

The machine vision system is a technology for analyzing an image in real time by computer. The increasing capacities of vision system tends the advancement in image processing classification [1][2]. The recognition of apparent characteristic of material such as shape and color is obtained by vision system. It is inexpensive and new advanced trends in image processing [3].

III. SEGMENTATION

The segmentation was done to remove the background image from the original image. The equation is used to remove the background of the object. Thus results were in binary image and the original image is superimposed on the image [4]. The segmentation of apple is carried out to segment the image from its background. The segmentation was done for raisin and apple. It removes the background and extracts the original image. The segmentation results were shown in Fig.1 The segmentation of raisins excludes the pedicel appearance in images. To remove the pedicel the

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 2, February 2019

morphological operation including erosion & dilation operation was performed on binary images. The segmentation done for raisin by removing pedicel is shown in Fig 1,2.

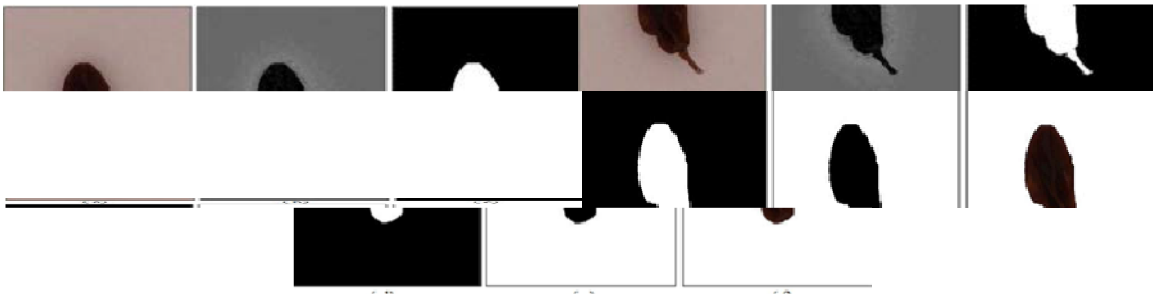

Fig.1: The segmented image of drying time

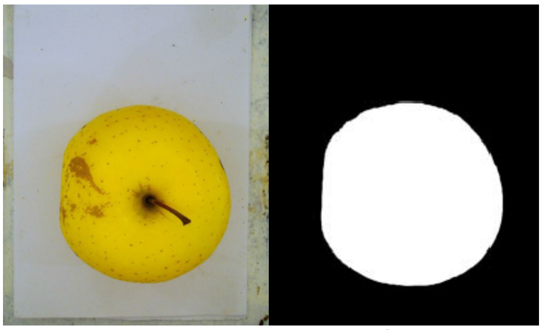

Fig 2: The segmented image of an apple

IV. DRYING PROCESS

The drying process includes the exposure of high content material in oven or tray drier. The drying processes were exposed to physical and chemical changes in the product [5]. The quality values were changed by amount of water content. The water content is reduced over dryness of product [6]. The dryness results in shrinkages of product which was used to classify the diseased product. The texture analysis was used to measure the wrinkles of an apple. The decreasing moisture content of apple decreased an effective influence on density of them [7]. The morphological features were used in grading and sorting of object. The shape and size changes during drying process modify the textural properties of an object [8]. Potato slice shrinkage was measured by drying process. The textural properties of shrinkage were measured at regular interval of time [9].The variation of moisture content is measured for raisin. The moisture content smoothly changes with drying time. The moisture content of samples was 4.56(g/H2O dry matter) decreased to 0.175(g/H20 dry matter). The morphological feature decreased gradually with increase in drying time is shown in Fig 3.

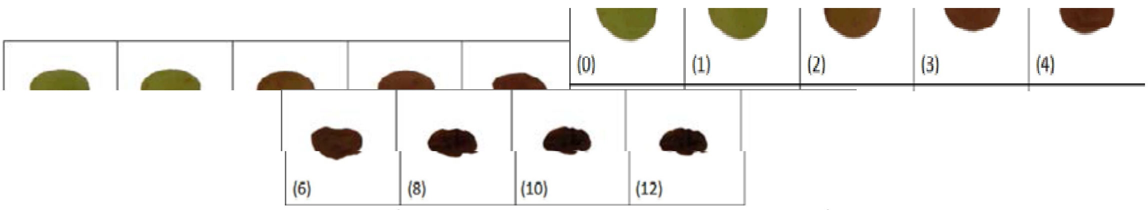

Fig. 3: The Changes of a Single Grape Sample as a Function of Drying Time.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 2, February 2019

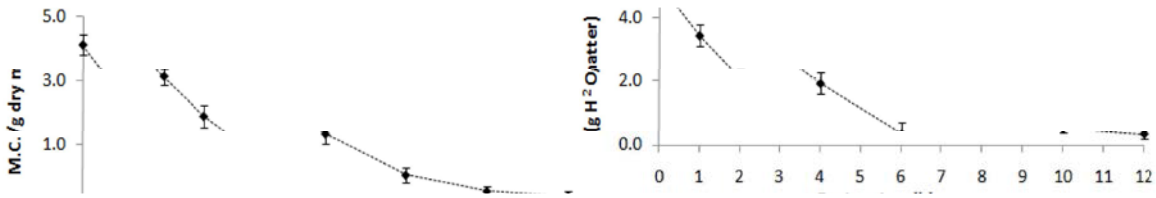

Fig 4: The variation of M.C during drying time during raisin production.

V. COLOR FEATURES

The different color spaces were used in classification application. The L*a*b*, HSI, RGB color component are the color spaces used in food processing industry. It was reviewed that saturation has highest correlation to the M.C of the meat showing potential in determining the M.C of the meat [10]. The evaluation of rice quality defection was found by HSI color space model determining discoloration and chalkiness [11]. The color information in dried potato slices has been studied analyzing color components of L*a*b* color space. The dehydration does not affect the Hue component hence the color of product does not changed. Drying makes the intensity values be reduced. b* does not any change in dried product. There was high correlation between the extracted feature moisture content [12].

VI. TEXTURE FEATURES

The texture feature was measured for shrinkage of fruit due to dehydration changes in the appearance of fruit. The texture feature is important feature which been applied in the food industry [13]. The correlation between shrinkage and moisture content as well as color intensity was observed in drying [14]. The shrinkage area, moisture content, color intensity was observed [15]. In addition moisture content plays a crucial role in prediction of food quality apart from textural and shape properties [16]. The excessive drying lost all the moisture content and made a problem in moisture content measurement.

The shape feature extraction measures

- Surface Area: The number of pixels having the value of 1.
- Perimeter: The perimeter was measures by counting the number of pixels in border.
- Max Diameter & Min Diameter: the major and minor axis lengths of an object in binary image.
- Equivalent Diameter: The diameter of circle with same area as object.

The texture feature extraction measures

- Entropy: Disorder of an image.

  Entropy=$\sum_{i=0}^{N-1}\sum_{j=0}^{N-1} P(i,j) logp(i,j)$ (1)
- Energy: Measurement of textural uniformity of image.

  Energy=$\sum_{i=0}^{N-1}\sum_{j=0}^{N-1} P(i-j)^2$(2)

  i, j is a gray level pairs, p is a GLCM element.
- Contrast: It is also called inertia. It measures the local variation in image.

  Contrast=$\sum_{i=0}^{N-1}\sum_{j=0}^{N-1} P(i,j)(i-j)^2$ (3)

- Correlation: The correlation between the elements of matrix.
- Inverse difference moment: It measures the image homogeneity.

The texture feature changes for grape images are measured. The value of contrast and entropy increased during the drying of grapes in raisin production. The energy, correlation and IDM is decreased in grape drying process [4].

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 2, February 2019

VII. ANN CLASSIFIER

To development of M.C. measurement tool based on the whole extractedfeatures including color, texture and shape features, the neural network with multilayer perceptron were developed. The back-propagation learningalgorithm was used in the networks. The number of neuron in each hidden layer is changed. The ANN was trained with Levenberg-Marquardt (LM) learning algorithm which is known to be where; n is the number of samples,Yis output ofvery efficient when applied to ANN [16]. PCA (Principal Component Analysis) was used because of large number of data as input.it is used to eliminate the ineffective feature from the input. To combine the different feature and to enhance the accuracy of prediction the ANN classifier is used. The multilayer perceptron were tested. The PCA was used to select the feature. The $R^{2,}$ RMSE, MAPE is calculated. The developed ANN model can be employed for predicting the grape M.C. and other drying behaviour during dehydration based on image extracted information with high accuracy over 99.6%.The moisture content measurement of apple ,that the difference between LMC correlation in training and testing steps is low and it shows that training of NN was proper. R2 of prediction with NN is close to results ofMireei et al.(2010) and Sudaram et al. (2009) which obtained 0.98 and 0.96 values of R2 respectively.

VIII. FUTURE DIRECTION

The moisture content measurement is an important factor to determine the texture and color feature. This methodology is tends to use in classification of sulphur fumigated copra from normal copra. The copra is maintained under tray drier for drying process. The moisture content is measured for regular time interval and feature of dried copra is measured at time interval. The textural, color and shape feature is measures and feed as input to the ANN classifier.

IX. CONCLUSION

In this paper we reviewed about the survey of vision based feature in moisture content. The measurement of moisture content during drying process and change textural, shape, color properties were discussed. The correlation between the extracted feature and moisture content were discussed. The A-NN was used to predict the moisture content and the A-NN classifier estimated moisture content with 99.6%. in raisin production .The sorting of apple based on moisture content estimation were discussed and A-NN classifier is best way to estimate the sorting of apples.

REFERENCES

1. Hemming, J. and T. Rath, 2001. Computer-Visionbased Weed Identification under Field Conditionsusing Controlled Lighting. J. agricultural EngineeringResearches, 78: 233-243.
2. Brosnan, T. and D.W. Sun, 2002. Inspection andGrading of agricultural and food products byComputer vision systems-a review. Computers andElectronics in Agriculture, 36: 193-213.
3. Mohebbi, M., M.R. Akbarzadeh, F. Shahidi,M. Moussavi and H.B. Ghoddusi, 2009. ComputerVision systems (CVS) for moisture contentEstimation in dehydrated shrimp. Computers and Electronics in Agriculture, 69: 128-134.
4. Adel Bakhshipour, Abdolabbas Jafari and Ali Zomorodian.2012.Vision Based Features inMoisture Content Measurement During Raisin Production. World Applied Sciences Journal 17(7): 860-869.
5. Kiranoudis, C.T. and N.C. Markatos, 2000. Pareto design of conveyor-belt dryers. J. Food Engineering,46: 145-155.
6. Paulus, I. and E. Scherevens, 1999. Evaluating and modelling the size classification of apples. J. Agricultural Engineering Research, 74(4): 411-419.
7. Jayas, D.S., J. Paliwal and N.S. Visen, 2000. Multi- layer neural networks for image analysis of agricultural products. J. Agricultural Engineering Research, 77(2): 119-128.
8. Yan, Z., J.M. Sousa-Gallagher and A.R.F. Oliveira,2007. Shrinkage and porosity of banana, pineappleand mango slices during airdryingJ.FoodEngineering, 83(3): 430-440.
9. Yadollahinia, A. and M. Jahangiri, 2009.Shrinkage of potato slices during drying. J. Food Engineering 94: 52-58.
10. Zheng, C., D.W. Sun and L. Zheng, 2006. Correlating colour to moisture content of large cooked beef joints by computer vision. J. FoodEngineering, 77: 858-863.
11. Jinorose, M., S. Prachayawarakorn andS. Soponronnarit, 2010. Development of aComputer Vision System and Novel EvaluationCriteria to Characterize Color and Appearance ofRice Drying Technology, 28(9): 1118-1124.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 2, February 2019

12. Fernández, L., C. Castillero and J.M. Aguilera, 2005 an application of image analysis todehydration of apple discs. J. Food Engineering,67: 185-193.
13. Wu, D., H. Yang, X. Chen, Y. He and X. Li, 2008. Application of image texture for thesorting of tea categories using multi-spectral imaging technique, and support vector machine. J. Food Engineering, 88: 474-483.
14. Martynenko, A.I., 2006. Computer-vision systemfor control of drying processes. Drying Technology, 24(7): 879-888.
15. Du, C.J. and D.W. Sun, 2004. Recentdevelopments in the applications of imageprocessing techniques for food qualityevaluation. Trends in Food Science&Technology, 15: 230-249.
16. Hagan, M.T. and M.B. Menhaj, 1994. Training feed-forward networks with the Marquardt algorithm. IEEE Transactions on Neural Networks, 5: 989-993.
17. Farshad Vesali, Masoud Gharibkhani2 and Mohmmad Hasan Komarizadeh3 An approach toestimate moisture content of apple with image processing methodAJCS5(2):111-115.