RICE QUALITY ANALYSIS USING IMAGE PROCESSING AND MACHINE LEARNING

R. C. Dharmik
Assistant Professor, Department of Information Technology Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, (India).

Sushilkumar Chavhan
Assistant Professor, Department of Information Technology Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, (India).

Shashank Gotarkar
Asst. Professor, Dept. of Community Medicine, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi (M), Wardha, (India).

Arjun Pasoriya
Software Test Team Lead,Amdocs, (Cyprus).

Reception: 07/11/2022 **Acceptance**: 22/11/2022 **Publication**: 29/12/2022

Suggested citation:

Dharmik, R. C., Chavhan, S., Gotarkar, S., y Pasoriya, A. (2022). Rice quality analysis using image processing and machine learning. *3C TIC. Cuadernos de desarrollo aplicados a las TIC, 11*(2), 158-164. https://doi.org/10.17993/3ctic.2022.112.158-164

https://doi.org/10.17993/3ctic.2022.112.158-164

ABSTRACT

Object Detection and its analysis are used in various fields. Rice quality evaluation subtask in Agricultural industries is not exception for object Detection. Manual identification using image processing techniques, Machine Learning Techniques and Deep Learning is also used for the rice quality analysis. Due to Feature identification challenge machine Learning and Deep Learning are in the demand. As rice is mostly used agricultural product so it is important to have the proper analysis of the crops. In this study we proposed the used of image processing method with the help of Machine Learning model. Rice grain morphological characteristics are what define a grain's quality analysis. The suggested method can operate efficiently with little expense.

KEYWORDS

Object Detection, Machine Learning, Morphological characteristics, Deep Learning.

https://doi.org/10.17993/3ctic.2022.112.158-164

1. INTRODUCTION

The oldest and largest sector of the global economy is agriculture. Traditionally, a human sensory panel uses physical and chemical features of food products to determine their quality (Mahale and Korde, 2014)(Shah, Jain, and Maheshwari, 2013). In Asian nations, rice is a popular and widely eaten cereal grain. It is widely accessible anywhere in the world. When rice is used for human consumption, several items with value added are created. Quality is a major factor in the milled rice business. With the growth of the import and export industries, quality assessment becomes increasingly crucial. The dispensable items found in rice samples include paddy, chaff, broken grains, weed seeds, stones, etc. These impurity levels affect the quality of the rice. As a complex problem it is solved by using image processing techniques. There have been major advancements in the essential and cutting-edge technology field of image processing such as canny edge detection algorithm (Mahale and Korde, 2014), Artificial Neural Network(Hamzah and Mohamed, 2020).

The approach of image processing is intended to preserve the integrity of the specifications. Image manipulation involves applying certain procedures to a target image in order to produce a better and more appealing image. And extract some useful data from the supplied image. Genetic algorithm based LS-SVM(Chen, Ke, Wang, Xu, and Chen, 2012) was used which provides good result but required lots of processing and complex operation. Later machine Learning based algorithms are used for this classification and Analysis. ANN(Chen et al., 2012), SVM(Philip and Anita, 2017) is mostly used algorithm which provides the good quality of results.

The main purpose of the proposed method is, to offer an alternative way for quality control and analysis which reduce the required effort, cost and time by using other Machine Learning algorithms and with object Detection. As rice quality analysis is control the diet and business of agriculture industry, proper analysis is required. Image Processing Techniques and Machine Learning are tested for the analysis. In this work we apply the object detection machine learning algorithm Region-based Convolutional Neural Networks (R-CNN) with dimension reduction techniques. Results depict that the results are less difference in the above methods.

This paper is organized as follows, and Section II describes the work of various researchers on Rice quality analysis or detection. Section III gives a detailed overview of the technology used to select good Rice and analyse it. Section IV uses this method to elaborate on the results. Section V provides an overview of the results description, better performance than other results, and shortcomings.

2. LITERATURE REVIEW

Philip and Anita (2017), proposed new characteristics for rice grain categorization. For the categorization of nine types of commercially accessible grains in the South Indian area, both spatial and frequency-based criteria were applied. The classification is carried out in two phases, with the first stage utilising the NB Tree classifier and the second stage utilising the SMO classifier.

Authors archives remarkable accuracy to the spatial features and suggested two work on real time. Images. Parveen, Alam, and Shakir (2017) proposed image processing algorithm based some characteristics with colour images. Characteristics wised results are obtained to user. Author suggested applying the same with large data with more feature or characteristics. Kuchekar and Yerigeri (2018) attempted to grade rice grains using image processing and morphological methods. Segmenting the individual grains comes first, followed by pre-processing of the picture.

The grain's geometrical characteristics, such as its area and the lengths of its main and minor axes, are extracted and classified. The results have been determined to be positive. Rice is graded according to the length of the grain. As a future scope it can be expanded in the future by focusing on moving images and identifying additional qualities of rice grains. Kong, Fang, Wu, Gong, Zhu, Liu, and Peng (2019) suggested to use an automated approach for extracting rice thickness based on edge properties.

https://doi.org/10.17993/3ctic.2022.112.158-164

The solution addressed the issue brought on by the structural similarity of edges by matching the appropriate edge points based on the form of the edge rather than its texture. As a future scope authors suggested to go with edge features extraction, with epipolar geometry to match the corresponding points on the rice edge.

Avudaiappan and Sangamithra () analyse the visual features with image processing and MLP.

Authors used the SVM and Na¨ıve bays algorithm with 90% accuracy. As a future scope authors focused on Non-Uniform Illumination with Transformation using top-hat so that rice can be classify in long, normal or small category. Using a k-NN classifier, Wah, San, and Hlaing (2018) suggested an image processing method and assessed three classes (30 images for each class).

Other studies Xiaopeng and Yong (2011), Yao, Chen, Guan, Sun, and Zhu (2009), Tahir, Hussin, Htike, and Naing (2015) put more focus on identifying the grain's apparent chalkiness. A grain with a partly opaque or milky white kernel is said to be chalky. One of the key markers in the evaluation process is the level of chalkiness. High levels of chalkiness in rice grains make them more likely to shatter during milling, which will alter how they taste. An automated system for grading milled rice is suggested by Wyawahare, Kulkarni, Dixit, and Marathe (2020).

Broken rice is an essential factor in rice grading. This technique may be used to determine the percentage of broken rice from a sample's picture. The relevant characteristics are retrieved from the coloured pictures of the samples using particular preprogrammed processing procedures, and the regression model is created. Estimating the percentage of broken rice requires less runtime than other approaches since basic regression models are used. Lin, Li, Chen, and He (2018) offered a comparison of two approaches—CNN and conventional methods—to identify rice grains with three distinct forms (medium, round, and long grain). 5,554 photos were examined for calibration, and 1,845 images were examined for validation. In the CNN approach, the experiments changed training parameters like batch size and epochs. In a separate trial, they used conventional statistical techniques, and the categorization accuracy they obtained ranged from 89 to 92%. As opposed to the conventional approaches, the experiment employing the CNN method obtained a classification accuracy of 95.5%. Benefits from the interplay between CNN and hyperspectral imaging were employed by Chatnuntawech, Tantisantisom, Khanchaitit, Boonkoom, Bilgi¸c, and Chuangsuwanich (2018). Their research used two sets of data, 414 samples from paddy rice and 232 samples from six different types of milled rice. The accuracy of the suggested approach was 86.3%. In contrast, the SVM method on the paddy seed dataset produced a result of 79.8%, whilst the accuracy of the other set was somewhat off. By combining three machine learning techniques—kNN, SVM, and CNN—with hyper spectral imagery, Qiu, Chen, Zhao, Zhu, He, and Zhang (2018) were able to identify four different types of rice seeds. Two distinct spectral ranges were used in the experiment, and there were various numbers of training samples.

In various studies, a hyperspectral camera was used to address the issue of classifying rice types. The gadget, however, was expensive and complicated. Additionally, a quick computer, sensitive detectors, and ample data storage were needed.

3. PROPOSED FRAMEWORK

By observing the various literature we Identified architecture. Process is as follows.

https://doi.org/10.17993/3ctic.2022.112.158-164

Fig 1: Architecture of the proposed system.

1. Training the data: To train the data Rice seeds image scanning needed then it Seed area segmentation is done then Seed orientation was performed then proper data frame of images is form for training of data.
2. Training of data Training is done for both RCNN and statistical classical model.
3. Feature Extraction: For better accuracy we have to find the Features of the data frames. We used Greedy Filter method to get the proper features.
4. Again training was performing and tests the accuracy on both RCNN and statistical classical model.
5. Dimension Reduction: to speed the process at each epoch we reduce the dimension by using PCA.

4. RESULTS

The below table gives average aspect ratio and classification which is based on kind of rice grain used. It will show the exact value of parameters for the rice grain used in a bar graph where x-axis belongs to particles and y-axis is average aspect ratio of parameters. Following Figure shows the ranges which generally known as classification of rice grains that have been identified and training was done.

Table 1: classification of rice grains.

Long Slender(LS)	Length >= 6mm, L/B Ratio>=3mm
Short slender(SS)	Length< 6mm, L/B Ratio>=3mm
Medium Slender (MS)	Length >= 6mm, 2.5< L/B Ratio <3mm
Long Bold (LB)	Length >= 6mm, L/B Ratio<3mm
Short Bold (SB)	Length < 6mm, L/B Ratio<3mm

As per Architecture we have applied RCCN object detection method for identification of edges of the rice so that classification can be done by training machine learning model. Here we train it using Recurrent neural network (RNN) with activation function as Relu in hidden layers which can be helpful for RCNN. The Rice quality analysis of application b uisng this application is shown below.

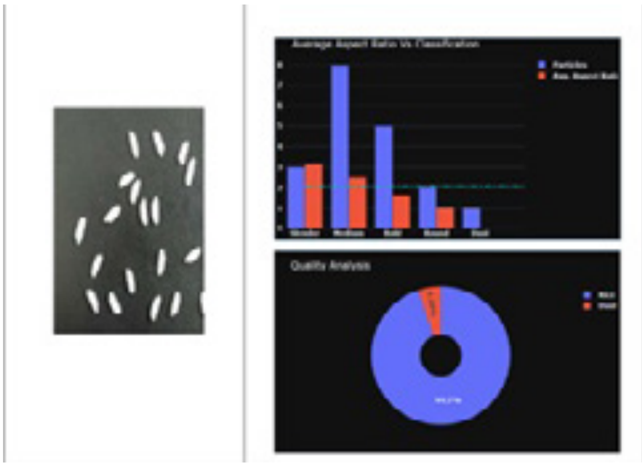

Fig 2: Quality Analysis Avg. Aspect Ratio VS Classification with single proper image.

5. CONCLUSION AND FUTURE SCOPE

In this work we applied machine learning and image processing techniques for identification and rice quality analysis of work. In the process we used RNN model as machine: earning model for classification. To detect the edge and identify its type RCNN object detect ion method where used. Accuracy of the model is 92.36% and analysis was done on the rice grace classification. We have successfully executed all the steps proposed. Last two steps include calculating the size of the grains and then classifying them according to the Table provided. As a future challenge we can try with another edge Detection algorithm which detect in less time so that above accuracy will be increased and reduced the time of analysis.

REFERENCES

[1] Avudaiappan, T. and Sangamithra, S. Analysing rice seed quality using machine learning algorithms.

[2] Chatnuntawech, I., Tantisantisom, K., Khanchaitit, P., Boonkoom, T., Bilgic., B., and Chuangsuwanich, E. 2018. Rice classification using spatio-spectral deep convolutional neural network. ArXiv abs/1805.11491.

[3] Chen, X., Ke, S., Wang, L., Xu, H., and Chen, W. 2012. Classification of rice appearance quality based on ls-svm using machine vision. Communications in Computer and Information Science 307, 104–109.

[4] Hamzah, A. and Mohamed, A. 2020. Classification of white rice grain quality using ann: a review. IAES International Journal of Artificial Intelligence (IJ-AI) 9, 600.

[5] Kong, Y., Fang, S., Wu, X., Gong, Y., Zhu, R., Liu, J., and Peng, Y. 2019. Novel and automatic rice thickness extraction based on photogrammetry using rice edge features. Sensors 19, 24.

[6] Kuchekar, N. and Yerigeri, V. 2018. Rice grain quality grading using digital image processing techniques. IOSR J Electronics Communication Eng 13, 3, 84–88.

[7] Lin, P., Li, X., Chen, Y., and He, Y. 2018. A deep convolutional neural network architecture for boosting image discrimination accuracy of rice species. Food and Bioprocess Technology 11, 1–9.

[8] Mahale, B. and Korde, S. 2014. Rice quality analysis using image processing techniques. 1–5.

[9] Parveen, Z., Alam, M. A., and Shakir, H. 2017. Assessment of quality of rice grain using optical and image processing technique. In 2017 International Conference on Communication, Computing and Digital Systems (C-CODE). 265–270.

[10] Philip, T. M. and Anita, H. 2017. Rice grain classification using fourier transform and morphological features. Indian Journal of Science and Technology 10, 14, 1–6.

[11] Qiu, Z., Chen, J., Zhao, Y., Zhu, S., He, Y., and Zhang, C. 2018. Variety identification of single rice seed using hyperspectral imaging combined with convolutional neural network. Applied Sciences 8, 212.

[12] Shah, V., Jain, K., and Maheshwari, C. 2013. Non-destructive quality analysis of Gujarat 17 oryza sativa ssp indica (indian rice) using artificial neural network. 2321–0613.

[13] Tahir, W. P. N., Hussin, N., Htike, Z. Z., and Naing, W. Y. N. 2015. Rice grading using image processing. ARPN Journal of Engineering and Applied Sciences 10, 21, 10131–10137.

https://doi.org/10.17993/3ctic.2022.112.158-164

[14] Wah, T., San, P., and Hlaing, T. 2018. Analysis on feature extraction and classification of rice kernels for myanmar rice using image processing techniques. International Journal of Scientific and Research Publications (IJSRP) 8.

[15] Wyawahare, M., Kulkarni, P. A., Dixit, A., and Marathe, P. 2020. Statistical Model for Qualitative Grading of Milled Rice. 234–246.

[16] Xiaopeng, D. and Yong, L. 2011. Research on the rice chalkiness measurement based on the image processing technique. In 2011 3rd International Conference on Computer Research and Development. Vol. 2. 448–451.

[17] Yao, Q., Chen, J., Guan, Z., Sun, C., and Zhu, Z. 2009. Inspection of rice appearance quality using machine vision. 2010 Second WRI Global Congress on Intelligent Systems 4, 274–279.

https://doi.org/10.17993/3ctic.2022.112.158-164