Advanced Fruit Grading Detection System Using AI

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Abstract- *Fruit rotting has significant economic effects; it is estimated that decaying elements account for nearly a third of the cost of the fruit. Furthermore, because customers feel that damaged fruits are dangerous to their health, fruit sales will be affected. Reduced levels of amino acids, vitamins, sugar/glucose, and other nutrients unavoidably create public worries about edibility, spurring ideas on ways to prevent or reduce decay.*

Despite the importance of food status in people's lives and its contribution to the economy, fruit freshness grading is a time-consuming manual operation. The employment of digital technologies to automate grading is regarded to be the solution to this challenge.

I. INTRODUCTION

Fruits and vegetables must be processed for sale after harvest. This can be done on a farm or at a retail, wholesale, or supermarket chain level. Removal of unmarketable material, sorting by maturity and/or size, grading, and packing are the four main important activities for the fresh market, regardless of the destination. To speed up the process and match the demands, we need a grading system. In the market, graded products attract a higher price. Grading aids in the development of stronger trust between buyers and farmers. Increase marketing efficiency by making it easier to acquire and sell products without having to makea personal choice. Grading can save money on marketing costs such as packaging and delivery. Grading is the practice of separating vegetables and fruits into different classes depending on their size, shape, color, and volume in order to maximize market value.

II. OBJECTIVE

- To create a method for identifying rotten/fresh fruits and evaluating them.
- To evaluate and enhance the efficiency of the system.
- To signify that CNN and Machine Learning are being used.

III. LITERATURE REVIEW

The approach suggested in [1] can efficiently acquire the form characteristic by drawing lines and then classifying the strawberry picture using the Kmeans clustering algorithm. The L*a*b* colour model is used in the planned automated strawberry grading system. The greatest fruit diameter is used to determine the size of the fruit, and the colour of the strawberry is retrieved using the Dominant colour technique on the channel. The strawberry size detection inaccuracy is less than 5%, the colour grading accuracy is 88.8%, and the form classification accuracy is above 90%, according to the data. The average time it takes to evaluate one strawberry is less than 3 seconds.

The provided date fruit rating method is based on computer vision [2]. Flabbiness, size, form, intensity, and faults are retrieved features in the grading process of date fruit. It categorizes dates into three quality groups (grades 1, 2, and 3) based on the retrieved attributes. Dates with a nice form, a large size, a high intensity, a high flabbiness, and no faults were labelled as being of the highest grade.

This study proposes a synthesis of colour and texture. Intensity, colour, shape, and texture are some of the several factors that may be used to grade fruit. Fruit is classified using a minimum distance classifier based on Wavelet transformed sub-bands [3].

[4] uses the direct colour mapping approach for automated fruit colour grading. The suggested technique calculates a unique set of coefficients forcolour space conversion using pre-selected colours. The three-dimensional RGB colour space is broken down into a minimal number of colour indices that are specific to the application. The suggested approach evaluates tomato and date ripeness as well as date surface fault identification. The strategy provided is straightforward yet effective. This novel direct colour mapping idea may be used in a number of colour grading applications that demand quick colour preference selection and tweaking.

[5] describes a novel method for evaluating pineapples based on colour. Pineapple images were gathered and the backdrop was eliminated. The pineapple image's RGB component was retrieved. The colour values collected during the sorting step are recorded in a database for training the Neural Network (NN). According to the test findings, the maximum level of accuracy attained for grading pineapples is 75%.

Bernard Gosselin and DevrimUnay used LDC to undertake an apple fruit categorization test. K-NN is a statistical classifier that employs a distance metric to estimate sample similarity (proximity). Within its nearest k neighbours, it allocates data to the most represented category. [6]

According to the exterior surface, Anuradha Gawande [7] suggested a technique to detect the contaminated region from the input photos and classify the diseased patterns as a low, average, medium, high, extremely high, and entirely infected fruits. However, it only processes one image at a time, rather than a batch, which is the system's main drawback.

[8] discusses several segmentation algorithms, colour models, and feature extraction strategies for fruit diseasediagnosis and grading. The sortingof mango fruits is done in [9] using a Gaussian Mixture Model and Fuzzy logic, using ripeness and size as parameters. For various maturity levels, results range from 88 percent to 92 percent. Color and texture data are combined with a unique radial basis probabilistic neural network for orange fruit defect classification, and 88 percent accuracy is reached in [10].

Based on the quality ratio, Sahu and Potdar [11] offer an algorithm to determine defect and maturity in mango fruit. The fruit is rotten if the quality ratio value exceeds the threshold value. The fruit is excellent if the quality ratio value is less than the cutoff value. As a result, the suggested algorithm sorts mango fruits based on quality, which is critical for fruit value addition.

Naik and Patel [12] propose a mango grading system based on size and ripeness. A thermal camera is used to forecast the maturity mean intensity method in CIELAB colour space. Mango size is predicted using weight, eccentricity, and area, with an accuracy of 89.00% and a time of 2.3 seconds.

Arakeria and Lakshmana [13] present a computer vision-based tomato fruit grading system that comprises of two phases: hardware development and software development. Without operator involvement, the created technology takes the picture and moves the fruit to the right container. The programme uses image processing techniques to evaluate the fruit for maturity and flaws, resulting in a 96.47 percent accuracy in determining the tomato's quality.

IV. EXISTING SYSTEM

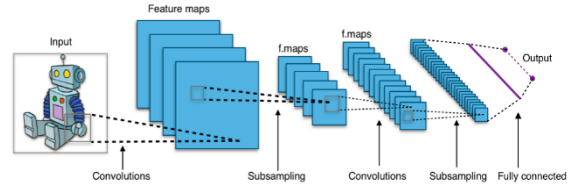
Existing system uses the direct colour mapping approach for automated fruit colour grading. The suggested technique calculates a unique set of coefficients for colour space conversion using pre-selected colours. The three-dimensional RGB colour space is broken down into a minimal number of colour indices that are specific to the application.

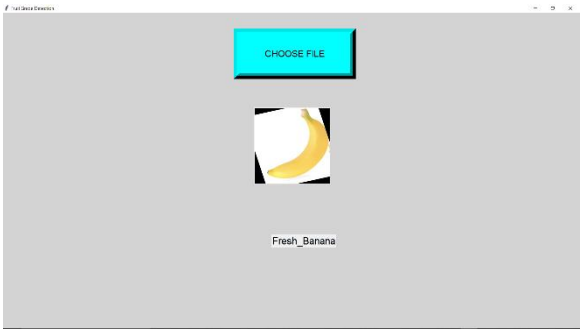
The suggested approach evaluates tomato and date ripeness as well as date surface fault identification. The strategy provided is straightforward yet effective. This novel direct colour mapping idea may be used in a number of colour grading applications that demand quick colour preference selection and tweaking

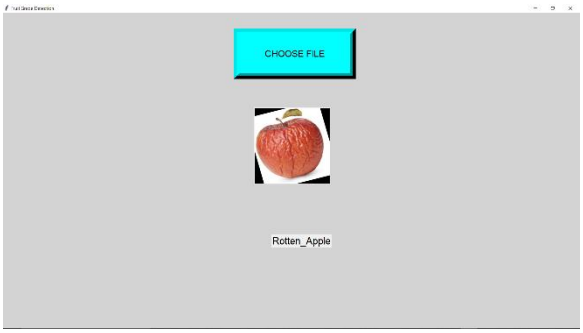
V. PROPOSED SYSTEM

The proposed system uses Modified cnn algorithm to detect fruit grading technique Our project is primarily concerned with improving the setup's architecture. We've added more layers to the CNN architecture. The hyper parameters including epoch, batch size, and validation split are altered to improve precision.The batch size refers to the number of image sets that will be learned at once. The accuracy improves as the number of photos decreases. The process's iteration count is called an epoch. Validation split is a method of validating data in a randomised order to increase accuracy.

VI. ARCHITECTURE DIAGRAM







VII. CONCLUSIONS

External characteristics of fruits, such as colour, size, shape, texture, and other defects, are particularly significant for classification and grading. Machine vision, as well as the availability of low-cost hardware and software, are becoming more common as technology improves.

Manual fruit sorting and grading has been replaced by automated machine vision systems due to software. The potential of non-destructive automation to generate accurate, quick, objective, and efficient results over manual effort could be the reason for its use. Machine vision will be the future of non-destructive testing, despite several hurdles have to be overcome.

We can work on picture categorization for local fruits and veggies in the future. We can also create fruit and vegetable grading algorithms and machine Based on the foregoing methodologies, mobile applications can be developed for farmers and the general public to utilise for horticulture product identification, classification, and grading.

REFERENCES

[1] Liming, X., &Yanchao, Z. (2010). Automated strawberry grading system based on image processing. Computers and Electronics in Agriculture, 71, S32-S39.

[2] Al Ohali, Y. (2011). Computer vision based date fruit grading system: Design and implementation. Journal of King Saud University-Computer and Information Sciences, 23(1), 29-36.

[3] Arivazhagan, S., Shebiah, R. N., Nidhyanandhan, S. S.,& Ganesan, L. (2010). Fruit recognition using color and texture features. Journal of Emerging Trends in Computing and Information Sciences, 1(2), 90-94.

[4] Lee, D. J., Archibald, J. K., &Xiong, G. (2010). Rapi color grading for fruit quality evaluation using direct color mapping. IEEE transactions on automation science and engineering, 8(2), 292-302.

[5] Asnor, J. I., Rosnah, S., Wan, Z. W. H., &Badrul, H. A. B.(2013). Pineapple maturity recognition using RGB extraction. International Journal of Electrical and Computer Engineering,7(6), 597-600.

[6] Unay, D., Gosselin, B., Kleynen, O., Leemans, V., Destain, M. F., &Debeir, O. (2011). Automatic grading of Bi-colored apples by multispectral machine vision. Computers and electronics in agriculture, 75(1), 204-212.

[7] Gawande, A., &Dhande, S. S. (2015). Implementation of fruits grading and sorting system by using image processing and data classifier. SSRG IntJ Comp Sci Engg, 2(6), 63-68.

[8] 8]Solanki, U., Jaliya, U. K., & Thakore, D. G. (2015). A survey on detection of disease and fruit grading. International Journal of Innovative and Emerging Research in Engineering, 2(2), 109-114.

[9] Nandi, C. S., Tudu, B., &Koley, C. (2014). Machine vision based techniques for automatic mango fruit sorting and grading based on maturity level and size. In Sensing technology: Current status and future trends II (pp. 27-46). Springer, Cham.

[10] Capizzi, G., LO SCIUTO, G. R. A. Z. I. A., Napoli, C., Tramontana, E., & WOŹNIAK, M. (2016). A Novel Neural Networks-Based Texture Image Processing Algorithm for Orange Defects Classification. International Journal of Computer Science & Applications, 13(2).

[11] Sahu, D., &Potdar, R. M. (2017). Defect identification and maturity detection of mango fruits using image analysis. American Journal of Artificial Intelligence, 1(1), 5-14.

[12] Naik, S., & Patel, B. (2017, February). Thermal imaging with fuzzy classifier for maturity and size based non-destructive mango (Mangifera Indica L.) grading. In 2017 International Conference on Emerging Trends & Innovation in ICT (ICEI) (pp. 15-20). IEEE.

[13] Arakeri, M. P. (2016). Computer vision based fruit grading system for quality evaluation of tomato in agriculture industry. Procedia Computer Science, 79, 426-433.