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Research Article

A STUDY OF THE GRADING PROCESS FOR AGRICULTURAL FOODS USING ARTIFICIAL INTELLIGENCE, MACHIN LEARNING TECHNOLOGY

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Abstract

Fruit anomalies can be detected using a multi-spectral image sensor in a computer vision system. As a starting point, the suggested method relies entirely on Near-Infrared (NIR) photographs to segment the fruit. Second, specific adaptive pre-processing methods are applied on the segmented RGB and NIR fruit images. By using thresholding techniques, the fruit's seven different colour components may be inspected for defects. Finally, the seven threshold colour component photos are put to a vote to see if the fruit image is defective. In the recent year, companies that provide services and deliver packages have changed. Online shopping provides various advantages for the postal and courier industry. Cartons or wooden boxes of various sizes are used to package the goods sold by the merchant. It is possible to depict the shape of an object by using a contour-based object detection algorithm. A contour is a representation of geometric principles in the form of edge or curve components. To determine the object's surface area, one must first determine its dimensions. Dimensions are widely used to measure the length, width, and height of an object.

Keywords: CNN, Machine learning, pre-processing, Classification, deep learning, detection

1. INTRODUCTION

The quality of a product has an impact on its pricing. Manual grading was once employed to verify the product's quality. For this reason, machine vision is being used to automate the grading process, as well as for other reasons, such as finding new uses for already existing technology and applying them in the real world. When it comes to inspecting and sorting products, Machine Vision is most commonly utilized for quality control. It is also possible to detect, classify, and track down a product's failure process using computer vision techniques. There must be a high-quality product for the health and safety of human beings in today's technological world, and a lot of manpower is needed for such a grading process. To avoid this, an automated product grading system is needed to ensure quality product manufacture. The experimental setup of a machine vision system is a camera on top of a conveyer belt. [1] The conveyer belt through which the fruits travel will be captured by the video camera. Finally, image processing techniques were used to enhance and enhance this still frame based on the size of the fruits.

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Currently, this technique is mostly used by the industry to assess the quality of fruits. It is also employed in the grading of vegetables, nuts, and a few other agricultural goods. India is one of the world's leading exporters of cashew kernels.

The ecology of fruit is critical. Deforestation is putting many plant species at risk of extinction. It's a win-win situation for both humans and the rest of the natural world. As a food source, a medical treatment option, and in a wide range of other business endeavors, they are extremely versatile. The identification of fruit helps to ensure the survival of all forms of life on Earth. A variety of methods can be used to identify fruit. Unlike other biometric components, such as flowers, which are only available for a brief time, fruits are readily available for use in classification. Many biometric characteristics, such as colour, shape, and texture, go into fruit classification. Performing identification by hand takes a lot of time and money. Fruits can be categorized based on colour, which includes the resemblance between two pictures, using a colour histogram; however, this is reliant on the season and the effect of sunshine. CNN can be used to categories Spices. Our goal is to determine the quality of fruits without consulting professionals. The old-fashioned way of finding fruit diseases with the assistance of experts. Consultations with specialists in neighbouring fields are expensive and time-consuming because of the lack of professionals in the region. This technology is capable of both classifying and detecting the quality of fruits.

Even while agricultural products are currently assessed properly, the grading system can be improved utilizing Artificial Intelligence to detect quality in other products as well. However, photographs of several things, particularly fruits, may have colors and shapes that are similar or identical. It's not enough to rely on colour or form feature analysis approaches because they're still ineffective. As a result, the method of colour, shape, and size, combined with Artificial Intelligence technique, is being utilized as a classifier to improve fruit quality detection accuracy. Low efficiency, slow speed, high expense, and complexity characterize the existing grading process. Products are used as a basis for selecting the optimal technique, which must meet all the necessary standards. It is possible to improve the grading process by using techniques like support vector machines (SVM), neural networks (BPNN), and fuzzy incremental learning (FLB) in combination with various image processing methods like histogram, RGB colour, space, and colour mapping, as well as artificial intelligence techniques like these.

II. LITERATURE SURVEY

In this section, the recent techniques related to topic are discussed. This covered the following sections:

Dr.P.M.Mahajan and Seema say, An image processing technology is utilized to determine the quality of the fruit grading system. When the fruit image is taken, several image processing methods can be used to extract the fruit's distinctive characteristics. The fruit's colour and texture are distinguishing characteristics that can be used to gauge its quality. In situations where the grading process is more advantageous in terms of high accuracy, speed, and low cost, We apply a variety of image processing approaches in this research to extract picture features, including as the RGB colour space method; colour mapping; HIS; and artificial intelligence techniques such neural networks, fuzzy logic, and support vector machines (SVM). [1].

Chandra sekhar, Bipan tudu and Chiranjib koley say, Based on a vision-based system for automatic grading and sorting of agricultural products, such as mangoes, which is based on

maturity level. Prior to this process, mangoes were graded and sorted manually. An automated mango grading system was designed to tackle this problem. Mangoes are being sent on a conveyer belt with a CCD camera mounted on top. The camera is set to video mode and captures photos of various attributes that indicate the maturity of the mangoes being conveyed. The IR vision is used to monitor photos of mangoes, where it can detect the tiniest changes in skin temperature caused by tissue damage, fruit fly or weevil infection. Mango quality is assessed using a variety of methodologies, including shape analysis, weight analysis, and maturity analysis [2]. For automatic grading and sorting, the GAUSSIAN MIXTUUURE MODEL is employed in this paper.

Vishnu S, A. Ranjith Ram," Identification of Plant Pathogens Using Patterns on the Surface of the Leaves There are several different methods for diagnosing whether or not your plants are affected with a disease, which are discussed on this page. Furthermore, more than half of all medical studies have found the practice of relying solely on a doctor's naked eye examinations for the diagnosis of diseases to be time-consuming, particularly in rural areas and underdeveloped countries. Even better, we now have a low-cost, high-accuracy method of photograph processing that is both quick and simple. Color transformation structure created by incorporating the RGB leaf picture into it. A subsequent step involves the transfer of colour space to the structure of colour transformation, which enhances the overall appearance of the picture. For the purpose of dividing the photographs into smaller groups, the second K-means clustering algorithm is applied. During this procedure, the textures of segmented infected entities are added to them. At this point, the features are sent into a neural network that was previously trained during the process's fourth step, and the process ends.

Pawan P. Warne, Dr. S. R. Ganorkar," In order to detect illness in cotton leaves, the K Mean Clustering Method is used. To reduce crop losses as much as possible, this article discusses the need of early disease identification, diagnosis, and treatment. Cotton diseases have been a key contributor to the fall in cotton production in recent years. The focus of research is on the leaf rather than the entire cotton plant because the majority of diseases such as Alternaria, Cercospora, and Red Leaf Spot begin on the leaf, which accounts for 85-85% of all infections. Object segmentation using the K means clustering technique, which organizes objects into a predetermined number of groups, and then classification using a neural network round out the preparation steps after the histogram equalization step, which improves low-contrast photographs.

Dimitri A. Lisin, Marwan A. Mattar, Matthe w B.Blaschko," Image Class Recognition Using Local and Global Image Features Computer vision is all about solving the problem of object recognition. The great majority of object recognition systems use one of two methods, both of which rely solely on local or global properties. The inability to properly integrate a single global feature vector with a collection of local features may be one cause for this. In this research, we show that when only crude object segmentations are available, integrating local and global features is useful in an application. Based on local characteristics, we provide a non-parametric Density estimation method for classifying data. After that, two methods for integrating local and global attributes are explained in detail. To begin, the first method makes use of a "stacking" ensemble strategy, whereas the second way employs a hierarchical classification approach.

P.Revathi, M.Hemalatha," Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques"[4] It is anticipated that farmers will reap significant benefits from

the cutting-edge computing system detailed in this proposed work when it comes to a variety of aspects of crop development. Crop disease evaluation and diagnosis in the field are critical for increasing crop productivity and reducing costs. Foliar disease, the most common fungal disease in cotton-growing regions in India, affects all cotton-growing regions. New technical ways for categorizing diseases are presented in this study, which makes use of the HPCCDD Proposed Algorithm as well as photos of cotton leaf spot symptoms captured by a cell phone. In order to accomplish intelligent farming, the classifier is being taught to do tasks such as disease detection in fruit orchards, selective fungicide treatment, and other tasks..

:Nikhitha M, Roopa Sri S, Uma Maheswari B," Fruit Recognition and Grade of Disease Detection using Inception V3 Model"[5] As a result of farmers' inability to identify diseases in fruits and vegetables, the yields of fruits and vegetables in India have decreased. Farmers from all around the world are losing a lot of money. Agricultural losses in the United States are most frequently caused by diseases of fruits and plants. Understanding the health state of the fruits and vegetables grown by farmers helps boost their productivity. An early detection system for diseases in crops is the end outcome of this research. We want to create a simple tool that can be used by anybody to assess the severity of a problem and give it a number grade. Classification is handled by the Inception model, which is retrained via the transfer learning method. A letter grade is also given to the percentage of fruit that has been infected by bacteria in the suggested method. The Tensor Flow platform was used to construct the system. Bananas, apples, and cherries were some of the fruits that were subjected to the suggested experiment.

A.S.Fathinul syahir, M.Z.Abdullah and A.Zakaria, "bio-inspired vision fusion for mango", (2012): As a result of farmers' inability to identify diseases in fruits and vegetables, the yields of fruits and vegetables in India have decreased. Farmers from all around the world are losing a lot of money. Agricultural losses in the United States are most frequently caused by diseases of fruits and plants. Understanding the health state of the fruits and vegetables grown by farmers helps boost their productivity. An early detection system for diseases in crops is the end outcome of this research. We want to create a simple tool that can be used by anybody to assess the severity of a problem and give it a number grade. Classification is handled by the Inception model, which is retrained via the transfer learning method. A letter grade is also given to the percentage of fruit that has been infected by bacteria in the suggested method. The Tensor Flow platform was used to construct the system. Bananas, apples, and cherries were some of the fruits that were subjected to the suggested experiment.

III. PROPOSED TECHNIQUES

In this essay, we will look at how Artificial Intelligence has entered the food market and how it has changed the food security assurance department. This review article will look at different AI technologies that have been deployed to give high-quality products to clients. As humans have gained knowledge over the years, their requirements have expanded and to fulfil them who AI (Artificial Intelligence) is being brought into the scene will be obvious through this paper. AI works more efficient as opposed to a person when it comes to specification and uniformity. Now a day's right from formation of micro-organisms, bacteria, Quality to Size of the cookie and no. of Chocó-chips on them everything is being closely monitored by the Food Associates and to ensure these AI has been brought into the scenario and it has helped a lot by increasing efficiency and decreasing the overall cost of the food product. Using a Ketchup manufacturing unit as an example, we will explain how ML (Machine Learning), DL (Deep Learning), NLP

(Natural Language Program), Computer Vision, and Robotics (a subset of AI) are used to make high-quality food items. This will help other industries adopt and enjoy the benefits of AI in their manufacturing units.

One of the most extensively produced and consumed agricultural items is the tomato Harvesting, sorting, and grading of fruits are the primary functions of these systems, while calibrations are performed to determine characteristics such as color and size as well as mass, shape, and flaws. So, the development of an effective fruit identification and mass estimate system is essential for the creation of a fully automated farming and packaging pipeline. Object detection, categorization, and analysis are the three key phases in this method.

A few of the most common picture pre-processing methods used in the processing of the ketchup includes the color processing of the final outcome i.e., the sauce itself. Imaging's segmentation is one of the most significant elements in image processing since it decides whether image analysis is concentrated on the target sample or not. Similarly, regression prediction models based on both 2-D and 3-D picture characteristics were used to estimate tomato fruit mass from volume. Using multiple artificial intelligence methods, we used the connection between 2-D size and mass of tomato fruit to derive the physical link between these characteristics. These techniques were trained and evaluated on the output from the geometry module (estimated dimensions) to estimate the final mass using the tomato dataset.

For e.g., Feature extraction backbone network, region proposal network (RPN) to generate anchors, and an FCN running parallel to fully connected networks that output instance-wise semantic masking and target detection with classification outputs are shown in the figure below as a complete framework for the Mask-RCNN.

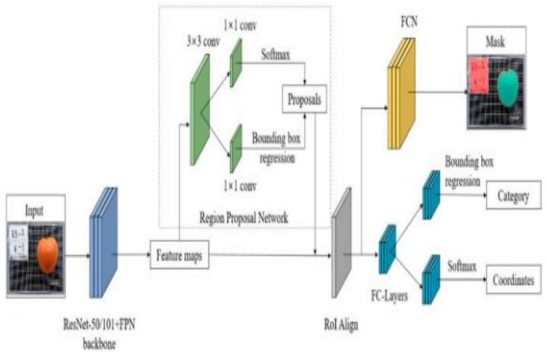

Fig-1 Process of Computer Vision at Machine level

ALGORITHMS

Convolutional Neural Network:-

A convolution (CNN/ConvNet) is a form of deep learning model used to evaluate visual imagery in machine learning. When we conceive about neural networks, we usually think of multiplications, but this isn't the case with Convolution. It employs a technique known as Convolution. Pooling layer is a mathematical function on two functions that yields a third function that explains how the shape of one is changed by the other. Multiple layers of artificial neurons make up convolution neural network. Connections between neurons are mathematical in

nature that calculate the weight value of various inputs and output an activity value, similar to their natural counterparts.

Each layer creates many activation functions that are passed onto next layer when you input an image into a ConvNet. Main characteristics such as horizontal or diagonal edges are usually extracted by first level. This data is communicated on to the next level, which really is able to detect more complicated features like corners and combinational edges. As we go deeper into the system, it can recognize even more complex elements like objects, faces, and so on.

ANN Technique in the Food Industry ANN is another AI aspect, which is also extensively employed in the food business. ANN is supposed to replicate the human brain and be able to obtain information through learning and the inter-neuro connections which are known as synaptic weights [59, 60]. Gandhi and coworkers have said that the configuration of ANN is created in such a way that it will fit particular application such as data classification or pattern recognition

According to Gonzalez-Fernandez, ANN is relevant to a varied kind of issues and scenarios, adaptable, and versatile. In addition, Gonzalez et al. (2019) have also mentioned that ANN is suitable to model most non-linear systems and is flexible to novel scenarios even though changes are needed. Moreover, the most notable properties of ANN is its non-linear regression. There are various forms of ANN including feed forward neural network, radial basis function neural network, Kohonen self-organizing neural network, recurrent neural network, convolutional neural network, and modular neural network [63]. Multilayer perceptron (MLP), radial basis function networks (RBFNN), and Kohonen self-organizing algorithms are the most effective types of NN when it comes to handling real issues [61]. The most frequent network that is used for prediction and pattern recognition is the multilayer perceptron

IV. CONCLUSION

This paper offers a method for detecting fruit diseases utilizing a variety of disease classification methodologies, as well as an image segmentation algorithm that can be used for automatic fruit disease detection and classification. • The advantage of this method is that fruit diseases can be discovered early or even before they manifest. In this procedure, image processing is employed to diagnose the quality. This image processing technology is advantageous for extracting and identifying the fruit's sick area. We should continue to explore and use digital image the identification of fruit diseases. This method is applicable to agriculture as well as greenhouse management

6. References

1. V. Balali, A. A. Rad, and M. Golparvar-Fard, “Detection, classification, and mapping of U.S. traffic signs using Google street view images for roadway inventory management,” Vis. Eng., vol. 3, no. 1, p. 15, 2015.
2. K. C. P. Wang, Z. Hou, and W. Gong, “Automated road sign inventory system based on stereo vision and tracking,” Comput.-Aided Civil Infrastruct. Eng., vol. 25, no. 6, pp. 468–477, 2010.

3. V. Balali and M. Golparvar-Fard, “Evaluation of multiclass traffic sign detection and classification methods for U.S. roadway asset inventory management,” J. Comput. Civil Eng., vol. 30, no. 2, 2016, Art. no. 04015022.
4. J. M. Lillo-Castellano, I. Mora-Jiménez, C. Figuera-Pozuelo, and J. L. Rojo-Álvarez, “Traffic sign segmentation and classification using statistical learning methods,” Neurocomputing, vol. 153, pp. 286–299, Apr. 2015.
5. M. Haloi. (2015). “A novel pLSA based traffic signs classification system.” [Online]. Available: https://arxiv.org/abs/1503.06643
6. Y. Zhu, C. Zhang, D. Zhou, X. Wang, X. Bai, and W. Liu, “Traffic sign detection and recognition using fully convolutional network guided proposals,” Neurocomputing, vol. 214, pp. 758–766, Nov. 2016.
7. R. Timofte, V. Prisacariu, L. Van Gool, and I. Reid, “Combining traffic sign detection with 3D tracking towards better driver assistance,” in Emerging Topics in Computer Vision and Its Applications. Singapore: World Scientific, 2011, pp. 425–446. doi: 10.1142/8103.
8. A. Mogelmose, “Visual analysis in traffic & re-identification,” Ph.D. dissertation, Fac. Eng. Sci., Aalborg Univ., Aalborg, Denmark, 2015.
9. J. Stallkamp, M. Schlipsing, J. Salmen, and C. Igel, “Man vs. Computer: Benchmarking machine learning algorithms for traffic sign recognition,” Neural Netw., vol. 32, pp. 323–332, Aug. 2012.
10. S. Houben, J. Stallkamp, J. Salmen, M. Schlipsing, and C. Igel, “Detection of traffic signs in real-world images: The German traffic sign detection benchmark,” in Proc. IJCNN, Aug. 2013, pp. 1–8.
11. A. Mogelmose, M. M. Trivedi, and T. B. Moeslund, “Vision-based traffic sign detection and analysis for intelligent driver assistance systems: Perspectives and survey,” IEEE Trans. Intell. Transp. Syst., vol. 13, no. 4, pp. 1484–1497, Dec. 2012.
12. F. Zaklouta and B. Stanciulescu, “Real-time traffic-sign recognition using tree classifiers,” IEEE Trans. Intell. Transp. Syst., vol. 13, no. 4, pp. 1507–1514, Apr. 2012.
13. Z. Zhu, D. Liang, S. Zhang, X. Huang, B. Li, and S. Hu, “Traffic sign detection and classification in the wild,” in Proc. CVPR, Jun. 2016, pp. 2110–2118.
14. [14] K. He, G. Gkioxari, P. Dollár, and R. Girshick, “Mask R-CNN,” in Proc. Int. Conf. Comput. Vis., Oct. 2017, pp. 2980–2988.
15. S. B. Wali, M. A. Hannan, A. Hussain, and S. A. Samad, “Comparative survey on traffic sign detection and recognition: A review,” Przegl¸ad Elektrotechniczny, vol. 1, no. 12, pp. 40–44, 2015.
16. Ms.Seema banot, Dr.P.M.Mahajan, “A fruit detecting and grading systembased on image preprocessing” International journal of innovation research vol.4,issue.1,Jan.2016.
17. Chandra sekhar nandi, Bipiain tudu, Chiranjib koley, “An automated machine vision based system for fruit sorting and grading”International conference sensing technology(ICST)vol.6,ISSN 2156-8065,pp.195-200,IEEE 2012.
18. A.S.Fathinal syahir, A.Y.M.Shakaff, A.Zakaria, M.Z.Abdullah, “Bio-inspired vision fusion for quality assessment of harumanis mangoes” vol.10,pp.317-324,IEEE 2012.
19. A.Shyna, Reena mary George, “Real time cashew grading and sorting system using SVM and BPNN” (ICCPCT),vol.10,IEEE,April 2017.
20. K.Vijayarekha, R.Govindaraj, “Citrus fruits external defect classification using wavelet packet transform features and ANN”(ICIT),pp.2872- 2877,IEEE 2008.

21. M.Shafqat, Aslam Muhammad, A.M.Martiniz, “Fault prediction using ANN and Fuzz logic”(MICA),PP.149-154,IEEE,Oct 2008
22. H. Zhong-zhi, L. Yan-zhao, L. Jing and Z. You-gang, "Quality Grade-Testing of Peanut Based on Image Processing," 2010 Third International Conference on Information and Computing, 2010, pp. 333-336, DOI: 10.1109/ICIC.2010.270.
23. N. N. Misra, Y. Dixit, A. Al-Mallahi, M. S. Bhullar, R. Upadhyay and A. Martynenko, "IoT, big data and artificial intelligence in agriculture and food industry," in IEEE Internet of Things Journal, DOI: 10.1109/JIOT.2020.2998584.
24. Gokce Iymen, Gizem Tanriver, Yusuf Ziya Hayirlioglu, Onur Ergen, Artificial intelligence-based identification of butter variations as a model study for detecting food adulteration, Innovative Food Science & Emerging Technologies, Volume 66,2020,102527, ISSN 14668564, https://doi.org/10.1016/j.ifset.2020.102527.
25. Vijay Kakani, Van Huan Nguyen, Basivi Praveen Kumar, Hakil Kim, Visweswara Rao Pasupuleti, A critical review on computer vision and artificial intelligence in food industry, Journal of Agriculture and Food the Research, Volume 2, 2020, 100033, ISSN 2666-1543, https://doi.org/10.1016/j.jafr.2020.100033.
26. J. A. García-Esteban, B. Curto, V. Moreno, I. González-Martín, I. Revilla and A. Vivar-Quintana, "A digitalization strategy for quality control in food industry based on Artificial Intelligence techniques," 2018 IEEE 16th International Conference on Industrial Informatics (INDIN), 2018, pp. 221-226, DOI: 11109/INDIN.2018.8471994.
27. N. Elakkiya, S. Karthikeyan and T. Ravi, "Survey of Grading Process for Agricultural Foods by Using Artificial Intelligence Technique," 2018 Second International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2018,