WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Mango Fruit Classification Based on Ripeness

Rushikesh S. Pande[1], Sonali S. Tribhuvan[2], Aniket J. Gholap[3], Siddhesh Upasani[4]

[1 2 3] Department of Electronics and Telecommunication, Pune Institute of Computer Technology

[4] Department of Electronics and Telecommunication, Pune Institute of Computer Technology

ABSTRACT –

This survey paper provides an overview of recent research on the application of machine learning for mango fruit classification based on ripeness. The paper summarizes the key findings, methods, and conclusions from a range of studies in this area and identifies areas where further research is needed. The paper argues that machine learning has the potential to improve mango fruit quality and increase the efficiency of mango supply chain management.

I.INTRODUCTION

Mango is a popular tropical fruit with a high demand globally due to its delicious taste, nutritional value, and versatility in culinary applications. The assessment of mango fruit ripeness is crucial for determining the optimal time for harvesting, post-harvest handling, distribution, and consumer satisfaction. Traditionally, the ripeness evaluation has been performed manually by experts based on visual cues such as color, texture, and aroma. However, this subjective and labor-intensive process is prone to errors, leading to inconsistencies in fruit quality and potential economic losses.

With the advancements in machine learning (ML) techniques, there has been growing interest in automating and enhancing the mango fruit ripeness classification process. ML algorithms can effectively analyze large volumes of data and learn patterns that differentiate ripe and unripe mangoes, providing accurate and objective classification results. These algorithms can process both visual and non-visual features of mango fruits, including color, texture, firmness, sugar content, and volatile compounds, among others.

The goal of this survey paper is to provide a comprehensive overview of the existing research on mango fruit classification based on ripeness using ML techniques. By conducting an extensive review of the literature, we aim to identify the key methodologies, algorithms, datasets, and performance metrics employed in previous studies. Additionally, we will examine the advantages and limitations of different ML approaches and discuss the potential implications and applications of this research in the mango industry.

II. LITERATURE SURVEY

1. The proposed approach in the research paper [1] introduces an automatic mango fruit grading system that utilizes non-destructive techniques, specifically thermal imaging and transfer learning with a pre-trained SqueezeNet model. Thermal imaging is a method that captures the heat distribution of an object, which can provide insights into the fruit's internal characteristics and ripeness. In the research paper by the authors highlight the impact of factors such as bruises, color, and appearance on fruit quality, which ultimately influence consumer preferences. The paper focuses on non-destructive techniques for assessing the maturity levels of mango fruits to enhance the accuracy of quality evaluation. Transfer learning, on the other hand, is a technique that leverages pre-trained models on large datasets and adapts them to a specific task with smaller datasets. In this case, the authors utilize a pre-trained SqueezeNet model, which is a deep learning architecture known for its efficiency, and fine-tune it using mango fruit data to enable accurate grading based on ripeness levels.

2. In the research paper. [2], the authors propose an approach that utilizes deep learning techniques for the classification of 10 different fruits. They obtained images of these fruits from the Kaggle website and employed a pre-trained Convolutional Neural Network (CNN) model, specifically VGG16, for their classification task. The authors conducted training and validation of the proposed model using the collected fruit images. They also evaluated the model's performance using a separate dataset that was not used during training or validation. Remarkably, they achieved an accuracy rate of 100% in their classification task, indicating that the proposed model effectively predicted and classified the different fruits without any errors, demonstrating high performance.

3. In the research paper [3], a real-time machine vision framework for date fruit harvesting robots in an orchard environment was proposed. The framework utilized deep learning techniques, specifically transfer learning with fine-tuning, to classify date fruit bunches based on their type, maturity, and harvesting decision. The authors investigated two pre-trained CNN models, AlexNet and VGG-16, for the classification tasks.

To build a robust machine vision system, a rich image dataset comprising five date types across all maturity stages was used. The dataset was designed to incorporate variations that represent challenges typically encountered in natural environments and date fruit orchards.

4. The proposed approach achieved excellent classification accuracies on the challenging dataset, without the need for image pre-processing techniques such as background noise removal or illumination enhancement. The fine-tuned VGG-16 model demonstrated the best performance, achieving accuracies of 99.01%, 97.25%, and 98.59% for date fruit type, maturity, and harvesting decision classification models, respectively. The classification times were also reported, indicating the efficiency of the approach.

5. In the research paper [5], published in 2022, the authors propose a CNN-based model for the classification of eight different popular date fruits in Saudi Arabia. The model is trained on an in-house dataset that comprises approximately 1750 images, with a frequency ranging from 204 to 240 images for each class. For the classification task, the authors adopt an existing architecture, MobileNetV2, as the basis for their proposed model. MobileNetV2 is a convolutional neural network architecture known for its efficiency and suitability for mobile and embedded devices.

6. The proposed model aims to accurately classify the eight different date fruit classes using the in-house dataset and the aforementioned preprocessing techniques. Unfortunately, further details regarding the specific results, accuracies, or performance metrics achieved by the proposed model are not provided in the given information.

III.PROPOSED METHODOLOGY

In this section, we are discussing the existing CNN models which are used for classification. Through literature reviews we have formulated some of the existing methodologies and designed our system based on the difficulties which they had faced. There are CNN algorithms which are used by the existing models. The fig shows an CNN architecture used for identifying class of a car. In our project we will be using the similar method.

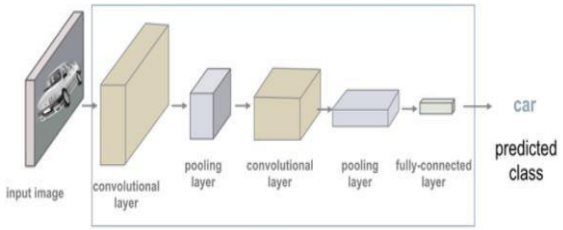

Fig 1. CNN

There are many fruit classification techniques which uses different datasets. One of the existing model is as follows:

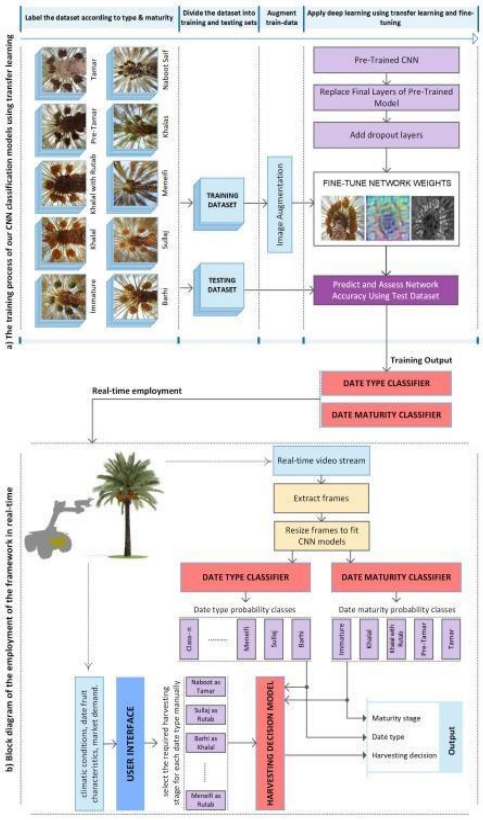

Fig 2. Date Fruit Classification Model

The above model is used for the Date classification. We are making changes in our project according to the datasets required, the accuracy and the overall performance for our final Mango fruit classification model.

IV. CONCLUSION AND FUTURE SCOPE

In this research, by using deep learning classification algorithms like CNN, we have proposed a model which first identifies the fruit whether it is mango or not, if it is mango then identity the maturity stages of the fruit- Mango. CNN extract features based on variations of color, shape. Based on its maturity stage the model will show the fruits remaining time period for ripening. The Proposed model uses a limited dataset which can only classify a particular fruit (Mango). By extending the dataset it can be further be used to classify other fruits based on their maturity stage. A real time interfacing model of the proposed model has multiple applications, but in fact has low accuracy. The system requirements for real time interfacing of the model are very high. A real time interfacing model with robotic arm can make many manual operations automatic.

ACKNOWLEDGMENT

We would especially like to thank our guide, Mr. Siddhesh Upasani, for helping us choose the topic, providing us with the excellent opportunity to work on this wonderful project of "Mango Fruit Classification Based on Ripeness," and guiding us all the way through the project.We are very grateful to him for teaching us new terminology and approaches.

REFERENCES

[1]Varsha Bhole, Arun Kumar – "Mango Quality Grading using Deep Learning
Technique: Perspectives from Agriculture and Food Industry".
[2]Mohammed A. Alkahlout, Samy S. Abu-Naser, Azmi H. Alsaqqa, Tanseem N. Abu- Jamie, "Classification of Fruits Using Deep Learning", IJAER
[3] Hamdi Altaheri, Mansour Alsulaiman and Ghulam Muhammad "Date Fruit Classification for Robotic Harvesting in a Natural Environment Using Deep Learning",2019 , IEEE
[4] Khalied Albarrak, Yonis Gulzar, Yasir Hamid, Abid Mehmood and Arjumand Bano
Soomro – "A Deep Learning-Based Model for Date Fruit Classification".

[5] Tej Bahadur Shahi, ChiranjibiSitaula, Arjun Neupane, William Guo –"FruitClassification using attention-based MobileNet V2 for Industrial applications.

[6] V.Eyrkai Nambi, K. Thangavel, D. Manohar Jesudas," Scientific Classification of ripening period and development of colour grade chart for Indian Mangoes using Multivariate Cluster analysis",2015

[7] Hafiza Ufaq Rehman, Jun Miura,"Viewpoint Planning for Automated Fruit Harvesting using Deep Learning",2021, IEEE.

[8] HaciBayranUmal, Ebru Vural, Burcu Kir Savas, Yasar Becerikli" Fruit Recognition and Classification using Deep Learning Support on Embedded System(fruitnet)", 2020, IEEE.

[9] Yan-Ping Liu, Chang-Hui Yang, Huang Ling, Shingo Mabu, Takashi Kuremoto,-"A visual System of Citrus Picking Robot Using convolutional Networks",2018, IEEE

[10] Mansour Alsulaiman, Mohammad Arafah, Mohamed Amine Mekhtiche, "Intelligent Harvesting Detection System for Date Fruit Based on Maturity stage Using Deep Learning and Computer Vision",2020, IEEE

[11] Om Prakash, " Diseases and Disorders of Mango and their Management".

[12]Liuchen Wu, Hui Zhang, Ruibo Chen, Junfei Yi "Fruit Classification using Convolutional Network via Adjust Parameter and Data Enhancement",2020 12th International Conference on Advanced Computational Intelligence (ICACI) , IEEE.

[13] Steven Puttemans, Y+++asminVanbrabant, Lauren Tits,ToonGoedeme-"Automated Fruit detection for Harvest estimation and Robotic Harvesting", 2016 6th International Conference on Image Processing Theory, IEEE