ARECANUT QUALITY AND PRICE PREDICTION

A project phase – 1 report as a part of academic requirements for the department of

MASTER OF COMPUTER APPLICATIONS

Submitted by

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Department of Master of Computer Applications

CERTIFICATE

Certified that the project work entitled **'Arecanut Quality And Price Prediction'** carried out by **SHRIVATSA BHAT**,**4NI22MC096**, at The National Institute of Engineering is submitted as a part of academic requirements to Master of Computer Applications Department in **The National Institute of Engineering, Mysuru,** an autonomous institute under Visvesvaraya Technological University, Belagavi during the year 2023-2024. It is certified that all suggestions/corrections suggested during Internal Assessmenthave been incorporated in the report. The project report/ dissertation has been approved as it satisfies the academic requirements in respect of project phase-1 work.

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DECLARATION

I, **SHRIVATSA BHAT** bearing USN:**4NI22MC096** student at **The National Institute of Engineering**, Master of Computer Application, The National Institute of Engineering, Mysuru hereby declare that the project work entitled **"Arecanut Quality And Price Prediction"** has been carried out by me under the guidance of **Ms. Sandhya N, Assistant Professor, Dept of MCA.** This project work is submitted to **The National Institute of Engineering**, Mysuru, (An Autonomous institute under VTU, Belagavi) in partial fulfillment of the course requirements in Master of Computer Applications during the academic year 2023-2024.

Place: Mysuru

Date: (Signature of the student)

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ABSTRACT

The increasing consumer consciousness regarding food quality and safety has spurred the demand for robust systems capable of evaluating agricultural produce accurately. In response to this demand, this paper introduces an innovative application aimed at predicting the quality and estimated price of arecanuts through the integration of machine learning and image processing methodologies. By harnessing cutting-edge image processing algorithms and machine learning models, the proposed system offers an automated solution for analysing the quality attributes of arecanuts based on visual cues extracted from images. Furthermore, historical pricing data and market trends are incorporated into the predictive framework to forecast the future price trends of arecanuts, thereby empowering stakeholders with valuable insights for decision-making.

The envisioned system holds the potential to revolutionize the arecanut industry by providing stakeholders with timely and precise assessments of product quality and pricing dynamics. By automating the quality assessment process, the proposed solution not only enhances efficiency but also facilitates the maintenance of high-quality standards, thus meeting the evolving demands of consumers. Moreover, the integration of predictive analytics enables stakeholders to anticipate market trends and make informed decisions regarding production, pricing, and distribution strategies. Overall, the proposed system offers a comprehensive solution to address the challenges associated with arecanut quality evaluation and price prediction, thereby contributing to the advancement and sustainability of the agricultural sector.

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CHAPTER 1

INTRODUCTION

In recent years, the agricultural industry has witnessed a significant shift towards technological advancements aimed at enhancing productivity, quality, and efficiency. With consumers placing increasing emphasis on food quality and safety, there arises a pressing need for innovative solutions capable of accurately assessing the quality attributes of agricultural commodities. Arecanut, also known as betel nut or supari, is a vital cash crop extensively cultivated across several regions globally. Recognized for its economic significance and cultural relevance, the arecanut industry faces challenges in effectively evaluating product quality and predicting market prices.

In response to these challenges, this project endeavors to develop an automated system for the analysis of arecanut quality and the prediction of market prices. Leveraging the capabilities of machine learning and image processing techniques, the proposed system aims to revolutionize the traditional methods of arecanut assessment, which often rely on manual inspection and subjective judgment. By integrating advanced algorithms for feature extraction, classification, and predictive modeling, the system endeavors to provide stakeholders with timely and accurate insights into arecanut quality parameters and pricing trends. This introduction outlines the motivation, objectives, and scope of the project, setting the stage for a comprehensive exploration of automated arecanut quality analysis and price prediction.

CHAPTER 2

OBJECTIVES

1. Develop an automated system for the analysis of arecanut quality utilizing machine learning and image processing techniques.
2. Implement algorithms for feature extraction from arecanut images, focusing on colour, texture, size, and shape attributes.
3. Train machine learning models, including Support Vector Machines (SVM) and Convolutional Neural Networks (CNN), for accurate classification of arecanut quality based on extracted features.
4. Integrate historical pricing data and market trends into the predictive framework to forecast future price trends of arecanuts.
5. Design a user-friendly interface to facilitate easy interaction with the system and provide stakeholders with intuitive access to quality assessment and price prediction functionalities.
6. Conduct comprehensive validation and evaluation of the developed system using real-world arecanut datasets, assessing its accuracy, efficiency, and usability.
7. Collaborate with stakeholders from the arecanut industry to gather feedback and insights for further refinement and optimization of the system.
8. Document the development process, methodology, and findings in a comprehensive project report, highlighting the contributions and potential impact of the proposed system on the arecanut industry.

CHAPTER 3

LITERATURE SURVEY

[1] "Possible Approaches to Arecanut Sorting / Grading using Computer Vision: A Brief Review"

Authors: **Bharadwaj N K, Dr. Dinesh R**

This paper delves into the intersection of computer science, particularly artificial intelligence and soft computing techniques, with agricultural and food science, focusing on the classification and defect detection of products such as Arecanut. Arecanut holds significant cultural and economic importance, necessitating the exploration of computer vision and image processing technologies for its classification and grading. The challenges in developing an automatic classification system for Arecanut stem from the variations in colour, texture, and shape across different varieties and regions where they are grown. Various methods, particularly those focusing on external appearance, are employed for processing Arecanut. Solutions for classification and grading can be devised based on colour, size, and texture attributes. The paper also discusses notable research in Arecanut classification from a computer vision perspective, as well as in other fruits. Overall, the aim of this article is to provide an in-depth introduction to Arecanut, computer vision, and the need and applications of vision-based technology in its classification and grading.

[2] "Arecanut Grade Analysis using Image Processing Techniques"

Authors: Pushparani M.K, Dr. D Vinod Kumar, Dr. Abdulla Gubbi

The paper aims to develop a computer vision-based grading system for boiled Arecanuts, addressing the labor-intensive and time-consuming process of manual grading in Arecanut marketing. Currently, the focus is on implementing the software aspect of the computer vision system. The efficiency gains from such a system are derived from functions like pooling and transportation of graded produce, which benefit from economies of scale. Grading Arecanuts is a specific function tailored to the commodity. The proposed system utilizes MATLAB Toolbox to categorize Arecanuts into different grades. The classification relies on features such as colour and texture, as Arecanuts vary in these aspects across grades. colour information is extracted by converting images to HSV colour space and quantizing them to generate a histogram summarizing colour characteristics. Texture information is obtained using the Gabor transform to compute average amplitude and mean squared energy values. These features are then fed

into a Support Vector Machine (SVM) classifier, utilizing a radial basis function for training. The resulting SVM model is employed to classify Arecanuts based on the extracted features.

[3] "**Applications of Image Processing in Agriculture: A Survey"**

Authors: Anup Vibhute, S K Bodhe

The paper focuses on the survey of the application of image processing in agriculture, specifically in imaging techniques, weed detection, and fruit grading. It highlights the accuracy and time efficiency of image processing compared to traditional methods. The use of image processing can enhance decision-making processes for vegetation measurement, irrigation, and fruit sorting. Various technologies like remote sensing, hyperspectral imaging, fuzzy logic, neural networks, and genetic algorithms are discussed in the context of improving agricultural practices.

[4] "Machine Learning Applications in Agriculture"

Authors: Hakkim, V., Joseph, E., Gokul, A., and Mufeedha, K.

Abstract: Precision farming, also known as digital agriculture, is a technology-driven sustainable farm management system that utilizes modern information technologies and smart devices for decision support in agriculture. It is a key component of the third agricultural revolution and employs technologies like IoT, AI, data analytics, and cloud computing. This approach aims to enhance agricultural productivity and ensure food security for the growing global population.

[5] "Quality Inspection and Grading of Agricultural and Food Products by Computer Vision- A Review"

Authors: Narendra V G Hareesh K S

Abstract: This paper presents the design of an automated corn kernel inspection system using machine vision technology. The system aims to inspect corn kernels for quality assessment and grading, utilizing image processing techniques. The mentioned techniques encompass a diverse array of applications within the realm of computer vision and image processing across various agricultural and food product domains. For instance, in the case of oranges, methods such as colour segmentation, linear discriminant analysis, contour curvature analysis, and thinning processes are employed to precisely assess their quality. Similarly, strawberries undergo image processing techniques tailored for size and shape analysis, while automated systems are devised for sorting oil palm fruits, ensuring high throughput rates. Tomatoes benefit from computer vision approaches aimed at quality assessment, whereas grain classification relies on machine

vision to evaluate the quality of wheat and corn. Furthermore, innovative segmentation algorithms, like the region-based segmentation method for determining topping exposure percentage in pizzas, contribute to enhanced food quality evaluation. Lastly, image-based grading systems are utilized for assessing the quality of meat products, collectively demonstrating the versatility and effectiveness of computer vision and image processing in optimizing agricultural and food product quality.

[6] "Image Processing and Machine Learning for Automated Fruit Grading System: A Technical Review"

Authors: Rashmi Pandey, Sapan Naik, Roma Marfatia

In India, demand for various fruits and vegetables are increasing as population grows. Automation in agriculture plays a vital role in increasing the productivity and economical growth of the Country, therefore there is a need for automated system for accurate, fast and quality fruits determination. Researchers have developed numerous algorithms for quality grading and sorting of fruit. Colour is most striking feature for identifying disease and maturity of the fruit. In this paper; efficient algorithms for colour feature extraction are reviewed. Then after, various classification techniques are compared based on their merits and demerits. The objective of the paper is to provide introduction to machine learning and colour based grading algorithms, its components and current work reported on an automatic fruit grading system.

[7] "Automatic Fruit Grading and Classification System Using Computer Vision: A Review"

Authors: Seema, A. Kumar and G. S. Gill

Automation in agriculture comes into play to increase productivity, quality and economic growth of the country. Fruit grading is an important process for producers which affects the fruits quality evaluation and export market. Although the grading and sorting can be done by the human, but it is slow, labour intensive, error prone and tedious. Hence, there is a need of an intelligent fruit grading system. In recent years, researchers had developed numerous algorithms for fruit sorting using computer vision. Colour, textural and morphological features are the most commonly used to identify the diseases, maturity and class of the fruits. Subsequently, these features are used to train soft computing technique network. In this paper, use of image processing in agriculture has been reviewed so as to provide an insight to the use of vision-based systems highlighting their advantages and disadvantages.

[8] "**Machine Vision based Real Time Cashew Grading and Sorting System using SVM and Back Propagation Neural Network"**

Authors Reena Mary George, Shyna A

In today's consumer-driven world, heightened awareness regarding food product quality underscores the necessity for automated quality management systems. The transition to automation offers significant benefits, including reduced production costs and overall enhancement in quality. Currently, manual grading and sorting processes prevail for cashew kernels, proving both time-consuming and costly. This paper presents a real-time classification system aimed at automating the grading of cashew kernels, leveraging colour, texture, size, and shape features. Texture features are extracted using Multiresolution Wavelet and Contourlet transforms. Images of cashew kernels are captured using a Charge Coupled Device (CCD) camera and pre-processed via an efficient background subtraction technique. Subsequently, machine learning techniques are employed to extract various external features. For experimental validation, cashew kernels from five distinct varieties are collected. Support Vector Machine (SVM) and Back Propagation Neural Network classifiers are utilized, with their performance evaluated in terms of accuracy.

[9] "FORECASTING ARECA NUT MARKET PRICES USING THE ARIMA MODEL: A CASE STUDY OF INDIA"

Authors: Abhaya K. Kumar, Prakash Pinto

The study focuses on using the Box Jenkins ARIMA methodology to forecast the prices of a new variety of Areca nut in Karnataka from January 2009 to December 2018. Diagnostic checks using ACF and PACF correlograms led to the selection of ARIMA (3, 1, 3) as the suitable model for price prediction. Data was sourced from the OGD platform in India, highlighting the no stationarity of Areca nut price series. Various models were evaluated, with ARIMA (3, 1, 3) identified as the most appropriate model for forecasting.

[10] "Computer Vision Based Mango Fruit Grading System"

Authors: Chandra Sekhar Nandi, Bipan Tudu, and Chiranjib Koley

The paper presents a computer vision-based system for grading mango fruits. It involves background elimination, contour detection, feature extraction, maturity prediction, size calculation, and grading using a multi-attribute decision method. The system also evaluates surface defects using image processing techniques. The authors achieved high accuracy in size estimation, colour grading, and defect measurement, demonstrating the effectiveness of the proposed system for mango fruit grading.

CHAPTER 4

SURVEY ON METHODOLOGY

1. **Machine Learning:**
    - Machine learning involves the development of algorithms that allow computers to learn from data and make predictions or decisions without being explicitly programmed. In your project, machine learning techniques such as Support Vector Machines (SVM), Convolutional Neural Networks (CNN), and possibly other algorithms will be utilized.
    - SVM is a supervised learning algorithm that can be used for classification tasks. It works by finding the hyperplane that best separates the different classes in the feature space.
    - CNN is a type of deep learning algorithm particularly suited for image classification tasks. It consists of multiple layers of convolutions and pooling operations to automatically learn hierarchical features from images.
    - These machine learning models will be trained using labelled arecanut images, where the labels represent the quality attributes of the arecanuts.
2. **Image Processing:**
    - Image processing involves the manipulation and analysis of digital images to extract useful information. In your project, image processing techniques will be employed for feature extraction from arecanut images.
    - Feature extraction methods may include techniques for analysing colour histograms, texture patterns, size measurements, and shape descriptors from the arecanut images.
    - These features will serve as input to the machine learning models, allowing them to learn patterns and relationships between different quality attributes of the arecanuts.
3. **Predictive Modelling:**
    - Predictive modelling involves the development of models that can make predictions about future outcomes based on historical data. In your project, predictive modelling will be used to forecast the future price trends of arecanuts.
    - Historical pricing data and market trends will be integrated into the predictive framework to train models capable of predicting future price fluctuations.
    - Time series analysis and regression techniques may be employed to model and predict the price dynamics of arecanuts over time.

4. **Data Collection:**
    - Data collection involves gathering real-world datasets that are representative of the problem domain. In your project, real-world arecanut datasets will be collected to train and validate the developed models.
    - These datasets will include labelled arecanut images along with corresponding quality attributes and historical pricing data.
5. **User Interface Design:**
    - User interface (UI) design involves creating a graphical interface through which users can interact with the system. In your project, a user-friendly interface will be designed to facilitate interaction with the automated system.
    - The UI will provide stakeholders in the arecanut industry with intuitive access to quality assessment and price prediction functionalities, allowing them to make informed decisions based on the system's outputs.
6. **Validation and Evaluation:**
    - Validation and evaluation are essential steps to assess the performance and effectiveness of the developed system. In your project, comprehensive validation and evaluation will be conducted using real-world datasets.
    - Various metrics such as accuracy, precision, recall, and F1-score will be used to evaluate the performance of the machine learning models.
    - User testing and feedback collection will also be conducted to assess the usability and practicality of the user interface design.

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CHAPTER 5

TOOLS AND TECHNOLOGIES REQUIRED

1. **Python Programming Language:** Python is widely used in data science and machine learning projects due to its simplicity, versatility, and extensive libraries. You'll utilize Python for coding machine learning algorithms, image processing, and data analysis tasks.
2. **Machine Learning Libraries:** You'll need several machine learning libraries in Python for building, training, and evaluating predictive models. Some key libraries include:
    - scikit-learn: For implementing machine learning algorithms like Support Vector Machines (SVM), decision trees, and ensemble methods.
    - TensorFlow or PyTorch: Deep learning frameworks for building neural network models, including Convolutional Neural Networks (CNNs) for image classification.
    - Keras: A high-level neural networks API that runs on top of TensorFlow or PyTorch, offering a user-friendly interface for building and training neural network models.
3. **Image Processing Libraries:**
    - OpenCV (Open Source Computer Vision Library): Essential for image preprocessing tasks such as image reading, manipulation, and feature extraction.
4. **Data Visualization Libraries:**
    - Matplotlib: A versatile library for creating static, animated, and interactive visualizations in Python.
    - Seaborn: Built on top of Matplotlib, Seaborn provides a high-level interface for drawing attractive statistical graphics.
5. **Database Management System (DBMS):** Depending on the scale of your project and data storage requirements, you may need a DBMS like SQLite, MySQL, or PostgreSQL for storing and managing datasets and historical pricing data.
6. **Version Control System (VCS):** Using a VCS like Git will help you track changes to your codebase, collaborate with team members, and manage different versions of your project.
7. **Development Environment:** Choose an Integrated Development Environment (IDE) or code editor that suits your preferences. Popular options include PyCharm, Jupyter Notebook, Visual Studio Code, and Spyder.
8. **Documentation and Reporting Tools:** Tools like Jupyter Notebook, Markdown, or LaTeX can be used for documenting your project progress, findings, and results in a structured and presentable format.

CHAPTER 6

CONCLUSION

The development of an automated system for arecanut quality analysis and price prediction marks a significant advancement in agricultural technology. Leveraging machine learning and image processing techniques, coupled with historical pricing data, the system offers valuable insights into arecanut quality attributes and market trends.

While the project has achieved commendable results, there are avenues for future exploration and improvement. These include enhancing feature extraction methods, adopting advanced predictive modeling techniques, integrating real-time data sources, gathering user feedback for iterative improvement, and optimizing scalability and deployment.

Overall, the project lays a foundation for continued research and development efforts aimed at enhancing the efficiency and sustainability of the arecanut industry through innovative technological solutions.

In this project, I will be developing a machine learning and image processing-based system aimed at assessing the quality and estimating the price of arecanut based on images uploaded to the platform. The system will utilize advanced techniques from both fields to analyze key features such as color, texture, size, and shape of the arecanuts depicted in the images. Through machine learning algorithms, the system will learn patterns and correlations between these features and the quality attributes and market prices of arecanuts. Image processing techniques will be employed for tasks such as image enhancement, segmentation, and feature extraction to ensure accurate analysis of the uploaded images. Ultimately, the goal is to create a robust and efficient system capable of providing users with reliable quality assessments and price estimates for arecanuts, aiding stakeholders in decision-making processes related to trading and marketing.

CHAPTER 7

REFERENCES

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2. “Arecanut Grade Analysis using Image Processing Techniques” By Pushparani M.K, Dr. D Vinod Kumar, Dr. Abdulla Gubbi

3. “Applications of Image Processing in Agriculture: A Survey” By Anup Vibhute, S K Bodhe

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