# Paper 1

**Paper Title**: Possible Approaches to Arecanut Sorting / Grading using Computer Vision: A Brief Review

**Year:** 2017

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

**Abstract:** 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.

**Summary:**

* Agriculture is crucial for India's economy, with over 60% arable land.
* Arecanut is a significant crop in India with cultural and economic importance.
* Computer vision technology is being used for sorting and grading agricultural produce.
* Techniques like colour segmentation and Haar wavelets are used for Arecanut classification.
* Computer vision systems offer faster, accurate, and error-free assessment for increased productivity in agriculture.

# Methodologies Used:

* Back Propagation Neural Network Classifier: Used for classifying dates into three quality categories with 80% accuracy. Applied for sorting the quality of Arecanut with 90.9% accuracy.
* Hybrid Approach: Combining colour, shape, and texture features for classification and grading of Arecanut.
* Decision Tree Classifier: Utilized for classifying Arecanut into six classes with high success rates.
* Image Processing Algorithms: Used for colour calculation, edge detection, and fruit size detection in various fruit grading systems.
* Machine Vision: Employed for classifying different types of dates and fruits based on colour components with improved accuracy compared to human vision.

# Paper 2

**Paper Title** Arecanut Grade Analysis using Image Processing Techniques

**Year:** 2019

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

**Abstract:** The paper aims to develop a computer vision-based grading system for boiled Arecanuts, addressing the labour-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.

**Summary: Arecanut Grade Analysis using Image Processing Techniques**

* Developing a computer vision grading system for boiled Arecanuts to streamline the tedious grading process.
* Utilizing HSV Histogram colour transform and Gabor filter for feature extraction and texture recognition.
* Implementing Support Vector Machine (SVM) for pattern recognition in Arecanut grading.
* Experimenting with SVM in MATLAB for accurate classification.
* References to similar computer vision systems in agriculture for inspiration.

**Methodologies Used:**

* **HSV Histogram colour Transform:** Extracted colour features from images.
* **Gabor Transform:** Used for texture feature extraction.
* **Support Vector Machine (SVM):** Employed as a classifier for pattern recognition.
* **MATLAB Toolbox:** Utilized for implementing SVM model and running the classifier.
* **Supervised Machine Learning:** Separated Arecanuts into different grades through training and testing phases.
* **Database Creation:** Involved creating a database using sample images for training.
* **Feature Extraction:** Extracted colour and texture features for categorizing Arecanuts into grades.
* **GUI Development:** Built the main GUI of the application using MATLAB's GUIDE tool.
* **Real-Time Sorting Unit:** Implemented to assist farmers in sorting Arecanuts quickly and accurately.
* **Economies of Scale:** Derived from efficient pooling and transportation of graded produce.
* **Linear Separability:** Applied Cover's theorem for transforming multidimensional space into a linearly separable feature space.
* **Optimal Separating Hyper-Plane:** Defined as a linear function of vectors from the feature space for pattern separation.
* **Classification:** Used SVM model with a radial basis function for training and classifying Arecanuts.

These methodologies collectively contribute to the efficient grading system for Arecanuts based on colour and texture features using image processing techniques.

# Paper 3

**Paper Title:** Applications of Image Processing in Agriculture: A Survey

**Year:** 2012

**Authors:** Anup Vibhute, S K Bodhe

# Abstract: 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.

# Summary:

* Image processing in agriculture can provide expert advice at an affordable cost.
* Applications include weed detection, fruit grading, and vegetation measurement.
* Remote sensing and image processing algorithms are used for crop discrimination.
* Various techniques like neural networks and fuzzy logic are employed for herbicide application.
* Image processing is effective for grading fresh products and evaluating crop quality.
* Different image processing approaches are explored for sorting and grading fruits, vegetables, and grains.

**Methodologies Used:**

* **Segmentation Methods**: S1 and S2 methods for segmentation of vegetation and soil.
* **Crop Row Elimination**: E1, E2, and E3 methods for eliminating crop rows using column pixels.
* **Weed Extraction**: F1 and F2 methods for extracting weeds using filtering and region extraction techniques.
* **Case-Based Reasoning (CBR)**: Problem-solving technique using previous knowledge about problems and solutions.
* **Fuzzy Algorithm**: Developed for site-specific herbicide application to reduce herbicide use and protect the environment.
* **Image Processing Techniques**: Used for grading fresh products, detecting defects, and evaluating crop quality.
* **Classification Methods**: Bayesian discriminant analysis, Support Vector Machine (SVM), Linear Discriminant Analysis (LDA), Classification Trees, K-Nearest Neighbours (K-NN), and Ensembles of Trees and LDA.
* **Artificial Neural Networks (ANN)**: Used for classification and weed detection.
* **Genetic Algorithm**: Used for weed extraction by combining segmentation, crop row elimination, and weed extraction methods.
* **Precision Agriculture**: Incorporating advanced techniques to enhance farm output and sustainability.

# Paper 4

**Paper Title****:** Machine Learning Applications in Agriculture

**Year:** 2022

**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.

# Summary:

* The world's population is projected to reach 9.1 billion by 2050, leading to a 70% increase in food demand.
* India will become the most populated country by 2050, facing challenges in domestic food production.
* Precision agriculture, utilizing technologies like IoT, AI, and data analytics, is crucial for ensuring food security.
* Machine learning plays a key role in smart farming, aiding in crop yield prediction, disease detection, and water stress identification.
* Deep learning algorithms and CNN models are used for crop disease detection and crop yield prediction.
* Precision agriculture, driven by AI and IoT, enhances productivity and quality of agricultural products.

# Methodologies Used:

1. **Leaf Water Content Estimation:** Machine learning techniques are employed to estimate Leaf Water Content (LWC) for assessing water stress in plants. Ensemble and regressor methods are utilized for predicting LWC values. Classification models are applied to classify water stress based on LWC and other parameters.
2. **Crop Mapping:** Satellite data is analysed using machine learning algorithms like LDA and random forest for crop type mapping. Features related to weather, fertilizers, land type, and soil information are used for classification.
3. **Irrigation Detection:** Machine learning techniques are used for detecting irrigation to manage water resources effectively. Pre-trained models are employed due to the lack of labelled data specific to irrigation systems.
4. **Crop Selection Prediction:** Machine learning models predict crop selection and yield for different regions using algorithms like SVM, random forest, and logistic regression. Features are identified to train models for efficient crop selection.
5. **Plants and Crops Disease Detection:** Deep learning algorithms are trained on plant images for accurate disease detection. Labelled images are used to train models for identifying crop diseases.
6. **Crop Yield Prediction:** Various algorithms like multi-linear regression, Light GBM, random forest, and deep neural networks are utilized for predicting crop yields. Factors such as weather data, soil moisture, and astronomy images are considered for accurate yield estimation.
7. **Crop Row Detection:** Deep learning methods, especially CNN architectures, are employed for crop row detection based on factors like weed density, growth stages, and shadows.
8. **Identifying Water Stress in Plants:** Machine learning techniques estimate Leaf Water Content to identify water stress in plants. Early detection of water stress enables corrective measures like irrigation to alleviate stress and enhance crop yield.

# Paper 5

**Paper Title:** Quality Inspection and Grading of Agricultural and Food Products by Computer Vision- A Review

**Year:** 2010

**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.

# Summary:

* **Oranges:** Neural networks can predict sweetness with 87% correlation efficiency.
* **Strawberries:** Computer vision sorts strawberries based on size and shape with 94-98% accuracy.
* **Oil Palm Fruits:** Automated system sorts oil palm fruits with a throughput rate of 40 nuts per second.
* **Tomatoes:** Computer vision techniques are used for tomato quality assessment.
* **Grain Classification:** Machine vision is used for wheat and corn quality evaluation.
* **Pizza:** Visual features like colour and size are used to assess pizza quality.
* **Meat Products:** Image-based grading is used for meat quality assessment.

# Methodologies Used:

* **Oranges:** colour segmentation, linear discriminants analysis, contour curvature analysis, and thinning process.
* **Strawberries:** Image processing for size and shape analysis.
* **Oil Palm Fruits:** Automated system for sorting with a high throughput rate.
* **Tomatoes:** Computer vision techniques for quality assessment.
* **Grain Classification:** Machine vision for wheat and corn quality evaluation.
* **Pizza:** New region-based segmentation algorithm for topping exposure percentage determination.
* **Meat Products:** Image-based grading for meat quality assessment.

**Paper 6**

**Paper Title**: Image Processing and Machine Learning for Automated Fruit Grading System: A Technical Review

**Year**:2013

**Authors****:** Rashmi Pandey, Sapan Naik, Roma Marfatia

**Abstract:** 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.

# Summary:

* Various techniques such as image processing, colour-based grading, and machine learning are used for inspection and grading of horticultural products.
* Novel approaches like colour and size-based sorting systems for fruits like lemon and strawberry have been developed with high accuracy rates.
* Different machine learning techniques are discussed for fruit classification, with merits and demerits outlined.
* Neural networks are utilized for tasks like evaluating fruit shape and determining sugar content in oranges.
* Challenges such as segmentation issues and misclassification rates are also highlighted in the document.

# Methodologies Used:

* **Colour Feature Extraction Techniques:** Fractal analysis and CIELAB parameters have shown 100% accuracy in fruit grading. Dominant colour method, dominant histogram matching method, and direct colour mapping techniques achieved accuracy between 85 to 97%.
* **Machine Learning Techniques:** Linear Discriminant Classifier (LDC) for linear separability in data. Nearest Neighbour Classifier for simple implementation. Support Vector Machines (SVM) for high-dimensional data classification. Artificial Neural Networks (ANN) for complex data interpolation. Rule-Based Systems (Fuzzy System) for knowledge-based classification. C4.5 for syntactical classification.
* **Other Techniques:** Fractal analysis and CIELAB parameters for accurate fruit grading. Image processing systems for automating fruit inspection. Thin fruit stem detection using modified thinning method for horticultural products.

**Paper 8**

**Paper Title:** Automatic Fruit Grading and Classification System Using Computer Vision: A Review

**Year:** 2015

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

**Abstract:** 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.

# Summary:

* Image processing and computer vision are widely used in various fields such as agriculture, food quality inspection, and disease detection.
* Different colour spaces like CIELAB, HSV, and HSI are utilized for image processing and analysis.
* Shape and texture features play a crucial role in machine vision for surface appearance and element distribution.
* Various classification techniques like Fuzzy Logic, Artificial Neural Networks (ANN), and Support Vector Machines (SVM) are employed for fruit grading with different accuracy rates.
* Machine vision systems offer efficient fruit grading solutions by replacing manual labour.

# Methodologies Used:

* **Colour Models:** Different colour models like Lb\*, RGB, HSV, and HSI are used for image processing and analysis in fruit grading systems.
* **Feature Extraction:** Features such as colour, shape, texture, size, defects, and morphological characteristics are extracted from fruit images for classification.
* **Classification Techniques:**
  + **Fuzzy Logic:** Utilized for grading fruits based on fuzzy sets and rules.
  + **Support Vector Machines (SVM):** Used for accurate classification of fruits based on colour and other features.
  + **Artificial Neural Networks (ANN):** Employed for pattern recognition and classification tasks.
  + **Adaptive Neuro Fuzzy Interference System (ANFIS):** Used for comparing fruit grading results with human experts.
* **Image Processing Algorithms:** Edge detection, threshold-based segmentation, and clustering methods like K-means are applied for feature extraction and classification.
* **Texture Analysis:** Methods such as pixel co-occurrence, run length, Difference Histogram, Fourier Transform, and Wavelet Transform are used for texture feature extraction in food grading systems.

**Paper 9**

**Paper** **Title** Machine Vision based Real Time Cashew Grading and Sorting System using SVM and Back Propagation Neural Network

**Year:** 2017

**Authors** Reena Mary George, Shyna A

**Abstract: 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.**

**Summary**

* Consumers are increasingly concerned about food quality, leading to a need for automated quality management systems.
* Research is focused on machine vision-based grading of food products like cashew kernels.
* A real-time classification system uses machine learning techniques to grade cashew kernels based on colour, texture, size, and shape features.
* The system includes a conveying unit, programmable logic controller, solid-state relay switching devices, and more.
* Image preprocessing involves background subtraction and feature extraction using wavelet and contourlet transforms.
* Feature extraction focuses on colour, texture, size, and shape for classification.
* The system achieves high accuracy in grading cashew kernels but performance may decrease with conveyor belt speed.
* Future work includes identifying damaged cashews for elimination during grading process.

# Methodologies Used

* **Granulometry:** Araújo et al proposed a method for beans quality inspection using correlate **Recommendations for Arecanut Classification Project**
* **Feature Extraction:** Consider extracting colour and texture features similar to the method used for areca nuts quality determination.
* **External Features:** Incorporate external features like colour and texture for better classification accuracy.
* **Machine Vision:** Utilize machine vision techniques for image analysis and feature extraction.
* **Real-Time System:** Aim to design a real-time classification system for efficient grading of arecanuts.
* **Wavelet and Contourlet Transform:** Explore the use of multiresolutional wavelet and contourlet transforms for extracting texture features in your project.
* **Performance Analysis:** Evaluate the performance of different classifiers like SVM and BPNN with various kernel functions for optimal results.
* **Elimination of Damaged Nuts:** Consider incorporating techniques to identify and eliminate damaged arecanuts based on colour during the classification process.
* By incorporating these methodologies and techniques, you can enhance the efficiency and accuracy of your arecanut classification project.
* on-based granulometry, comparing captured images with kernels to compute correlation.
* **Machine Vision:** Huang developed a method for areca nuts quality determination based on colour a **Recommendations for Arecanut Classification Project**
* **Feature Extraction:** Consider extracting colour and texture features similar to the method used for areca nuts quality determination.
* **External Features:** Incorporate external features like colour and texture for better classification accuracy.
* **Machine Vision:** Utilize machine vision techniques for image analysis and feature extraction.
* **Real-Time System:** Aim to design a real-time classification system for efficient grading of arecanuts.
* **Wavelet and Contourlet Transform:** Explore the use of multiresolution wavelet and contourlet transforms for extracting texture features in your project.
* **Performance Analysis:** Evaluate the performance of different classifiers like SVM and BPNN with various kernel functions for optimal results.
* **Elimination of Damaged Nuts:** Consider incorporating techniques to identify and eliminate damaged arecanuts based on colour during the classification process.
* By incorporating these methodologies and techniques, you can enhance the efficiency and accuracy of your arecanut classification project.
* **External Features:** Arun et al proposed an automated cashew grading system using colour, texture, size, and shape features.
* **Real-Time Systems:** Ohali designed a date grading system based on external features like colour, size, shape, and defects.
* **Potato Sorting:** Razmjooya et al developed a real-time system for sorting potatoes based on size and colour features.
* **Barley Identification:** Szczypinski et al used morphological features, statistical texture features, and colour histograms for barley variety identification.
* **Wavelet and Contourlet Transform:** Multiresolution wavelet and contourlet transforms were used for extracting texture features in the proposed system.

**Paper 10**

**Paper Title** FORECASTING ARECA NUT MARKET PRICES USING THE ARIMA MODEL: A CASE STUDY OF INDIA

**Year:** 2021

**Authors:** Abhaya K. Kumar, Prakash Pinto

**Abstract:** 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.

**Summary:**

* The study aims to predict the prices of a new variety of Areca nut in Karnataka using monthly price data from January 2009 to December 2018.
* Box Jenkins ARIMA methodology is used to develop the model, with ARIMA (3, 1, 3) identified as the appropriate model.
* ACF and PACF correlograms are used for diagnostic checks.
* Areca nut has various industrial uses, and demand is increasing in foreign markets.
* Data collected from the OGD platform in India.
* Different models were considered, with ARIMA (3, 1, 3) chosen for estimation.

# Methodology Used:

The study employs the Box Jenkins Autoregressive Integrated Moving Average (ARIMA) methodology to forecast the prices of a new variety of Areca nut in Karnataka. The process involves: 1. Identifying the appropriate ARIMA model through the selection of p, d, and q values. 2. Using ACF and PACF correlograms to determine the AR and MA process terms. 3. Developing alternative ARIMA models and estimating significant coefficients, variance, log-likelihood, AIC, and BIC statistics. 4. Selecting the most suitable model based on the estimated statistic values. 5. Estimating the residuals of the chosen ARIMA model. 6. Conducting diagnostic checks using ACF and PACF correlograms. 7. Ensuring stationarity of the time series data before proceeding with the ARIMA methodology.

The study emphasizes the importance of accurate model selection and the iterative process of model development to enhance forecasting accuracy.

**Paper 11**

**Title:** Computer Vision Based Mango Fruit Grading System

**Year:** 2014

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

# Abstract: 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.

# Summary:

* Computer Vision is utilized in the food industry for quality evaluation.
* Machine vision is increasingly used in agriculture for various applications.
* A computer vision system is developed for grading mango fruit based on maturity, size, and surface defects.
* The system uses image capturing, preprocessing, feature extraction, and multi-attribute decision making for grading.
* Results show high accuracy rates for size, colour grading, and surface defect measurement.
* Researchers involved in the development of the system are from various universities in India.

# Methodologies Used:

1. **Image Capturing Method:** Five different varieties of mangoes were collected for experimental work. Each mango underwent a computer vision-based grading system.
2. **Preprocessing of Images and Features Extraction:** Still frame extraction, filtering, edge detection, and background elimination were performed. Features extraction and calculations were detailed in a previous study.
3. **Maturity Identification:** Support Vector Machine (SVM) based classifier was used to estimate parameters for maturity identification. Performance accuracy for different mango varieties and maturity levels was evaluated.
4. **Size Calculation:** Size of mangoes was calculated using binary SVM classifiers and Error Correcting Output Code (ECOC). Minimum hamming distance based rule was applied in decision making.
5. **Mango Surface Defect Grading:** Surface defects were evaluated using image processing. The amount of surface defects was analysed for different mango varieties.
6. **Colour Calibration of Camera:** Colour calibration of the camera was performed for accurate colour measurements. Calibration was done at all pixels in the image with a windowing function for local regions of interest.
7. **Multi-Features Grading:** The automated mango grading system incorporated human-computer interaction for setting thresholds on maturity, size, and surface defects. A flowchart of the complete grading process was developed.
8. **Result and Discussions:** Tests were conducted to validate the accuracy and real-time performance of the grading algorithm. Precision and success rates of the mechanical parts were analysed. Five different mango varieties from West Bengal, India, were used in the tests.

**Paper 7**

**Paper Title:** A Comprehensive Review of Crop Yield Prediction Using Machine Learning Approaches with Special Emphasis on Palm Oil Yield Prediction

**Year:** 2021

**Authors:** MAMUNURRASHID MOHAMADANUARKAMARUDDIN, BIFTA SAMA BARI, YUSRI YUSUP ANDNUZHATKHAN

**Abstract:** Accurate prediction of crop yield is crucial for strategic planning and financial evaluation in the agricultural sector. With the increasing importance of machine learning algorithms in crop yield prediction, this article offers a comprehensive review, focusing specifically on palm oil yield prediction. Beginning with an overview of global palm oil yield status, widely used features, and prediction algorithms, it evaluates current machine learning-based methods for crop yield prediction. The review includes an analysis of machine learning applications in the palm oil industry and a comparison of related studies. It discusses the advantages, challenges, and potential solutions in machine learning-based crop yield prediction. Furthermore, the article explores future perspectives such as remote sensing, plant growth and disease recognition, mapping, and proposes architectures for machine learning-based palm oil yield prediction. The objective is to develop highly effective models for predicting palm oil yields with minimal computational difficulty, driving advancements in crop yield prediction technology.

# Summary

* Machine learning-based crop yield prediction involves various factors like transmissivity, water conductivity, aquifer type, and crop management data.
* Prediction algorithms like LR, MLR, SVM, DT, and RF are commonly used for forecasting crop yield.
* IoT is utilized in precision agriculture for monitoring soil moisture, temperature, and light intensity.
* Satellite-based SIF features can enhance yield forecasting performance.
* UAVs are cost-effective for remote sensing in agriculture, providing high-resolution data.
* Different algorithms like k-NN, ANN, and SVM are used for crop yield prediction in the palm oil industry.

# Methodologies Used

* Machine learning algorithms such as Linear Regression (LR), Multiple Linear Regression (MLR), Support Vector Machine (SVM), Decision Trees (DT), and Random Forest (RF) are commonly employed for crop yield prediction.
* Precision agriculture techniques involving Internet of Things (IoT) for monitoring soil conditions and artificial intelligence (AI) for decision-making are utilized.
* Satellite-based data collection methods, including Satellite Indicated Fluorescence (SIF) features, are used to enhance yield forecasting accuracy.
* Unmanned Aerial Vehicles (UAVs) are cost-effective tools for remote sensing in agriculture, providing high-resolution data for analysis.
* Various algorithms like k-Nearest Neighbours (k-NN), Artificial Neural Networks (ANN), and Support Vector Machines (SVM) are applied in the palm oil industry for crop yield prediction.