REVIEW OF INTERNATIONAL GEOGRAPHICAL EDUCATION

ISSN: 2146-0353 ● © RIGEO ● 11(3), SUMMER, 2021

www.rigeo.org

Research Article

Implementation of Pest Detection Based on International Technological Education in Orange Plants Using Neural Network and Svm Methods

Muhammad Benny Chaniago[1]
Department, Widyatama University
benny.chaniago@widyatama.ac.id

Yustika Dwi Rahma[2]
Department, Widyatama University
yustika.dwi@widyatama.ac.id

[2] Corresponding author: Information System Department, Widyatama University Jalan Cikutra No.204A Bandung. Email: yustika.dwi@widyatama.ac.id

Abstract

We cannot avoid international technological education because technological advances will run by scientific advances. Therefore, technology also provides many conveniences, as well as new ways of carrying out human activities. With the rapid advancement of technology, making people innovate and create new things is no exception to making an intelligent agricultural system. Smart agricultural technology works and has benefits for farmers or plant owners and solutions for communicating with plants.Thus, growing good Citrus requires special care because citrus plants are very susceptible to pests during their growth. The dominant pests on citrus plants generally include Lahat (Bactrocera spp.). Lack of information regarding citrus crop problems makes it difficult for employees to detect pest symptoms early and control them to take the necessary action effectively, especially with the many symptoms that occur. The pest detection application has been in great demand by most practitioners in agriculture to meet their personal needs, including to meet the needs of plants. This application uses two methods, namely the Neural Network method and the SVM method. We hope that the application of the Information System Application to identify pests in citrus plants can help employees in citrus plants to identify the types of problems that attack citrus plants and provide control suggestions.

Keywords

Horticultural Plants, Citrus Plants, Applications, Neural Network, SVM

To cite this article: Chaniago, M, B.; Rahma, Y, D. (2021) Implementation of Pest Detection Based on International Technological Education in Orange Plants Using Neural Network and Svm Methods. Review of International Geographical Education (RIGEO), 11(3), 33-42. doi: 10.33403/rigeo. 800466

Submitted: 05-02-2021 ● **Revised:** 10-03-2021 ● **Accepted:** 15-03-2021

Introduction

We cannot avoid technological advances because technological advances follow scientific advances by scientific advances. Creating innovation will provide positive benefits for human life. Technology also offers many conveniences, as well as a new way of doing human activities. Technological innovation has had many positive impacts on humans in the last decade. With the rapid advancement of technology, making people innovate creating new things is no exception making intelligent farming systems one of them. Smart farming technology functions and has benefits for farmers or plant owners and solutions for communicating with plants. It means that the plant owner can know the condition of the plant, such as nutrition and its needs (Junaidi, 2015; MacIntyre, Lanxi, & Khajavy, 2020). (Ishak & Mansor, 2020; Zych, 2020) indicate that institutes need to give more attention to create new knowledge and applications.

Horticultural crops are branches of crops that deal with garden plants. Horticultural plants have various types of plants, namely fruit plants (fruticulture), flower plants (floriculture), vegetable plants (olericulture), and medicinal plants (biopharmaca). In terms of plant growth, both horticultural, agronomic, and forestry plants require intensive care for plant growth and breeding. The care given to plants consists of watering, fertilizing, eradicating pests, weeding and so forth (Siswati & Nizar, 2014).

One of them is the Citrus Plant. Plants Citrus is an annual fruit plant originating from Asia. It is widely believed that China is the place where oranges were first grown. For hundreds of years, oranges have grown naturally in Indonesia. Citrus plants in Indonesia are a legacy from the Dutch, which brought in sweet oranges and tangerines from America and Italy (Ridjal, 2008).

Citrus is a type of horticultural crop of high economic value. For that, an excellent way to grow oranges requires special care because citrus plants are very susceptible to pest disease during growth.

Several things need special attention to eradicate these pests, such as spraying with certain drugs (pesticides), cleaning circles on plants, and conducting periodic checks on the plant area. The crop area in the Horticultural Agriculture Office is now abundant and makes employees forget about plant health. Information system design can assist employees in determining the type of pest to detect problems in citrus plants because this application performs an initial diagnosis based on the symptoms of citrus plants inputted by the officer. The input is then processed using the correct pest detection system method to produce the right result (Wijaya et al., 2017).

We hope that the Design of Information System Application to identify pests in citrus plants can help employees in the citrus fruit sector to identify the types of pests that attack citrus plants and provide control suggestions. Taking advantage of the vast availability and use of the internet offers the opportunity to spread expertise and knowledge about the identification of citrus pests to the Office of Food and Horticultural Crops (Horticultural Seed Centers) and many people.

Citrus

Plants Citrus is an annual fruit plant originating from Asia. It is widely believed that China is the place where oranges were first grown. For hundreds of years, oranges have grown naturally in Indonesia. Citrus plants are one of the high economic value horticultural plants. For that, an excellent way to plant oranges requires special care because citrus plants are very susceptible to pest disease during growth (Sutabri, 2012).

The following are the types of pests on citrus fruit plants:

Orange jumping flea (Diaphorina citri)

These pests attack citrus plants of all types on the stem, leaf buds, buds, and young leaves.

Dompolan lice (Planococcus citri)

This pest attacks the stalk fruit. It leads to a yellow mark on the stalk, then the stalk dries. As a result, the fruit falls prematurely—ants left the plant.

Mites (Tenuipalsus sp., Eriophyes sheldoni tetranychus sp.)

This pest attacks the stems, leaves and fruit ofall types of oranges. The characteristics of these

pests are that there are silvery or brownish spots on the fruit and yellow or brown colours on the leaves.

Thrips (Scirtotfrips citri)

This pest attacks young stems and leaves. The impact of this pest attack is that the leaves thicken, the edges of the plates are rolled up, and at the tip of the shoots, blacken, then dry out and fall off. The scar is greyish brown with necrosis.

Fruit flies (Dacus sp.)

This pest attacks fruits that are almost ripe. The fruit that fruit flies attack is a small hole in the middle, the death of the fruit, and the discovery of tiny larvae in the fruit flesh.

Aphids (Toxoptera citricus aurantii and Aphis gossypia)

These pests attack young shoots and flowers on all types of oranges. An orange plant's characteristics that are attacked by aphids are curved leaves, and there is still a mark on it until the plant is mature. The way to deal with this pest is to provide an insecticide with active ingredients methidathion, dimethoate, diazinon, phosphamidon, and malathion.

Leaf Caterpillar (Phyllocnistis citrella)

This pest attacks young leaves on all types of citrus plants. The characteristics of pests that attack plant leaves are clear leaves or silvery circular grooves. Also, young shoots and leaves appear to constrict, roll up, and then fall out (Azzamy, 2017).

The following are types of diseases in citrus plants:

CVPD

This disease is caused by a bacterium that is spread by fleas (Diaphorina citri). The part of the plant that is attacked is the central cylinder of the stem (phloem). Symptoms of this disease attack, among others, the leaves become small and taper-shaped, the fruit is small and tastes sour, rotten seeds, and the base of the orange-colored fruit.

Woody gall (vein enation)

The cause of this disease is the Citrus vein enation virus with vector spreaders of aphids, Toxoptera citridus and Aphis gossypii. Plants attacked, among others, lime, sweet orange, conjoined orange, rough lemon, and sour orange.

Scabies

This disease is caused by the fungus Sphaceloma fawcetti, which attacks leaves, stems, and fruit. Symptoms include small, clear patches that turn into yellow or orange corks.

Fruit rot

This disease is caused by Penicillium sp., Phytophtora citriphora, and Botryodiplodia theobromae. This disease attacks all types of oranges in the fruit. Symptoms include the presence of bluish-green solid flour in the skin of the fruit.

Root rot and stem base

The cause of this disease is the fungus Phyrophthoranicotianae which attacks the root and base of the stem. The characteristics of the affected tree are the leaves at the end of the yellow branch, the buds are not fresh, and the plants are dry.

Premature autumn fruit

The cause of this disease is the fungus Fusarium sp., Colletotrichum sp., And Alternaria sp. Plant parts that are attacked are fruit and flowers. Symptoms of the fruit fall in the period 2-4 weeks before harvest. This disease can be eradicated by administering benomyl fungus or captafol.

Cancer

The cause of cancer in citrus plants is the bacterium Xanthomonas campestris. This disease attacks the leaves, stems and citrus fruits of all types. The sign is a small patch of dark green or yellow along the edge of the plant being attacked. The wound then enlarges and looks like a broken cork with a diameter of 3-5 mm. Treat with Cu fungicide (Azzamy, 2017).

Information System

Information System is a combination of information technology and people who use that technology to support operations and management. In a broad sense, the term information systems often refer to interactions between people, algorithmic processes, data, and technology. In this sense, the term refers not only to information and communication technology (ICT) and how people interact with this technology in supporting business processes. Some make a clear distinction between information systems, and computer ICT systems, and business processes (Sutabri, 2012). (Csachová, 2020; Frazier & Boehm, 2012; Sutabri, 2012) indicates that technology is also used for geography education for web based development and other subjects.

Neural Network

Neural Network or commonly called an Artificial Neural Network (ANN), is a data processing system inspired by the configuration of the human brain—made of artificial neurons that are identified as interconnected processing constituents acting together to achieve specific problems. Neural Network is a soft computing technique that involves an input layer, one or more hidden layers and an output layer. The hidden layer connects to the other layers with weight, bias, and transfer functions (Goh et al., 2019).

Support Vector Machine

Support Vector Machine (SVM) is a classification method that Vapnik first introduced in 1998. SVM is in the same class as the *Artificial Neural Network* (ANN) in terms of functions and problem conditions that can be solved. This method works by defining the boundary between two classes with the maximum distance from the closest data. The maximum limit between types must be formed *hyperplane* (dividing line) at the input space obtained by measuring the hyperplane's margin and looking for the whole point. The margin is the distance between the hyperplane and the closest point of each class. This nearest point is called the *Support Vector Machine* (SVM). *Support Vector Machine* (SVM) can overcome/do separate data classification in a linear (linearly separable) and non-linear (non-linear separable) (Vapnik, 1998).

Camera

The camera on this system can use a standard camera and can be used in outdoor conditions. The camera will be prepared to record the orange leaves to be detected by a pest and disease detection system in citrus fruit plants.

System

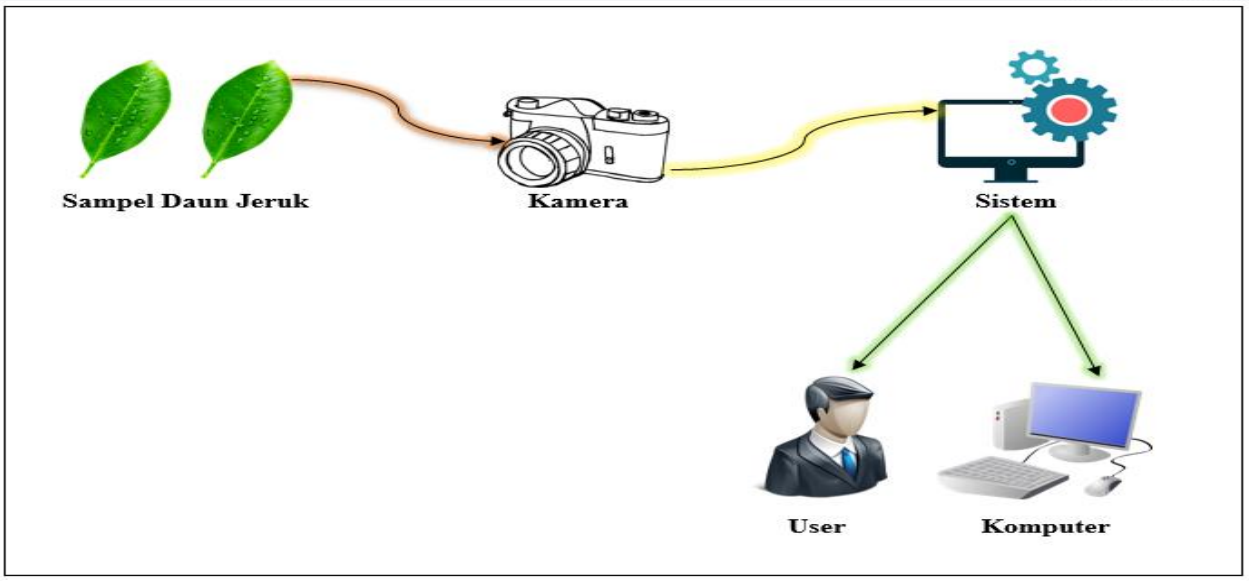
The system here is software that facilitates the user in solving problems such as detecting pests and diseases in citrus fruits. This system detects pests and diseases through samples of orange leaves that the camera has recorded.

Computer

In this section, computers are used to add data and store the systems that have detected pests and diseases in citrus fruits. These results can be used for further research. The stored data is divided into two parts: training data and testing data, which contain types of diseases in citrus fruits in photos of disease symptoms and their control (Chaniago & Wibowo, 2019).

Research

Design Method of Citrus Fruits

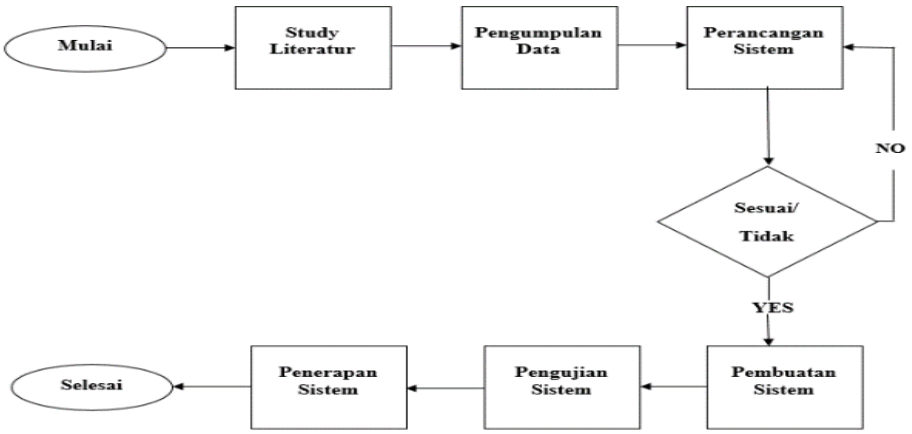


Picture 2.1 Design Method of Citrus Fruits

Description

Figure 2.1 this is explained the method of designing citrus fruit plants. This system can be used on vast agricultural fields or food crops or challenging to reach. The system is supported by hardware and software as follows:

Stages of Research



Picture 2.2 Stages of Research

Study Literature

Studies related to this research include looking for pests and diseases in citrus fruit plants, controlling them, and learning Neural Network and SVM methods. The data used were obtained by interviewing agricultural officers in citrus crops, internet searches, journals, and books related to the topic.

Data Collection

Collected came from consultations with staff/employees in the Department of Agriculture for Food Crops and Horticulture, especially for employees who work in citrus plants. From there, researchers can find out the pests and diseases of citrus fruit plants.

Design System

Design is the stage after the analysis of the system development cycle. The system's design here is in the form of depictions, planning and sketching or arrangement of several separate elements into a single unit that is intact and functioning.

Making System

Making the system is done for the application of system designs or databases into the programming language. Making this system will be seen to find out the errors contained in the system and immediately repaired.

System

Testing System or application testing is done to ensure that the system has been made by the design and all functions can be used properly without any errors by user requirements.

System Implementation

This stage is the stage of using the system by the user. There must be system maintenance to maintain the operational processes of the system and allow for system development to be done in the future.

Results and Implementation

Use Case Diagram

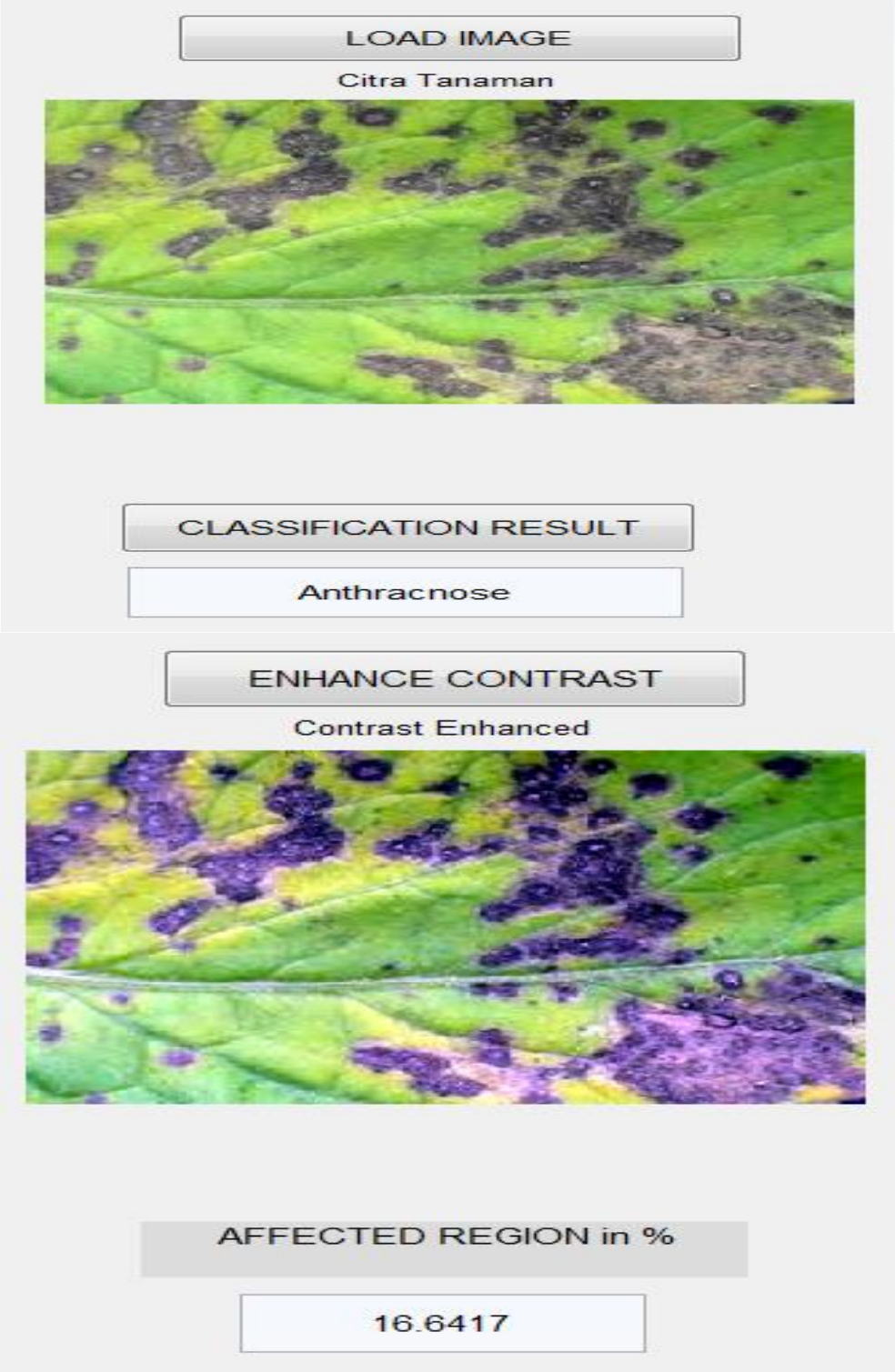
Use Case Diagram is used to describe the system from the user of the plan (*user*), so making Use Case Diagram is more focused on the functionality that is on the system, not based on flow or sequence of *events*. A Use Case Diagram represents an interaction between the actor and the system to be developed.

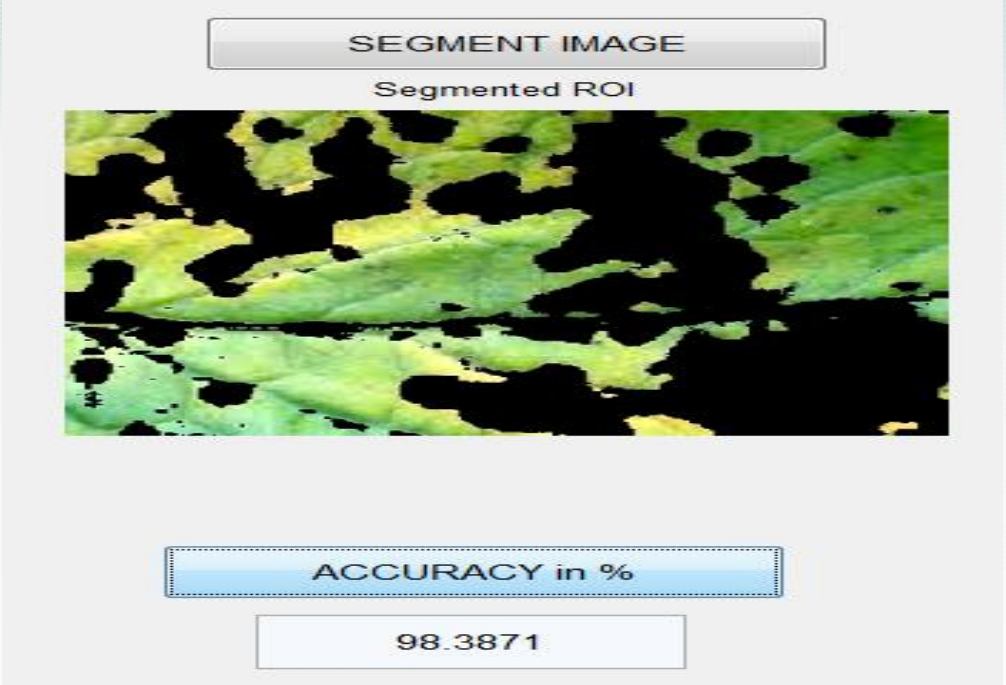
Picture 3.1. Use **Case Diagram**

This Use Case Diagram can be seen in the picture above, where it was made from the system's point of view. In this Use Case Diagram, users can interact with the system, such as displaying examples of orange leaf plants, displaying images of the uploaded orange leaf plants, detecting pests in citrus fruit plants, and displaying features of the detection results citrus plants.

Implementation System

Implementation is the stage of system implementation that will be carried out if the system has been successfully tested and designed. The Pest Detection Information System has been implemented as follows.

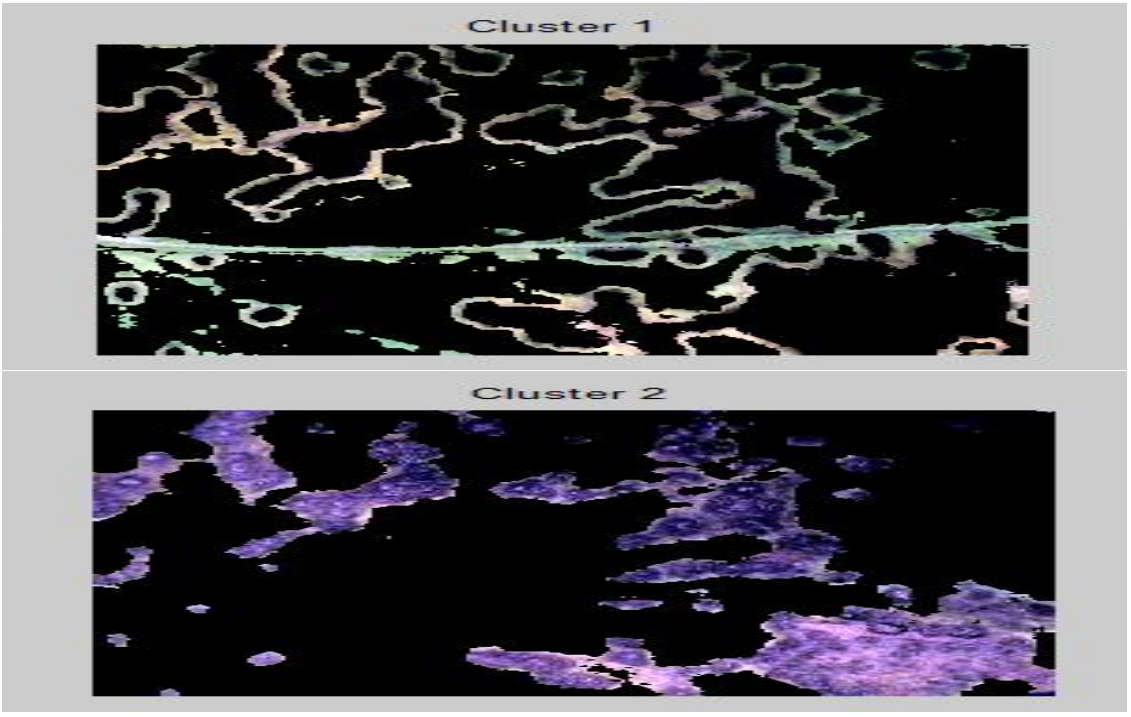




Picture 3.2 Upload Image and Classification Results, Anthracnose, and Accuracy

Description

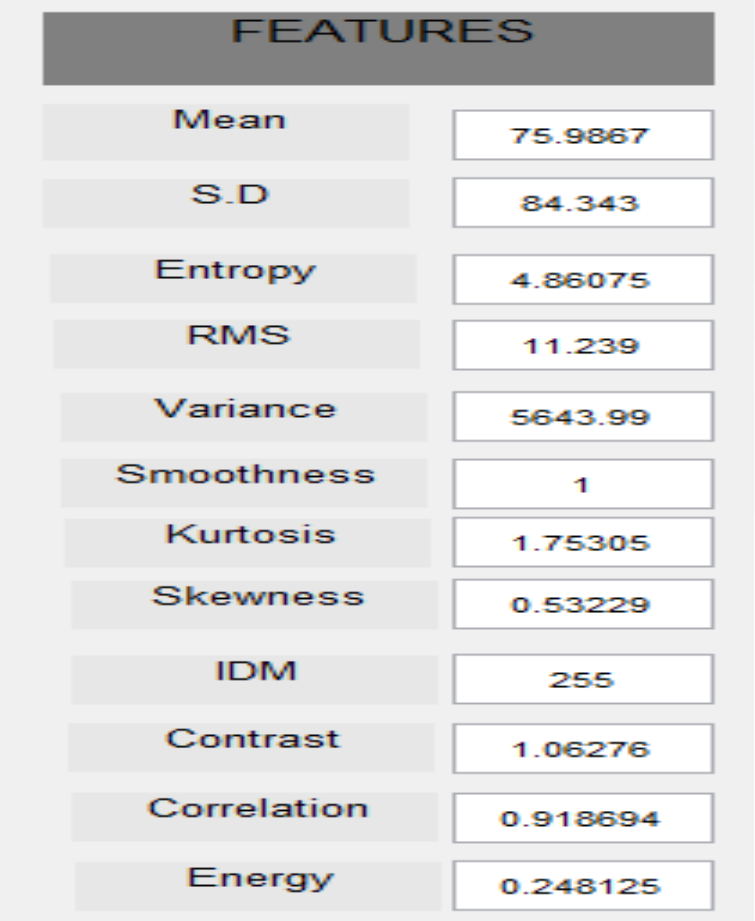
The picture above is the sampling of orange leaf plants that will be used for testing the system. The system uses techniques of *image processing* that will be used to see the state of orange leaves by looking at input data from *thermal imaging*. The system will then display visual color data. The color of orange leaves that are attacked by pests and diseases will be indicated with a contrasting color, as shown above, which shows that pests and diseases attack the orange leaves. This picture is also displayed accurately shows how much% of the orange leaves are affected by what pests and types of problems attack the orange leaves.



Picture 3.3. Display of The Process of Detecting Pests and Diseases of Orange Leaf Sample Match

Description

The picture above results from analysis with *thermal imaging* that functions pests and diseases of the orange leaf plant. This system provides a visual display in colorful code. The condition indicates that this orange leaf plant is affected by pests and diseases, so it needs to be dealt with immediately by the employees/staff at the Department of Agriculture, Food Crops and Horticulture.



Picture 3.4. Features Detailed Results of Detection of Orange Leaf Plants Affected by Pests

Description

The picture above is where this makes the final result in the detection of pests on orange leaves. In this process, the system will feature the products of the detection of orange leaves that are attacked by pests and diseases, and the final result will be told in detail about the problems and conditions that attack the orange leaves.

Conclusions and Suggestions

Conclusion

a. Application of Information System Design of Pest and Disease Detection in Citrus Fruits Web-Based has been successfully designed/built to provide information to the Staff / Employees in the Field of Citrus Plants in identifying pests and diseases in Citrus plants.
b. The resulting system uses Neural Network and SVM methods in the form of images of citrus leaves affected by pests, types of problems, and other features that explain pests and diseases in citrus fruit plants identified through their orange leaves.

Suggestions

Suggestions that will be given after this research for further development, namely:

a. This application can later be developed on platforms other than the Web, such as iOS and Android.
b. This application can be added features to support features that did not exist before.
c. This application can monitor directly on cropland.
d. The application can provide notification to the user if there are plants that have been exposed to pests and diseases.

References

Azzamy. (2017). General Guidelines for Complete Oil Palm Cultivation. *Plantation Cultivation.* from https://mitalom.com

Chaniago, M. B., & Wibowo, A. P. W. (2019). Monitoring of Coffee and Cabbage Plantation Areas and Protective Trees (Pinus) by Using WSN (Wireless Sensor Network) and Computer Vision Technology. *Journal of Intelligent Systems,* 2(1), 13-21. doi: https://doi.org/10.37396/jsc.v2i1.17

Csachová, S. (2020). Using WebGIS platforms and inquiry-based activities to teach about world political map and world population. *Review of International Geographical Education Online, 10*(2), 72-91.

Frazier, C. A., & Boehm, R. G. (2012). Using technology for geography teacher education: Web-based professional development. *Review of International Geographical Education Online, 2*(1), 78-94.

Goh, J. X. H., Tan, L. T.-H., Goh, J. K., Chan, K. G., Pusparajah, P., Lee, L.-H., & Goh, B.-H. (2019). Nobiletin and derivatives: Functional compounds from citrus fruit peel for colon cancer chemoprevention. *Cancers, 11*(6), 867.

Ishak, R., & Mansor, M. (2020). The relationship between knowledge management and organizational learning with academic staff readiness for Education 4.0. *Eurasian Journal of Educational Research, 20*(85), 169-184.

Junaidi, A. (2015). Internet of things, history, technology and its application. *Scientific Journal of Applied Information Technology, 1*(3), 5. doi: https://doi.org/10.33197/jitter.vol1.iss3.2015.66

MacIntyre, P. D., Lanxi, W., & Khajavy, G. H. (2020). Thinking fast and slow about willingness to communicate: A two-systems view. *Eurasian Journal of Applied Linguistics, 6*(3), 443-458.

Ridjal, J. A. (2008). Analysis of Determinants of Farmer Group Participation, Income and Marketing of Siamese Oranges in Jember Regency. . *JSEP (Journal of Social and Agricultural Economics), 2*(1), 1-9.

Siswati, L., & Nizar, R. (2014). Farmers Welfare Integrated Farming Patterns of Horticultural Crops and Livestock. *Scientific Journal of Animal Sciences,, 17*(1), 10-14.

Sutabri, T. (2012). Concepts of Information Systems. *Publisher Andi, Yogyakarta*, 139-141.

Vapnik, V. (1998). The support vector method of function estimation *Nonlinear modeling* (pp. 55-85): Springer.

Wijaya, I. N., Adiartayasa, W., Wirawan, I. G., Sritamin, M., Puspawati, M., & Sudarma, I. M. (2017). PESTS AND DISEASES IN ORANGE PLANTS AND CONTROL. *Udayana Serving Bulletin, 16*(1), 51-56.

Zych, I. (2020). Research in educational sciences: Its importance and quality standards for evidence based educational practice. *Kuram ve Uygulamada Egitim Bilimleri, 20*(1), 1-4.