



EARLY DISEASES DETECTION ON MAIZE AND COTTON

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Abstract: Plant diseases pose a significant threat to global food security, with maize and cotton being important crop in many regions. Maize is not only essential for food purpose but also use in industries. Maize is primary food in some of the regions because it is rich source of carbohydrates and provides nutrient. Cotton is crucial crop in many regions and it is widely used in industries for its fiber. Cotton is mostly used in textile industries for making clothes. The rapid rise of diseases has the potential to destroy the hectares of crops in large amount, and it is resulting in economic and financial losses for farmers. Maize disease effect on reduction of both quality and quantity of agricultural products. Cotton disease can cause a significant reduction in production, quantity and quality. The rise of diseases also effects on economy rate of nation. The prevention of diseases is necessary for reduce the problems of farmers and nations also. It is necessary to identify accurate diseases on crops to solve the problems of farmers. The machine learning technique is used to early detection of diseases on crops. Image processing technique is used to extract the similar features from leaf images, capturing visual symptoms of diseases. This technology is used to categorize the images in different disease or healthy state. The feature of categorizing images is fed into different machine learning algorithms to classify the images into various categories such as disease state and healthy state. The developed model aims to accurately identify diseases at their early stages, enabling timely interventions and reducing the crop losses. This research contributes to the development of agriculture system for sustainable management.

I. INTRODUCTION

Maize and cotton, are two of the world's most important crops, these crops are essential not only for food but also for the economy because they are widely used in various industries Maize also known as corn, is one of the most important staple foods in the world. It serves as a primary source of food for many people, and it is also one of the main food for cattle feeding and utilizes industrial products. Maize is cultivated in different conditions in different parts of different countries where the temperature is warm with adequate rainfall. Maize is a rich source of carbohydrates and provides nutrients, it also helps the countries for their development. Maize has some common diseases like rust, leaf blight, fungal, bacterial, and viral diseases. These diseases impact crop yielding and quality.

Cotton is also one of the most important crops, it is widely used in the industries for its fiber. Cotton is mostly used in the textile industries for making clothes. The cultivation of cotton needs a warm climate and it needs moderate rainfall. Cotton has some diseases like cotton leaf curl virus, bacterial blight, and target spot. These diseases impact crop yielding and quality.

How to diagnose maize and cotton diseases quickly and accurately and take corresponding control measures is of great significance to maize and cotton production.

Many factors affect the growth of the production the maize and cotton and it leads to the development of diseases. Climate and weather conditions are some of the factors affecting both of the crops. Maize needs warm temperatures between 60°F and 95°F (15°C to 35°C), on the other hand, cotton needs temperatures between 70°F and 100°F (21°C to 38°C). Maize requires 20-30 inches (500-750mm) of rainfall and cotton needs about 20-30 inches of rainfall. Soil Quality is another factor affecting crops because maize needs loamy soil with good drainage, on the other hand, cotton needs clay soils and sandy soil. Both contain nutrients like potassium, nitrogen, and phosphorus which are essential for the growth of the crops. The genetic factors affecting the growth of crops are dwarfism. The other factor that affects the production of the crops is the overuse of pesticides, insecticides, fertilizers, and weeds which compete with the crops for sunlight, water, and nutrients.

Nowadays, the constantly developing technology, machine learning, and image processing techniques have revolutionized the way we detect and diagnose diseases in maize and cotton. Images captured from various angles of the maize and cotton leaves using cameras. Then preprocessing contains image enhancement and segmentation. Then feature extraction which contains the color, texture, and shape features. Develop the model using Machine Learning and train the model and deploy it and regular updation of the model.

II. LITERATURE REVIEW

2.1 Challenges faced by Farmers in maize and cotton disease detection

Nowadays, drastic changes in climate and deficiency in fertility of soil leads to increase the rate of diseases on crop. Due to this, we have seen huge downfall in crops, decreasing production in agriculture and ultimately it leads to financial as well as environmental losses for farmers. Day by day rapid changes in environment effects on the crop. Due to this, farmers saw various varieties of new diseases and incomplete knowledge of farmers about it. It is major challenge for farmers to identify and treatment on them.

2.2 Existing solutions for disease detection

There are several existing solutions for disease detection that adopts modern technologies like machine learning, computer vision and deep learning.

2.2.1 Technology driven methods:

Nowadays rapid development in technologies is also helpful for farmers. There are many technologies to detect the disease of crops by capturing image from the user/farmers by using mobile applications, machine learning and deep learning models using image processing. Remote sensing and drone technology is also use to capture high resolution images of large fields and to detect plant disease through spectral analysis. Some IoT based sensors are used to real time monitoring on environmental factors that contributes to crop diseases, such as temperature, humidity, soil moisture and water resources.

2.2.2 Gaps in the existing solutions

After analyzing these solutions, it is found that all of them may have some challenges like limited dataset available for image processing, and getting blurry images as input from the user. Due to blurry images limited detection means model is unable to detect symptoms appear on leaves. Not only identifying of diseases, but farmers also need actionable solutions to prevent further spread on crops. Sudden changes in climax are also major challenge for existing solutions. There are some similar symptoms for multiple diseases (yellowing of leaves, leaf spots) making confusing situation for models to categorize the diseases on leaves and it leads to inaccurate identification or misdiagnosis. Not every farmer is able to afford remote sensing technologies. Farmers may face language barriers or cultural differences that are not addressed by any platforms.

III. DEVELOPMENT METHODOLOGY

3.1 Introduction

This section includes the software methodology used in the execution and implementation of the project it also focuses on the technologies and frameworks used in this implementation. This section also highlights the analysis and design concepts used in this implementation.

3.2 Requirement Elicitation

- The basic requirement is to develop a machine learning model that translates the real-world problem into the machine learning problem.
- Also focused on the quality of data that is used to provide for our model, data will be come from farmers in the form of images, that will be scanned with the help of image processing and provide a result which will work on the provided data by the farmers.

3.3 Machine Learning Architecture

- Machine Learning Architecture is a structured design of components and process like planning a model, developing a model and deploying a model.
- Cleaning the data, data transformation and data splitting using tensor flow and Apache-spark.

3.3.1 Data Collection:

Image capture

- Images of maize and cotton leaves are captured using cameras or smartphones.
- Image should be taken on different angles and lightning conditions.
- Techniques such as histogram equalization, and contrast adjustment are applied to enhance image quality.

Labeling

- Each image is accurately labeled with their corresponding diseases which is categorized like rust, blight healthy or unhealthy.

3.3.2 Preprocessing

Here we enhance the quality of image by adjusting contrast, brightness and color balance. Also remove the noise from the images like blurring or median filter. We can resize the image at a proper dimension for consistent input to machine learning models.

3.3.3 Feature Extraction

- It can extract and identify the color feature which is Red, Blue, Green. It can extract text features.
- It can also identify and extract the shape features which shows the shape, size, and contour of the leaf.

3.3.4 Model Training and Testing

- This model is trained using the training dataset of machine learning.
- Data collection, cleaning, transformation and splitting help to prepare the data for training.
- Step of prediction includes input in the form of images, text, or numerical data and output can be label and numerical. We can test the model using metric values like accuracy, precision.

3.3.5 Deployment of model

- This model is deployed into production environment after finalized.
- Right choice of environment that would be efficient for prepared model.
- Real time deployment including real time prediction on the data where it can make prediction.
- Batch processing the model make prediction on large dataset at specific intervals.
- Monitoring the performance to ensure that the model works efficiently.

3.3.6 Maintenance

- After the deployment, model needs to regular maintenance and monitoring, to fix the regular user requirement.
- To ensure that deployed model works efficiently regarding to the requirement.
- Using machine learning and image processing for disease detection in maize and cotton enhances the efficiency and accuracy of model.

Accuracy: Track that how accurately the model is predicting a new provided data.

Error-Rate: Track the rate of incorrect predictions over time.

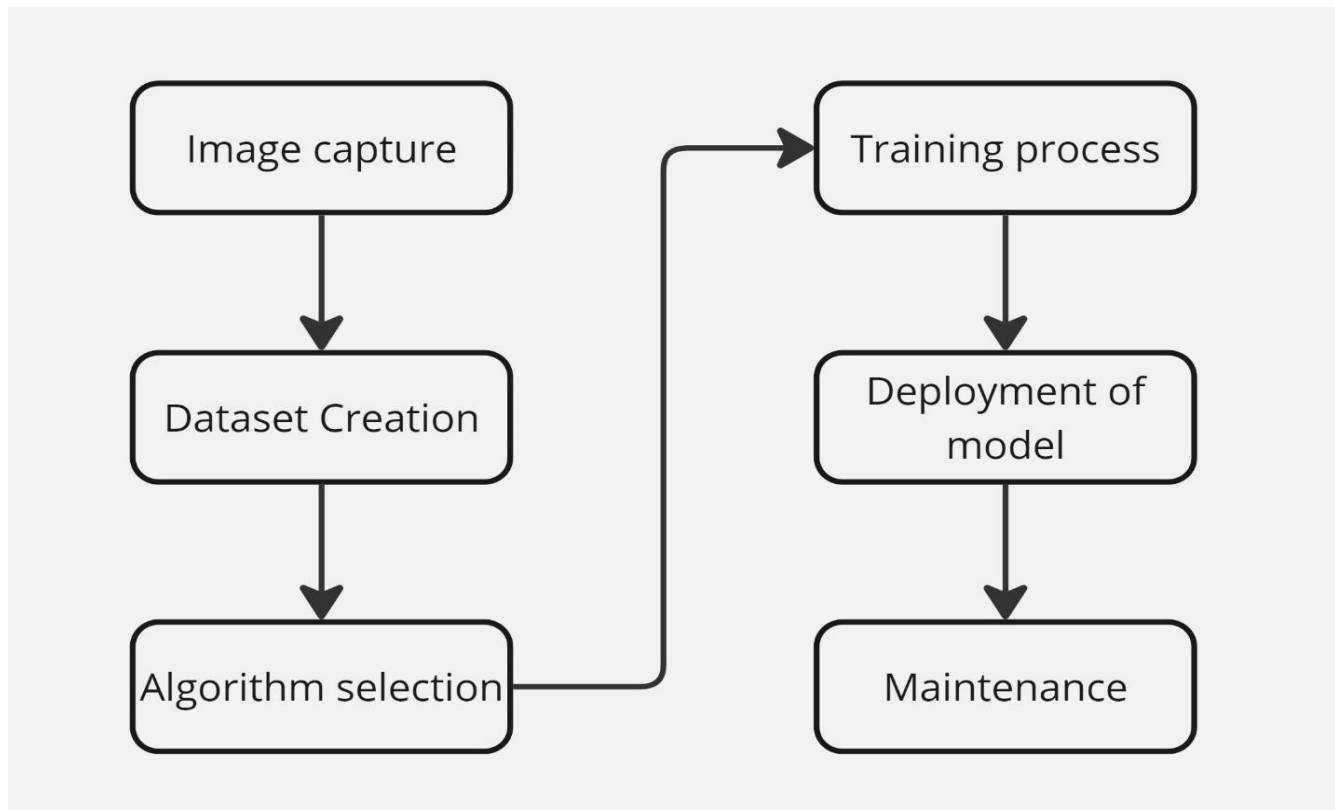


Fig: Architecture of machine learning

CONCLUSION:

The detection and management of diseases in maize and cotton are crucial for maintaining crop health and ensuring agricultural productivity. As these crops face increasing challenges from climate change and soil fertility issues, accurate and timely disease diagnosis becomes vital.

Modern technologies, particularly machine learning and image processing, offer promising solutions to these challenges. By leveraging high-quality images captured from various angles and under different lighting conditions, advanced models can analyze features like color, texture, and shape to identify diseases effectively. However, several gaps remain, including limited datasets, issues with image clarity, and the need for actionable recommendations for farmers.

The proposed methodology emphasizes a structured approach to developing a machine learning model, from data collection and preprocessing to model training, deployment, and ongoing maintenance. Regular monitoring of the model's performance ensures it remains effective in real-world conditions.

In summary, integrating these technological advancements not only enhances the accuracy of disease detection in maize and cotton but also supports farmers in making informed decisions to improve their crop yields and overall agricultural sustainability.

Overall, machine learning and image processing have the potential to revolutionize the way farmers manage maize and cotton crops by providing a powerful tool for disease detection and prevention.

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