VEGETABLE DISEASE AND INSECT PEST RECOGNITION BASED ON TINYML:
Cotton Case in Benin

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PLAN

01

Introduction

We'll underlined the research question and briefly introduce our objective

02

Literature survey

We will discuss in this point the relative research works and the techniques used until now

03

Methodology

What were the objectives of your research

04

Conclusion

We summarize up what we have done so far and expected results

Introduction

- In recent years, the world is facing a drop in agricultural production [1]. This is due to several scourges, among which, diseases and pests that destroy most of the agricultural production.[2].

- Pathogens and other pests destroy more than 40% of agricultural production [3] despite the use of pesticide.

- Nearly 3 million tons of pesticides per year in addition to the use of control non-chemical methods such as crop rotation and biological controls [4].

- However, pesticides and other chemical solutions pollute soil water and also cause erosion [3].

Introduction

- In response to these challenges, there is a growing interest in Precision Agriculture (PA) in order to increase yields in a sustainable way.

- Early and accurate detection of pests and diseases is a key pillar of PA
- Existing techniques rely on internet of things and cloud computing for early detection of disease and insects' pests

Introduction

- In the primary sector, cotton has been the main export product in Benin for several years.
- More than 728,000 tons of cotton following the 2020-2021 campaign.

- The aims of this work is to improve the productivity of cotton by detecting and recognizing of crop diseases and insect pest, while reducing the number of pesticides used..

Cotton Diseases

Bacterial blight

Water soaked spots become brown with age, Lesions on stems and on the leaves vein, Water soaked spots become brown with age [5]

Cotton boll weevil

Insects: Adults grey-brown, 5mm long,

Plants: Puncture marks in squares and bolls, Discolored bolls, Boll rot and abortion, Feeding damage on leaves [5]

Cotton leaf curl disease

Curling margins, Downward cupping of youngest leaves, Swelling and darkening of veins, Stunted [5]

Tarnished plant bug

Insects: Adults have multicolored ‘tarnished’ Appearance.

Plants: Feeding damage to buds, bolls and Leaves, Shoot blackening, Dieback [5]

Literature review

Areas that you may wish to cover

Visual detection

Extension officers are trained to diagnose pests and diseases by visual inspection or by conducting laboratory tests on plant samples [6–8]. These approaches, however, have several limitations.

Detection with hand-crafted feature extraction

Feature extraction involves mining information (manually) from a segmented image, facilitating accurate anomaly classification. E.g., texture, shape, size, colour.

Detection using deep learning

The feature extraction here is automated. The Convolutional Neural Networks is used to perform feature extraction and classification at the same time.

Comparison

For this Comparison, we used the following criteria :

Techniques	Feature extraction	MLA	Performance	Cost
hand-crafted Feature extraction	Manually	Shadow Classification: SVM, PCA, MLC, KNN, NB, DT,RF and ANN	Good	Expensive (Time, money, energy, bandwidth)
Deep learning	Automatic	CNN, Transfer Learning (Alexnet, LeNet, GoogleNet, ResNet, etc.)	Good	Expensive (money, energy, bandwidth)

Methodology

Tiny Machine Learning

To build such a system that requires fewer resources in memory and power, we rely on Tiny Machine Learning. Tiny Machine learning is the intersection of machine learning and embedded internet of things devices.

Methodology

Dataset Collection

- Compare the data with the one we have.
- Label the data depending from the type we have.
- Clean the data.

Train the Model

- Choose the most suitable transfer learning.
- Split the data into train test and validation.
- Launch the process for training.

Convert the model

- Convert the model in order to enable it to run the tiny devices
- Include the model in the device.

Run the model in tiny device

- Run the model inside the tiny device and perform some test
- Evaluate and troubleshoot

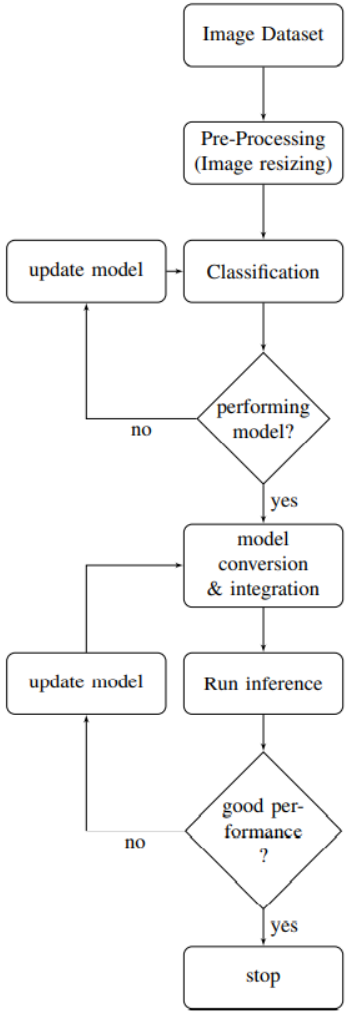

Fig. 2. overall workflow to obtain lite model

Research Challenges

The immediate challenges we could face are the following :

01

Cotton Dataset

dataset related to fresh cotton

02

System Deployment

how system will be positioned

03

System Monitoring

We need to ensure the operate as we expected it to be and make sure that predictions are correct.

Small cotton Plant

Attacked Plant

Conclusions / Expectation

Vegetable disease and insect pest are a threat to increased agricultural production

it is urgent to find a solution that can help in their eradication

Several solutions have been proposed in order to fight diseases and insects, but the challenge remains for developing countries

Our expectation is to enable a more autonomous and independent system

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QUESTIONS