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Insect Classification and Detection Using Skeletonization

Prem Gorde
MMCOE
Pune, India
premgorde2019.it@mmcoe.edu.in
rutujalalge2018.it@mmcoe.edu.in

Rutuja Lalge
MMCOE
Pune, India

Stuti Bhongale
MMCOE
Pune, India
stutibhongale2019.it@mmcoe.edu.in
pratikshahiwale2018.it@mmcoe.edu.in

Pratiksha Hiwale
MMCOE
Pune, India

Guide Name - S.P. Mankar
MMCOE
shraddhamankar@mmcoe.edu.in

ABSTRACT

Timely detection of pests plays a major role in agriculture. There exist many pest identification systems, but almost all of them suffer from the misclassification due to lighting, background clutter, heterogeneous capturing devices as well as the pest being partially visible or in the different orientation. This misclassification may cause tremendous yield loss. To mitigate this situation, we proposed an architecture to provide high classification accuracy under the aforementioned conditions using skeletonization along with neural networks as classifiers. We have considered the crop rice as a use case as it is the staple food grain of almost the entire population of India. The number of pesticides used is highest in rice as compared to all other food grains. This paper offers a robust technique to identify the pests in rice crops. The performance of the proposed architecture is tested with an image dataset, and the experimental results reveal that our proposed approach provides better classification accuracy than the existing pest detection approaches in the literature. Furthermore, the experimental results also provide the performance comparison among the popular classifier.

Keywords: *convolutional neural network; insect detection; field crops , Keywords: armyworm insect, RGB armyworm insect, gray scale armyworm insects Image processing, deep Learning, CNN model*

INTRODUCTION

Pests are among the main causes of losses in agriculture. Insects can be particularly damaging, as they can feed from leaves, affecting photosynthesis, and they are also vectors for several serious diseases.

1. First of all, our team is going through literature survey. In literature survey we have known about how to classify insects and how to identify with machine.

2. So, We came to the conclusion that we have to used classifier for classification of insects

and feature extractor for identifying features of images.

3. We take CNN classifier and Skeletonized feature extractor.
Now we have selected 2 pests for cross checking And we are collecting database and create dataset according to dataset.

MOTIVATION

Agriculture is the basic necessity for human survival. The progress in agriculture is intertwined with the economic progress of the society in which the farmers play a key role in putting up the capital and the labor. The innovations and applications of technology impact large sections of rural farming societies and bring them into the mainstream of development. In the past decades the government has launched many schemes to improve the livelihoods of people engaged in this sector. As per 2011 census,24.6% of the populations are involved in agriculture. The production of food grains for a colossal population of 1.2 billion people requires extensive investments in the form of pesticides, fertilizers, and labor. The use of pesticide is essential for the survival of rural economy as the yield obtained, is often equivalent to a quarter of the total GDP. As rice, sugarcane is the major crop which covers 63% of the total area under cultivation, we have considered this as the use case in this paper. The indiscriminate use of pesticides causes extremely high rate of cancer among the humans who consume the said product, and the farmers who use these pesticides. Multiple surveys conducted by the government in a span of 5 years from 2015 to 2019 has shed light on the fact that at least 1.6% to 3% of all the food grown is poisonous and unfit for consumption. The lack of awareness about the harmful effect of the pesticides is alarming to say the least. This use of multi-stage features improved the accuracy over systems that use single stage features on a number of tasks, such as in pedestrian detection and certain sorts of classification. Motivated by many advantages of the multi-layer's features, we propose an alternative multistage strategy that can be applied to a standard one-track CNN whose weight parameter is fixed after the training has been finished without the multi-stage strategy in mind. The experiment results show that our approach can further improve performance of a standard one-track CNN. Note that the proposed approach is different from the one in that the work in trains the multistage architecture from the beginning, whereas the proposed method can be applied to a standard CNN and skeletonization whose training has been already finished. This paper includes us approach's motivation to easily help to understand why this model provides good result. This describes our proposed model and explains how it works. We report experiment result on a various image classification data set and conclude our research.

LITERATURE REVIEW

Identifying pests' images with multiple insects with insects in different orientation is challenge. Results can be improved if other morphological features are considered for pest identification and with image augmentation on larger dataset. Feature extraction techniques and classifiers like skeletonization and CNN (Convolution neural network) are performed.
Basically, skeletonization is basically result of thinning process used for preprocessing phase for several applications such as writer identifier and script identifier.
In skeletonization most things proceed repeatedly for removing boundary elements until a pixel sets with max thickness of 1 or 2. After skeletonization further process is CNN which extract the features and classify it basedon some properties.

FUNCTIONAL REQUIREMENTS

1. Product identifies the insect given by user and classify it based on its characteristics.
2. The input given is user defined and on the input image processing is done and forwarded for further process.

3. Total process works on backend dataset which is trained in the program.
4. The product is totally based on python language with machine learning algorithm named as CNN as well as Skeletonization Process.

We have taken 2 insects based on their features it will identify which insect is it and pesticides required for it.

NON-FUNCTIONAL REQUIREMENTS

1. It is Basically Desktop application which can be affordable and require only desktop.
2. It does not require any Internet connection.
3. It is efficient for lot of insects also.
4. It is reliable and safe to use.

METHODOLOGY

Step 1: Start

Step 2: Import dataset and libraries.

Step 3: Augmentation of dataset and arrange them for comparison.

Step 4: Feature Extraction using Skeletonization.

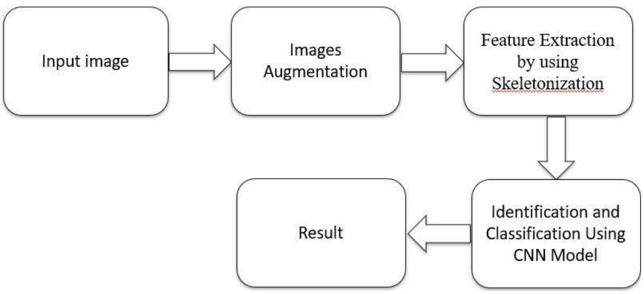
Step 5: Performing thinning process in Skeletonization.

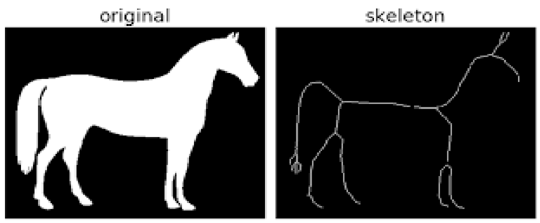
Step 6: Creating histogram of input pest

Step 7: Creating Classification Model with CNN and classify pest depending on common properties.

Step 8: Stop

BLOCK DIAGRAM





TECHNIQUES

1. SKELETONIZATION

Skeletonization provides a compact yet effective representation of 2-D and3-D objects, which is useful in many low- and high-level image-related tasks including object representation, retrieval, manipulation, matching, registration, tracking, recognition, and compression. In its general form, the skeleton retains numbers on its medial lines indicating the distances of the nearest pixels on the outside of the figure; the fact that the combined information of skeleton and distance function values is sufficient to regenerate the entire shape (within the accuracy of 1 pixel) increases the power of the skeleton approach to shape analysis.

2. FEATURE EXTRACTION AND CLASSIFICATION USINGCNN.

The convolutional neural network (CNN) is a class of deep learning neural networks. CNNs represent a huge breakthrough in image recognition. They're most commonly used to analyze visual imagery and are frequently working behind the scenes in image classification.

A CNN has Convolutional layers ReLU layers Pooling layers

A Fully connected layer

Input ->Convolution ->ReLU ->Convolution ->ReLU ->Pooling ->ReLU ->Convolution ->ReLU ->Pooling ->Fully Connected

CNNs have an input layer, and output layer, and hidden layers. The hidden layers usually consist of convolutional layers, ReLU layers, pooling layers, and fully connected layers.

CONVOLUTION

The main purpose of the convolution step is to extract features from the input image. The convolutional layer is always the first step in a CNN. You have an input image, a feature detector, and a feature map. You take the filter and apply it pixel block by pixel block to the input image. You do this through the multiplication of the matrices.

ReLU layer

The ReLU (rectified linear unit) layer is another step to our convolution layer.

You're applying an activation function onto your feature maps to increase non-linearity in the network. This is because images themselves are highly non-linear! It removes negative values from an activation map by setting them to zero.

Pooling

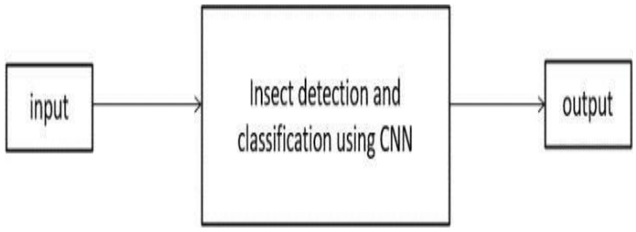
The last thing you want is for your network to look for one specific feature in an exact shade in an exact location.

That's useless for a good CNN! You want images that are flipped, rotated, squashed, and so on. You want lots of pictures of the same thing so that your network can recognize an object (say, a leopard) in all the images. No matter what the size or location. No matter what the lighting or the number of spots, or whether that leopard is fast asleep or crushing prey. You

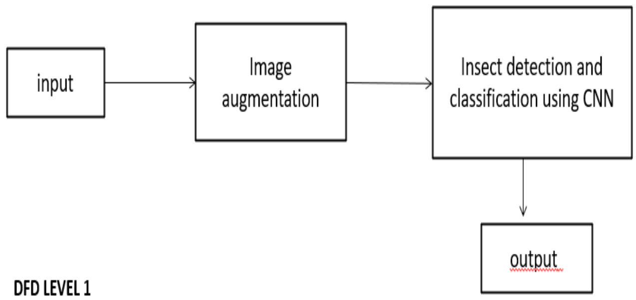
want **spatial variance**! You want flexibility. That's what pooling is all about.

Pooling progressively reduces the size of the input representation. It makes it possible to detect objects in an image no matter where they're located. Pooling helps to reduce the number of required parameters and the amount of computation required. It also helps control **overfitting**.

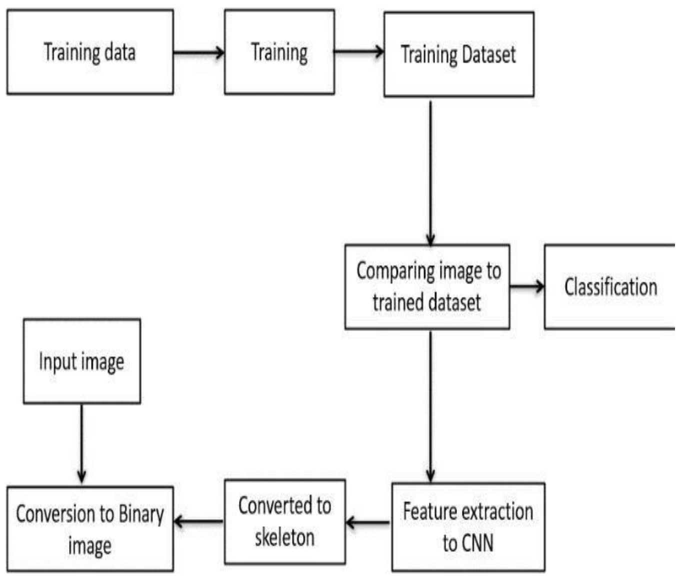
DFD LEVEL



DFD LEVEL 0

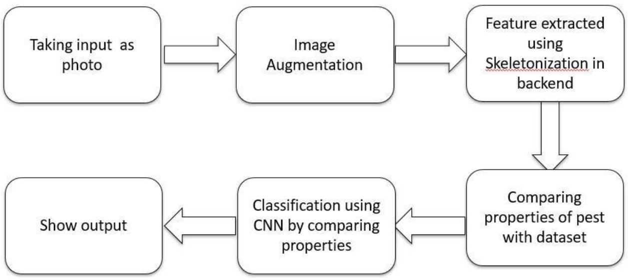


DFD LEVEL 1



DFD LEVEL 2

SOFTWARE ARCHITECTURE



FUTURE SCOPE

Used in farms and greenhouse, flower gardens. Project can be expanded to give details about pesticides to be used on crops.

It helps in research labs of pests and agriculture center for recognizing the pest of huge dataset.

1. Now these projects can be made for only two insects this can be further upgrade to large number of insects.
2. It can also be expanded to details of crop it mostly found, precautions to be taken for this etc.

APPLICATION

1. Used for identification of pest or insect found on crops if it is unknown and it also suggest pesticide can be used for it.
2. Used in various laboratories over vast number ofpests to identify each of them.
3. Main purpose is for agriculture field for farmer touse proper pesticide for suitable crop or insect.

CONCLUSION

In this project we investigated the use of CNN and Skeletonization to detect and classify Armyworm and whitefly pests. The images are preprocessed and feature extraction then finally classified the armyworm and whitefly insects into appropriate classes.

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