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SMART AGRICULTURE: WEED CLASSIFIER USING IMAGE PROCESSINGAND COMPUTER VISION ALGORITHMS

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ABSTRACT
In recent years, farmers have adapted the method of Precision Agriculture to produce more yields efficiently, through economical use of available resources. In Precision Agriculture, continuous monitoring of soil conditions and physiochemical parameters of plants can achieve optimal conditions required for plant growth by using sensors located at the farms. Such automated system of continuous monitoring and providing appropriate actions for plant growth, saves time and cost in the daily operation of agricultural practices. In this proposed idea, automated system will classify crop and weed using Image processing and Computer vision algorithms are presented. In this, maize crops are continuously being monitored by capturing images using camera. Features such as colour and texture are extracted for the purpose of classification of plant as crop or weed. I have made use of statistical features such as Mean, Standard Deviation, smoothness, and Intensity. This will include four steps namely image acquisition, pre-processing, feature extraction and classification. Machine learning algorithms such as support vector machines and neural network classifiers are used for accurate prediction if the plant is crop or weed. This application makes use of images of maize crop, which are 500 in number and equal number of weed images.
KEYWORDS: *Precision Agriculture, Image Processing, Computer Vision, Neural Networks*

1. INTRODUCTION

Precision Agriculture (PA) is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. Precision Agriculture is not widely practised in India but it is used largely in well-developed countries. Issues concerning agriculture, countryside and farmers have been always hindering a development. The only solution to these problems is agricultural modernisation. The main objective of our project is to predict if the plant is crop or weed using algorithms like SVM, Neural Networks. [1][2].

Project Overview

This project aims to develop an automated system for classification of Crop and Weed. The project mainly involves steps like Feature Extraction, Normalisation,Classification and Image Segmentation. Classification is carried out in two ways. Support Vector Machine and Neural Networks.

Motivation

In existing systems, we have drawbacks such as volunteer removal of weeds, which requires manpower, and it is difficult to practice, so there is a need for an automated system to detect if the plant is Crop or Weed. This automated system will prevent unnecessary damage caused to the crop and it is time efficient. This also leads to an improvement of technology in Indian agriculture. [3][4].

Problem Statement

Smart Agriculture: Weed Classifier using Image Processing and Computer Vision algorithms

2. SYSTEM STUDY AND ANALYSIS

Requirement Analysis: Functional Requirements

2.1 Feature Extraction

Feature Extraction is one of the major steps in most of the image processing techniques involved in

weed detection. let us consider four texture features (mean, intensity, standard deviation, and smoothness*).*

2.2 Normalization

The features extracted vary significantly for different images. It is important to transform all variables (features extracted) to a specific range for further processing. We have applied min-max normalization to each feature extracted, so that they are normalized to 0-1 range. Normalized(z) = x-min(x)/((max(x)-min(x)) where, x- value of feature extracted , min- minimum value for the considered feature and max -maximum value for the considered feature. These normalized features are further given as the input to the appropriate classifier to distinguish between crops and weeds.

2.3 Classification

SVM (Support Vector Machine) and Neural Networks are applied to the normalized features extracted for the image which are stored in text files. 900 images of both crop and weed are considered as training set. All the features extracted for each image are stored in an array and given as input to the SVM function. Classifier Model is obtained by training the classifier with the data set. All these processes come under the training phase. The testing phase comprises of giving 100 images as input and the extracted features are given to the classifier model for predicting whether the image is crop or weed. Both SVM and Neural Networks are used for classification. Further to get more accuracy of the application we make use of K-fold cross validation. In K-fold cross validation every input is taken for training and testing. For each time the training and testing values will be used randomly.

2.4 Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

3. NON-FUNCTIONAL REQUIREMENTS

3.1 Performance Requirements

The system is expected to perform with adequate efficiency Prominence is given on the result rather than on performance. The system takes input of 2D images, extracts the features of images, normalises it and give it to the SVM and Neural Networks classifier, which gives the output.

3.2 Scalability

The systems is highly scalable, it performs well even if it is tested with huge datasets (images).The system takes input of 2D images, extracts the features of images, normalises it and give it to the SVM and Neural Networks classifier which gives the output.

Literature Review/ Survey

India had established itself as one of the world's faster-growing economies. The Indian economy is the ninth largest economy of the world and also one of the fastest growing world economies. This growth is attributed to various Indian industries which have grown tremendously post independence to increase national income, to generate employment and to generate foreign earnings. India was initially an agriculture based economy but after liberalisation norms of 1991 particularly, the services sector has taken a lead contributing the most to the gross domestic product. Presently the agricultural, manufacturing and service sector account for 16, 27, 57 percent of GDP respectively.

Existing System

Volunteer removal of weeds. Some Mycoparasites have potential for broad-spectrum control of fungal pathogens.

Proposed System

In the proposed system, images of maize are captured by using high-resolution camera. These images are used to extract features, which is done by the system. We have extracted seven features. Extracted feature values are normalized and then passed to the classifiers namely SVM and Neural Networks. To find the accuracy of the prediction done we make use of K-fold cross validation. Image segmentation technique is applied to the image to show which part is crop and weed.

4. SYSTEM DESIGN

Pipe and Filter architecture are presented to illustrate the system and the interactions between components. It discusses the components of the system and their role in the systems execution.

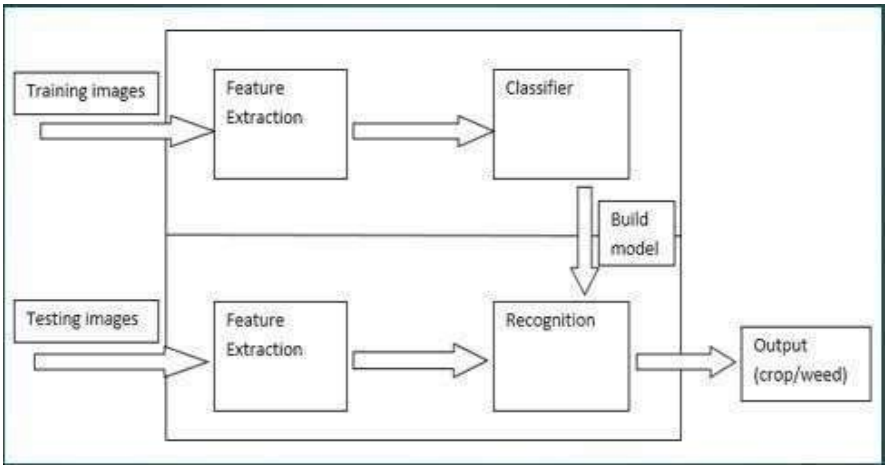

Fig. 1: SYSTEM MODEL

The pipe and filter Architecture is one where the processing of the data in a system is organised so that each processing component (filter) is discrete and carries out one type of data transformation. The data flows (as in a pipe) from one component to another for processing

System Functionalities

This Architecture also suits our project because system is divided in set of different layers. These layers provides individual different functionality such as extracting features, normalization, classification and image segmentation

Module 1: Feature Extraction

Input: Images are taken as input.

Processing: four features are extracted from the Input image

Expected Output: Values of the extracted features Will be displayed on the console

Module 2: Normalization

Input: Text files which contains the extracted values

Processing: Using the extracted values, value are normalized within the range 0-1

Expected Output: The application shall provide the values in the range between 0-1.

Module 3: Classification

Input: Normalized values are given as input to SVM and Neural Network Classifier

Processing: The application shall compute and prediction is made.

Expected Output: The application shall make a prediction and provides the accuracy of the application.

Module 4: Image segmentation

Input: Image is used as input.

Processing: The application shall split the Image and provide colour to the predicated as per the results of classifiers used.

Expected Output: The application shall provide different to colour crop and weed present in the image

5 .CONCLUSION

The use of automated systems will be more efficient and it consumes less time. We tested our dataset using two algorithms namely SVM and Neural Networks. Both algorithms predict the values in different ways and we get different accuracy

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