Agrigras: Precision Farming for Weed Detection & Control

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Abstract

This analysis has been supported by the employment of preciseness agriculture tools for the management of weeds in crops. It has focused on the creation of an image processing formula to sight the existence of weeds in an exceedingly specific website of crops. The most important objective has been to get formula so a weed detection system will be developed through binary classifications. The initial step of the image process is the detection of inexperienced plants to eliminate all the soil within the image, reducing data that are not necessary. Then, it's targeted on the vegetation by segmentation and eliminating unwanted data through medium and morphological filters. Finally, labeling objects have been created in the image so weed detection may be done employing a threshold based on the world of detection. This formula establishes correct observance of weeds and may be enforced in automated systems for the obliteration of weeds in crops, either through the employment of machine-controlled sprayers for a selected website or a woodcutting mechanism. additionally, it will increase the performance of operational processes in crop management, reducing the time spent sorting out weeds throughout a plot of land and focusing weed removal tasks on specific sites for effective management.

Keywords: **Image Processing; Artificial Intelligence; Neural Networks, weed detection, crop monitoring, agriculture.**

1. Introduction

This new concept has led to developed countries highly productive in agriculture, opting for the use of new tools to improve their technological management in the agricultural enterprise. In this way, agricultural practices are determined to replace the usual inputs based on average values, as in traditional agriculture, for more precise agriculture, with localized management, which studies the changes in yield in an entire area. The control of weeds is of vital importance in agriculture, these are unwanted by the farmer since they are causing several problems in the crop [1,2,3,4, 5]. Among its negative effects is the contamination of production, the shelter of insects and diseases facilitates the growth of other pests and increases irrigation costs. The idea of making an algorithm that using image processing detects the weeds that are located in a specific area of plantation then arises. This methodology is advantageous because it offers a technological tool for farmers throughout the process of sowing, growing and harvesting crops. It increases the performance of operational processes in crop management, reducing the time spent searching for weeds throughout a plot of land and focusing weed removal tasks on specific sites for effective control.

2. Related work

The research about using a machine learning technique to identify A. J. Irías Tejeda, R. Castro Castro[6]. They have used so-called 'KNN' algorithm to identify the weed. They use the data set of weed as their training and testing data, and the accuracy of their algorithm is about 78%. Though the result it made was not the best, it has inspired many researchers to apply machine learning techniques to the identification of poisonous weed. Various great results have been made using various algorithms. They are focused on adopting the algorithm on some particular input data and reached 84.7% on the identified inputs. They had discussed how to build the network and had a similar result as Gail A. From all those researches we can see that they all explored weed identification through one particular method and modified and improved it to its best or approximate best. The purpose of our research is to explore a bunch of common machine learning techniques for poisonous weed identification and compare them comprehensively.

3. Motivation

Farming is one of the main occupations in India. India is the second largest producer of Agriculture products in the world. Lack of Awareness about the recent development in the field of agriculture and the poor socio-economic background of the farmers are some of the fundamental reasons for continuously decreasing agricultural productivity. Non-availability and untimely supply of agricultural inputs (seeds, fertilizers, pesticides, etc.) are also one of the main issues. Agricultural production must double by 2050 in India to meet the expected food demand due to population growth. The key to improve productivity and efficiency in the use of resources is precision agriculture. This helps to achieve the goal under the diverse challenges currently faced by Indian agriculture due to climate changes, land degradation, availability of farmable land, labor force shortage and increasing costs. Precision agriculture helps in facing these challenges and develops accurate methodologies that provide information about the crop growth and health indicators.

In this system, Farmer will give a picture to the Authorized person. Then, a person will test the Image by image comparer and Image converter. It will find the categories of the weeds. According to the categories of weeds i.e. most dangerous, mild dangerous and least dangerous, we will recommend that what action should be taken on that weed and suggestions will be provided accordingly. It will help the farmers to increase the productivity of the Farm.

4. System Overview

The program developed classifies the types of agri-gras detecting unwanted weed, so that represents a tool of care and prevention for physicians and normal peoples and pets. A system of learning, recognition, and classification must consist of the so-called "ABCDE" or alphabet of weed which consists of the following points: - Asymmetry of the form: one-half of the weed are different from the other. - Borders: blurry, irregular, festooned, diffuse or imprecise. - Color: varied in the same place or multiple colors on the same weed as green, white, black.

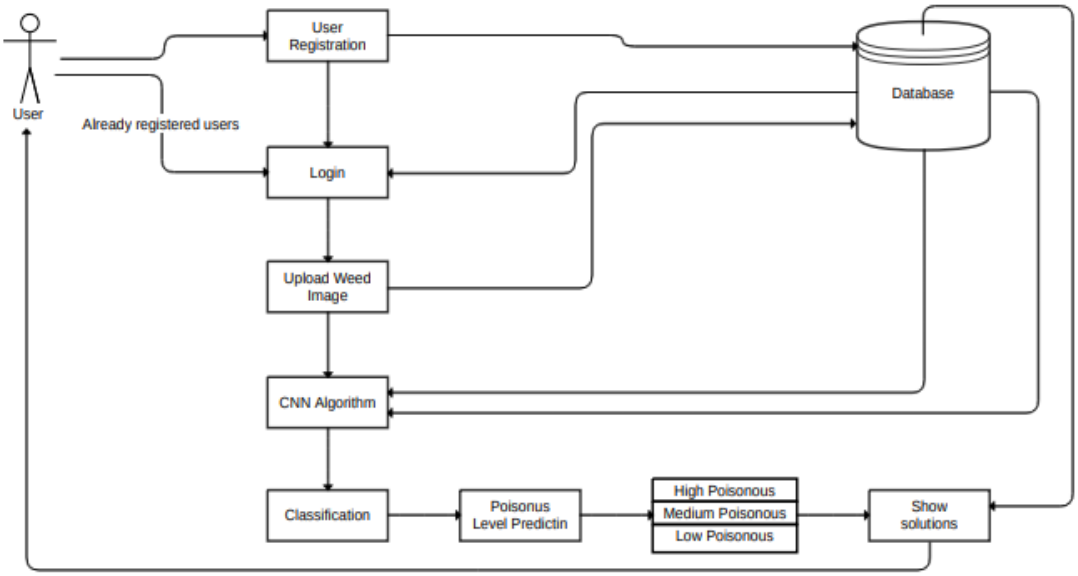


Figure 1: System Architecture

As per fig 1, the following steps will be performed:
i. **Registration**: This module is used to store the details of the user.
ii. **Login**: This module is used for entering the home page by entering username and password.
iii. **Upload Image**: This module id used to store an image of the user into the database.
iv. **Fetch Image**: This module is used to pass the image to the classifier for the prediction of the weed.
v. **Prediction**: These modules show the result or predication of the weed CNN algorithm is used for feature extraction and KNN used for classification.
vi. **Solution:** This module will provide a solution in the form of suggestions to the user after prediction.

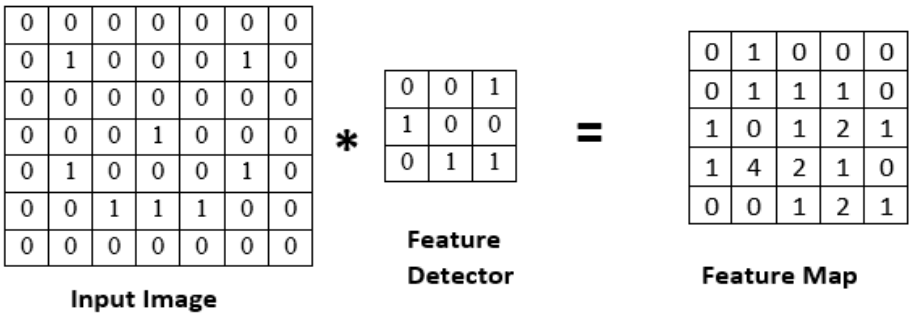
5. Algorithms

5.1 CNN algorithm

CNN algorithm is used to classify the image of weed. It is also used to extract the features from the images.
Steps followed in CNN:

i) Convolution Layer

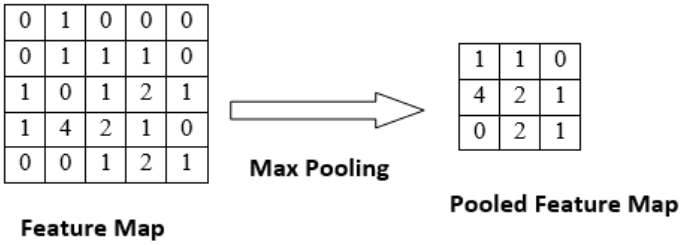
Input image, feature detector and feature map are the elements used to operate on this layer. Feature detector can be 3*3, 5*5 or 7*7 matrix. It is placed over the input image beginning from the top-left corner. Then the number of cells in which the feature detector matches the input image is counted. The number of matching cells is then inserted in the top-left cell of the feature map. The feature detector is then moved one cell to the right and the same thing is done. After the first row is done then the same procedure is followed for the next row and so on. Example:



ii) Pooling layer

It enables the convolutional neural network to detect the image when presented with the image in any manner. There are three types of pooling:

- Max Pooling
- Min Pooling
- Sum Pooling



iii) Fully Connected layer

They are those layers where all the inputs from one layer are connected to each activation unit of the next layer. In the following diagram X_1, X_2,…, X_m are nodes of the input layer and y is of the output layer.

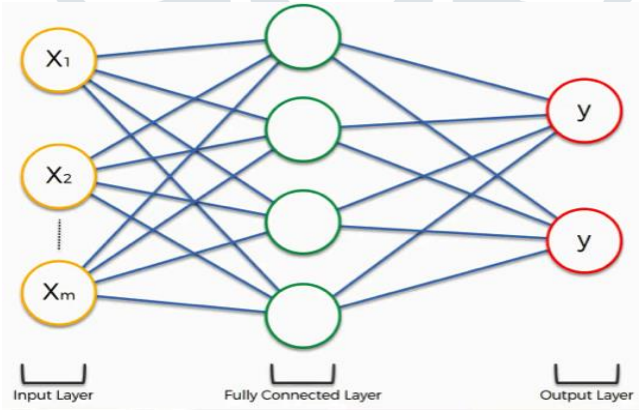


Fig 2: Process of fully connected layer

5.2 KNN algorithm

It is used for both classification and regression predictive problems. It is also used to find the nearest value from the given dataset. The train dataset and test dataset are compared for prediction using the KNN algorithm where the K- nearest neighbor is being calculated. It gives the prediction of test image that is to which class the image belongs to. For performing KNN algorithm distance is measured by using Euclidean distance's formula (1). In the equation d(p,q) and d(q,p) are the distance between two points p and q.

$$d(\mathbf{p},\mathbf{q}) = d(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}. \qquad (1)$$

6. Conclusion:

This research has proposed a practical way to detect weeds by image processing based on the characteristic of the area of each object in an image. The proposed algorithm has the advantage of detecting weeds present between the plants in the crop lines. It also detects effectively as crop plants even those that are outside the crop lines, which is an objective difficult to achieve with other methods using computational vision. A specific database of weeds is not necessary to be able to train the algorithm and identify weeds, as an automatic learning algorithm would do. but the results are good enough to use the algorithm in practical applications. In the same way, the system gives a result with greater efficiency, due to the analysis and image processing being done in small intervals at a time, limited by the type of computer and the processor that has at its disposal, obtaining a timely and efficient result. For the purpose of classification, the KNN algorithm is used. The solution is provided after the prediction.

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Reference:

[1] *R.Anirudh Reddy, G.Laasya, T.Sowmya, P.Sindhuja, Mudasar Basha "Image Processing For Weed Detection", Volume 5, Issue 4, ISSN 2349-4476* ***(April 2017).***

[2] *A. Paikekari, V. Ghule, R. Meshram, and V. B. Raskar, "Weed detection using image processing", International Research Journal of Engineering and Technology (IRJET), vol. 3, no. 3, pp. 1220-1222* ***(2016).***

[3] *K. R. Thorp and L. F. Tian, "A review on remote sensing of weeds in agriculture", Precision Agriculture, p. 477–508 (****2004).***

[4] *Basavarajeshwari, Prof. S. P. Madhavanavar, Weed detection using image processing", International Research Journal of Engineering and Technology (IRJET), vol. 3, no. 3, pp. 1220-1222* ***(2016).***

[5] *Anup Vibhute, S K Bodhe; "Applications of Image Processing in Agriculture: A survey; International Journal of Computer Applications"* ***(2012).***

[6] *Tejeda, A. J. Irías and R. Castro Castro. "Algorithm of Weed Detection in Crops by Computational Vision." International Conference on Electronics, Communications and Computers (CONIELECOMP) 124-128* ***(2019).***