A CONVOLUTION NEURAL NETWORK BASED SMART INTELLIGENT
WEED DETECTION SYSTEM

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ABSTRACT
Artificial intelligence, explicitly deep learning, is a quickly developing examination field today. One of its
different applications is object acknowledgment, utilizing PC vision. The blend of these two innovations
prompts the motivation behind this proposal. In this paper, a system for the identification of different crops
and weeds implemented. Weed management is one of the costliest input to the agriculture and its one of the
unmechanised area. Weeds are the plants, that normally growing in a incorrect position which participate
with crop for water, luminosity, nutrients and room, causing decrease in yield. It can also cause a trouble in
agriculture. Weed picking is not the cost effective because of the laborious job in fields. Weeds can also
crowd pests and diseases that can extend to cultivated crops. The most important step in this area is to bring
mechanization is to detection of weed in agricultural field. Weed can be detected by using convolution neural
network in opencv. Convolution neural network uses special image processing techniques. Weed in
agricultural field can be detected by its properties such as Size, Shape, Spectral Reflectance, Texture features.
In this paper we are demonstrating weed detection by its Size and colour features.

Keywords: Weed detection, Crop, Image, Convolution neural network.

I. INTRODUCTION
One of the freshest and most explored advancements these days is profound learning. Profound learning is a
strategy used to make clever frameworks as comparative as conceivable to human cerebrums. It has had a major
effect in a wide range of spaces like video, sound and picture handling. Then again, horticulture is humankind's
most seasoned and most fundamental movement for endurance. The development of populace during the most
recent years has prompted a more popularity of farming items. To meet this demand without draining the
environmental resources the agriculture uses, automation is being introduced into this field. Deep Learning is
mainly accommodating in decision making, because it is an significant function in artificial intelligence that work
related to that of our intellect in dealing out data and it creates pattern. Deep learning has the potential of
knowledge any unconfirmed data that even the data may be in unlabeled, or in shapeless form. The present paper
aims to merge both concepts by achieving autonomous weed recognition in agriculture; this goal will be reached
by using new technologies such as Matlab, and Python programming, image processing, deep learning and
convolution Neural Networks.

II. REVIEW OF RELATED STUDIES
Kuntal Kumar Pal & Sudeep K. S, (2016) describe the concepts using CIRAR 10 dataset that shows the
importance of preprocessing methods with the help of 3 variations of the convolutional neural network and they
produce the better result when using the zero component analysis technique. MamounAwad et al. (2006)
presents a process that needs time and human intervention known as image annotation. They propose a system
based on user need to increment annotate image and they develop classifier and user feedback from that increase
the size of the training set and also facilitates semi- automated image annotation.Identifying the display of the
online advertisement done by image classification model developed by An TienVo, Hai Son Tran & Thai Hoang
Le. (2017). They propose a device called nLmf convolutional neural network approach and produce the result only
yes which means advertisements display clearly or no means produced advertisement do not display the result or
not clear. D.C. Slaughter, D.K. Giles & D. Downey, (2008) conducted an important review on the four core
concepts of the automatic weed control system. They explained detection and identification of weeds under wide
range of conditions and also the other parts like weed control and mapping. The survey of image processing in the domain of agriculture field was done by Anup Vibhute & S K Bodhe, (2012). They took analysis of the different parameters and proved traditional methods not accurate and need more time consuming because image processing can improve decision making for vegetation measurement, irrigation, fruit sorting, etc. The ability of a back propagation network approach has been successfully applied to the recognition of handwritten zip code digits provided by Y. LeCun, et al (1989). P.Lakshmi Prasanna, et al, (2020) describe the implementation of image classification based convolutional neural network system which is widely used in visual image analysis. Here fully connected layer used to connect all neurons and process the output. Potharaju, Sai Prasad, Sreedevi & Marriboyina, (2018) proposed a Symmetrical Uncertainty Attribute Evaluator using quarter feature selection. They divide whole data space into 4 sets and each such set has less than or equals 25 % features of whole data space. NVS Pavan Kumar. et al, (2019) describe the method that include mines regular, frequent and maximal patterns in the field of data mining with negative and positive associations.Murad Omarov, Vusal Muradova, Vyacheslav Lyashenko,(2020) discusses the approach to the methods of creating expert assessments and they conclude the level of understanding of students in learning computerization systems with remote access. Kavitha, K. Sandhya, B, Rao, B & Thirumalarao, (2018) present a deep CNN, AlexNet, which is used in the place of handcrafted features for feature extraction in the primary point of image registration. Anitha, R., Jyothi, S., Mandhala, V. N., Bhattacharyya, D., & Kim, T.(2017) done a case study on Alzheimer’s disease and compare normal and abnormal disease diagnosis. Meghana, P., Sagar Imambi, S., Sivateja, P., & Sairam, K, (2019) describes a comprehensively analysis of challenges of clustering in the text environment.

III. OBJECTIVES OF THE WORK

- Collecting the dataset of images of different types of weed and preprocessing the images using convolutional layer, flattening layers and pooling.

- Splitting the dataset into train and test sets, training the model with the help of training set and then testing the required model with the trained test set.

- Cross justification using k-fold technique and optimizing the performance of the generated device model.

IV. CONVOLUTION NEURAL NETWORK

As the point of this task is carrying out a weed location framework, it will be reached by making a program ready to distinguish yields and weeds utilizing picture processing methods and deep learning. This paper is not only technical, developing and implementing a program to differentiate crops and weeds with the available technologies. ANN is a Neural Network which is constructed based on the Biological Neural Network. Its main idea is taken from the Cognitive science where many simple Computational units are connected for intelligent behaviours. But due to its disadvantage of not having large computational power CNN is introduced. Image analysis is most common use of CNN and overview of convolution neural network is shown in figure 1. Deep Learning has arisen as a primary instrument for self-insight issues like agreement pictures, the voice from people, robots investigating the world. We plan to execute the idea of the Convolutional Neural Network for the acknowledgment of pictures. Understanding CNN and applying it to the picture acknowledgment framework is the objective of the proposed model. Convolutional Neural Network extracts the feature maps from the 2D images by using filters. The Convolutional neural organization considers the planning of picture pixels with the local space instead of having a completely associated layer of neurons. The Convolutional neural network has been proved to be a very dominant and potential tool in image processing. Indeed, even in the fields of PC vision like penmanship acknowledgment, common article arrangement, and division, CNN has become a vastly improved instrument contrasted with any remaining recently carried out devices.
V. METHODS OF IMPLEMENTATION

5.1 Data Collection

Pictures of weed are taken from online dataset or from crop field utilizing high goal camera for more exactness in. Each image is stored in separate size and in jpg format. Convolutional neural network has hidden layers, known as Convolutional layers which make CNN more effective for image analysis.

CNN layer types mainly include three types:

- Convolutional layer
- Pooling layer
- Fully connected layer

When a computer sees image, it converts the image into an array of pixel values depending on the image resolution and size. Let’s consider an image of type of jpg and size be 480 x 480. Then its converted to 480 x 480 x 3 image where the represents the RBG values. To describe the intensity of the pixel, they are given numbering from 0 to 255. Further the arrays with numbers are given as input to the image classification.

5.2 Convolutional layer

Convolutional Layer is most important part of image classification and shown in figure 2. The main task in this layer is extracting features from the input image. Convolution layer consists of many feature maps. The neuron of same element map is utilized in removing local qualities of different situations in the previous surface. But for single neuron, its extraction is regional feature of the same positions in the former separate feature map. The results in the Conv layers are passed to nonlinear Activation function like sigmoid, tanh, ReLu. It shows how high-level image features are extracted from image using a kernel.

5.3 Pooling layer

![Figure 1. Over view of CNN Method](image)

![Figure 2. Convolutional Layer](image)
A problem with the output of the Conv layer is that they are sensitive to the location of the features in the input. One idea to reduce the sensitivity is that we can decrease its dimensionality i.e., down sampling. Pooling layer is used to decrease the dimensions of the feature map. There are two types of common pooling techniques that can be used to decrease the dimensionality. They are max pooling and the average pooling. In max pooling, example as shown in figure 3 used to calculating the max value of each patch in the feature map. Whereas average pooling, finding the average of each patch in the feature map.

![Figure 3. Example of Max pooling.](image)

**5.4 Flattening layer**

Flattening is converting the data into a 1-dimensional array for inputting it to the next layer. We flatten the output of the convolutional layers to create a single long feature vector. Flattening layer as illustrated in figure 4 produces the flattened output and it is connected to the final classification model, which is called a fully-connected layer.

![Figure 4. Output Generation of Flatten layer](image)

**5.5 Classification**

Flow model for classification is illustrated in figure 5 and generally classification techniques are used to classify the type of weed. Extracted Features are passed as input to the classifiers. In characterization classifiers are prepared, approved and tried utilizing pictures of various types weed.
VI. ALGORITHM

This System will recognize the type of weed using opencv. The following algorithmic steps clearly explain the way to achieve the desired output.

Step 1: Begin
Step 2: Collecting the Weed Dataset
Step 3: Extracting features of Image
Step 4: Train the dataset
Step 5: Classify the type of image
Step 6: Test the dataset
Step 7: Save the model
Step 8: Load the model in opencv
Step 9: Run the opencv
Step 10: output

VII. RESULTS

This model would detect the weed in the field which will be a threat for the crops in the field. The module has been trained in such a way that when the algorithm is embedded with robotics the robot would will move along the field and remove the unwanted weeds in the fields preventing them from damaging the crops. This would cause a revolution in the field of agriculture. The sample output is shown in figure 6. The paper has been developed as an end to end tool with a web page and with the use of flask framework.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Weed detection using CNN</th>
<th>Automatic data generation for accurate weed detection</th>
<th>Accurate weed detection using the summarised training set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>A small number of RGB images.</td>
<td>A small number of RGB images.</td>
<td>A large number of RGB images.</td>
</tr>
<tr>
<td>Classifier used</td>
<td>CNN</td>
<td>SegNet</td>
<td>eNET</td>
</tr>
</tbody>
</table>
Technique used | RGB images with different vegetation indices and representation are given as different input for generalisation. | The procedural generation is used to create a dataset that satisfies two goal realism and variety to generate the large dataset. | Unsupervised data summarization that automatically selects K images from the dataset of N images, which represents the most informative images such that K<<N. 

| Experimental evaluation | Higher accuracy of about 97%. | High accuracy of about 90%. Even greater accuracy when using mix dataset of both real and synthetic images. | Fast and High accuracy of about 95% |

Table 1 shows the comparison of different parameters with different approaches. Here availability of large dataset is the bottleneck of eNET classifier and a presence if a good pixel wise image is must, fail to which the result is less accurate in signet classifier. Presented computational neural network classifier technique provides good accuracy of 97% compared to other two classifiers.

VIII. CONCLUSION

Here we show a model which can perceive and group the picture. Later it tends to be stretched out for object acknowledgment, character acknowledgment, and constant article acknowledgment. Picture acknowledgment is a significant advance to the huge field of computerized reasoning and computer vision. As seen from the results of the experiment, CNN proves to be far better than other classifiers. The results can be made more accurate by increasing the number of convolution layers and hidden neurons. For image classification we need a system that itself can extract features efficiently and classify them. We used Convolutional Neural Network (CNN) for image classification which contains Conv layers to extract features and max pooling to decrease the size of image thus classifies the image accurately.

REFERENCES