Weed Classification using Convolution Neural Networks

Mrs. Shailaja Mantha, Associate Professor Kamuni Chandana, Paku Venkata Sri Sivani, V. Abhigya
Department of Electronics and Computer Engineering
Sreenidhi Institute of Science and Technology
Hyderabad, India

Precis-*Farmers have a significant role in the society. They provide us food for survival and so it is a necessity for all of them on this planet. Their survival depends on the yield produced while most of their hard work is going in vain because of the growth of weeds in the place of crops. Therefore, it is necessary to ensure that the fields are free from weeds. Weed classification focuses on separating weeds from crops with the use of convolution neural network algorithm which predicts the name of the weed and outputs an audio file as per the language of the user using Google Text-to-speech Application Program Interface.*

Keywords: Weed classification, Convolution neural network, gTTs.

I. INTRODUCTION

A weed is an undesired crop that develops along with the genuine crop. It utilizes all the needed minerals, water, area and many of them grow soon. They gain control of the crop area, thereby altering the volume of yield. This heads to the use of rich land served for no purpose. With the rise in productivity of agricultural areas, the food supplies augment in the response of the large population globally. We are suffering numerous troubles such as weeds and plant diseases in the fields. We should identify the weeds and eliminate them. Now we do not get added labour to work in the fields. Due to inadequate laborers, several farmers fail to foster a yield. When the cultivation of the produce is lowered due to various reasons, then there will be a high demand for food commodities. The fundamental requirement of surviving bodies is food and water. The ultimate intention of the plan is to recognize the weed in agrarian land. Weed management and controlling manually using herbicides is a common practice that is not expedient. Weed plantation management can be performed using various methods like livestock, mechanical methods and manually. For the classification of weed convolution neural networks have been used. The neural network behaves similar to the brain where it learns from the training data and predicts the weed type based on the validation data provided. Classification of the weed should be performed before it affects neighbouring plants or crops. If the weed is not identified and removed, then the yielding of the crop will be decreased. For the machine learning process, a deep learning approach is used. The convolutional neural network is an exceptional algorithm used for deep learning. It is used to recognize the object and image segmentation. They get to extract features of the picture without hand-operated help. Convolutional neural networks can have many layers that each discovers to detect distinct characteristics of an image. Filters are implemented to each training image at varying resolutions, and the output of each convolved image is used as the input to the succeeding layer.

II. STRATAGEM

A. DATA ASSEMBLAGE

An attempt is made to develop a classification model that will analyse weed type according to input in image format. The input PNG image used has been imported from Kaggle where a data set is further sorted manually into the test dataset and train dataset. The training dataset consists of the image of a weed of 267 images each. The training dataset is used for training the model whereas the test dataset is used for validation of the model.

In our training data, we have 75% of imageries in training and 25% of the imageries in verification. The images are RGB and png format. Here we are displaying a few images of a train and test dataset. The figure Fig.1 shows the train data as well as the valid data.

B. PRE-PROCESSING DATA

Pre-processing is the step where the raw data is made feasible for analysis from different data sources. For pre-processing, the data has been normalized to binary values i.e., [0,1]. Here, pre-processing of data is done using the framework called Keras by importing Image generator. This involves the data collection, importing datasets, importing the libraries, importing the dataset, setting the datasets into dependent and independent variables.

Fig 1. Before and after pre processing

C. CLASSIFICATION

Convolutional neural network has a distinctive design when compared to customary neural networks. The layers present here are completely allied to whole neurons that are preceding it. Customary neural networks convert input via introducing it into a chain of obscure ones. Ultimately, the outermost layer is the outcome layer that depicts the extrapolations. The layers existing are composed of three dimensions which are altitude, thickness and profundity. Besides, a single neuron in the grid connects to few other neurons in a minor expanse but not all of them.

Model: "sequential_1"

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 148, 148, 32)	896
activation_1 (Activation)	(None, 148, 148, 32)	0
max_pooling2d_1 (MaxPooling2	(None, 74, 74, 32)	0
conv2d_2 (Conv2D)	(None, 72, 72, 32)	9248
activation_2 (Activation)	(None, 72, 72, 32)	0
max_pooling2d_2 (MaxPooling2	(None, 36, 36, 32)	0
conv2d_3 (Conv2D)	(None, 34, 34, 64)	18496
activation_3 (Activation)	(None, 34, 34, 64)	0
max_pooling2d_3 (MaxPooling2	(None, 17, 17, 64)	0
flatten_1 (Flatten)	(None, 18496)	0
dense_1 (Dense)	(None, 64)	1183808
activation_4 (Activation)	(None, 64)	0
dropout_1 (Dropout)	(None, 64)	0
dense_2 (Dense)	(None, 1)	65
activation_5 (Activation)	(None, 1)	0

Total params: 1,212,513
Trainable params: 1,212,513

Fig.2. Summary of trained model

D.ARCHITECTURE

The convolutional neural network mainly consists of 3 Convolutional, 5 activation, 3 max pooling, 1 flatten, 2 dropout,2 dense CNN layers and total parameters 1,212,513. In CNN, convolutional layers are the building blocks. Convolution is the application of a filter to input that results from inactivation. The application of the same filter repetitively to an input gives an outcome in an activations map format called a feature map. It signifies the input locations and strength of a detected feature like an image. The function of the pooling layer is to gradually decrease the longitudinal, latitudinal dimensions of the illustration to lessen the constraints' number and network calculation. A pooling layer performs operations on every map of features individually. RELU is a non-linearity that is applied in neural networks. At the end of CNN, there is a completely allied layer of neurons. Neurons have contacts to entire activations in preceding layer.

III. STEPS IN WEED CLASSIFICATION

1. The very first step in weed classification is the dataset. It is imported from Kaggle and it is separated as a train and test dataset.

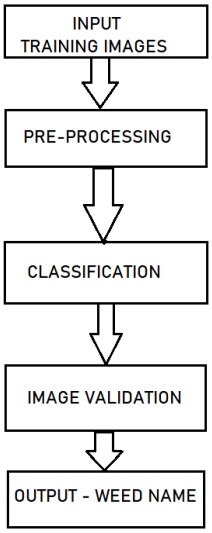

Fig 3. Steps in weed classification

2. The very first step in weed classification is the dataset. It is imported from Kaggle and it is separated as a train and test dataset.

Fig 4. Random images from train dataset

Fig 5. Random images from test dataset

3. The second and third figures represent the train dataset and the validation dataset respectively.

4. The source code can be implemented using any Integrated development environment. Here, we are using Eclipse IDE for execution of the code.

5. After successful installation of Anaconda, the anaconda navigator looks as shown. Through Anaconda various frameworks can be installed, here we can observe the tensor flow environment.

6. This is the tensor flow terminal in which the python project is executed.

7. Summary of model is exhibited in the figure.

8. The user selects the language and based on the user input, the audio output of weed's name is played in respective language. This is done using Google Text-to-speech Application Program Interface.

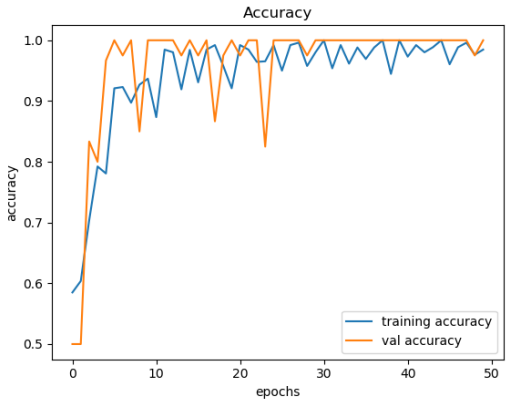

Fig 6. Accuracy plot display

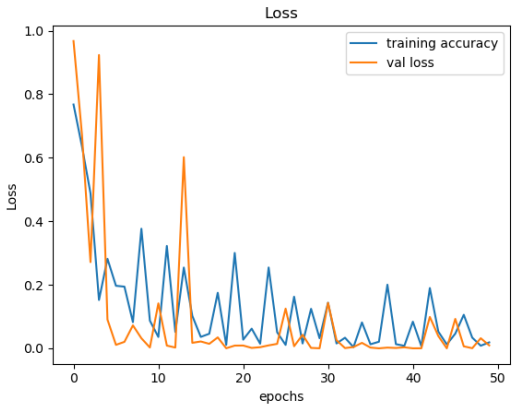

Fig 7. Loss plot display

IV. DISCUSSION

A. ADVANTAGES: This model conveys a set of benefits making fit for application in the rural discipline. Primarily, model can perceive weeds efficiently. The weed model will be supportive to agriculture as it saves expenses, time and labour which benefit the agriculture in an optimum manner.

B. DRAWBACKS: Each success model has its drawbacks. Here, the images taken are considerably less. But, extending the number of inputs may consume a lot of processing time and speed. Increasing the images may provide more accuracy and perfect predictions.

V. SYNOPSIS AND CONCLUSION

The classification model generated gives a bunch of advantages to the end user. It sustains a huge market potential. However, there is a demand for further improvements in enterprises. The principal element which may influence the performance of model is eminence of resources.

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AUTHORS' PROFILE

Mrs. Shailaja Mantha is working as an Associate Professor in the department of Electronics and Computer Engineering at Sreenidhi Institute of Science and Technology, Hyderabad, India. Mrs. Shailaja received her Bachelor of Engineering degree in Electronics & Communication Engineering from JNTU College of Engineering, Hyderabad in 2003. She received her Master of Technology degree in Digital Systems and Computer Electronics from Jawaharlal Nehru Technological University, Hyderabad in the year 2009. Currently she is pursuing Ph.D from Jawaharlal Nehru Technological University, Hyderabad. Her research work is in the area of Fault Tolerant Testing, Mixed Signal Architectures etc. She has published papers in various National & International Journals and Conferences

Kamuni Chandana is a fourth year student from the Sreenidhi Institute of Science and Technology and she will be graduating with a bachelor degree of Electronics and Computer Engineering in 2020. Her research interests include AI applications, intelligent agents, image processing and machine learning.

Paku Venkata Sri Sivani is a fourth year student from the Sreenidhi Institute of Science and Technology and she will be graduating with a bachelor degree of Electronics and Computer Engineering in 2020. Her research interests include Data Science, image processing and machine learning.

V. Abhigya is a fourth year student from the Sreenidhi Institute of Science and Technology and she will be graduating with a bachelor degree of Electronics and Computer Engineering in 2020. Her research interests Data Science,Big data, image processing and machine learning.