Machine Learning Engineer Nanodegree

Plant Seedlings Classification Capstone Project

Gajula Karthik Kumar
Jan 7th, 2019

Proposal :

Domain Background:

This project is intended to determine the species of a seedling from an image. The project basically helpful for the agricultural domain. The publicly available database found in S 矣 derkvist (2001) but their usability for developing machine vision systems was yet to be determined. The identification of the species enables the effective mean better crop yields and better stewardship of the environment. Below link describe the research about the https://arxiv.org/abs/1711.05458 , the research is most relevant for the our project. The Plant seedlings classification is related to agriculture, which is one of the backbone of life and applying machine learning for the smart agricultural practice helps farmers which is one of the motivation for this project.

Problem Statement:

This project is intended to classify the plant seedlings based on the image data for which we have trained model on the set of image data available from Kaggle competitions. Since our training data are images of the different classes of the plants, we have decided to use the convolutional neural networks to get the hidden pattern in the data and the accuracy of its predictions on the validation sets and testing set recorded. we have used categorical cross entropy as to predict the loss.

Datasets and Inputs:

A database of images of approximately 960 unique plants belonging to 12 species at several growth stages is made publicly available. It comprises annotated RGB images with a physical resolution of roughly 10 pixels per mm. We have 12 classes and each classes have following number of image.
The paper https://arxiv.org/abs/1711.05458 describe the way these data collected from 12 species which mostly included photography with commercial camera.The dataset are 4750 images which is perfect for the training in CNN. During checking of the input data and the images in each classes we have found following number of images which seems enough to train the model.

Common wheat -> 221, Black-grass -> 263, Charlock -> 390
Scentless Mayweed -> 516, Maize -> 221, Cleavers -> 287
Loose Silky-bent -> 654, Small-flowered Cranesbill -> 496
Shepherds Purse -> 231, Sugar beet -> 385, Common Chickweed -> 611
Fat Hen -> 475.

The data only have images for the training and we have to split the data into training and testing sets for that purpose we have planned to use the train_test_split from Sklearn library.

Solution Statement:

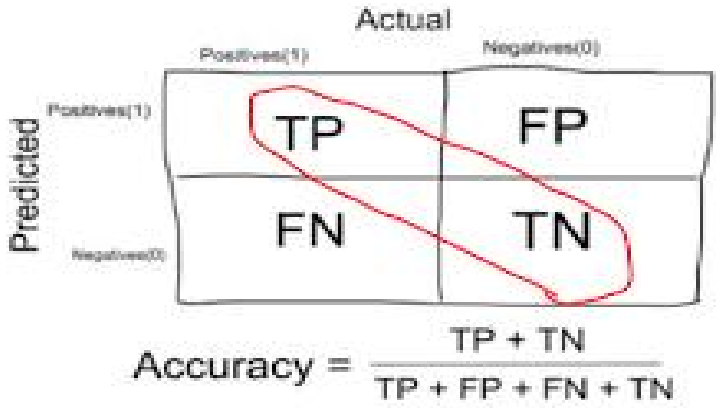
Since this problem is about image classification we choose to experiment with convolutional neural networks which is one of the efficient method for image classification tasks. The convolution layers find the different shapes of the objects in the image and compare it with respective label to train the network, this process continues with forward and back-propagation where the weights updated in each epoch to get the final weights.

Benchmark Model:

We have considered prestigious Kaggle competitions https://www.kaggle.com/mnishant2/custom-vanilla-cnn-0-91-f1 kernel as our benchmark model which implements the vanilla convolution neural network model on the same datasets. The benchmark model has utilized the image augmentation technique in the preprocessing stage of the data along with normalization technique and the model has also well described the 4 convolutional layers along with pooling layers. The benchmark model has produced acceptable accuracy of 77% which is good metric to compare to our model.

Evaluation Metrics :

The evaluation metrics we are using here is Accuracy score which is enough to quantify the performance of the both benchmark and solution model. The Accuracy is the most intuitive performance measure and it is simply a ratio of correctly predicted observation to the total observations. The formula is as follows.



Higher value of the accuracy score indicates the higher accuracy in the prediction. For image classification task Accuracy is very good metrics.

Project Design:

We are implementing the Convolutional neural networks model for this project. We take the input image and resize the image for the particular pixels for example 224*224 (rows and columns), then we convert the image to tensors and normalize. The normalized data will be passed on to the convolution layers where we have considered Relu as activation function and we have considered Max-pooling layers to reduce the number of features. For the final layers we have considered Dense layers with final activation function as Soft-max to get the probabilities of the 12 classes. We have planned to use the accuracy as our metrics, rmsprop as optimizer.We train the model with different number of epochs and check the validation set accuracy and finally we check our test set to get desired output.

Data Source:
https://www.kaggle.com/c/7880/download-all

API :
kaggle competitions download -c plant-seedlings-classification

Competition from which Project considered:
https://www.kaggle.com/c/plant-seedlings-classification