Name: Kancharla.Sairam

Email address: kancharlasairam81@gmail.com

Contact number: +91-7989881335

Anydesk address: **+91-9515847069**

Years of Work Experience: **9 months**

Date: **01-Feb-2022**

Self Case Study -2: *** Crops Image classification ***

"After you have completed the document, please submit it in the classroom in the pdf format."

Please check this video before you get started: https://www.youtube.com/watch?time_continue=1&v=LBGU1_JO3kg

Overview

*** Write an overview of the case study that you are working on. ***(MINIMUM 200 words)*** ***

Abstract:

Agriculture is the very important sector of each country.Agricuture is considered as a backbone of economy and source of employement in the developing countries like India. The complete factor of the crop yield depends on timely monitoring and suggestion. Artificial intelligence gives a way to monitor the crop and to predict the yield in an automatized outcome.

Artificial Intelligence is the current technology which is benefiting farmers to minimize the losses in the farming by providing rich recommendations and insights about the crops. Application of AI in agriculture allows more efficient and precise farming with less human manpower with high quality production.

Problem Formulation:

Here I am going to work on Crops image classification using the agriculture crop images dataset using deep learning algorithms and explain how I improved my models and model efficiency.

Here I am going to solve the multiclass classification problem . I have an 5 sets of crop images like rice,maize,wheat,sugarcane,jute .

Objective/Task : To classify 5 types of agriculture crop images (wheat, rice, sugarcane, maize and jute) with better accuracy.

Image classification is the process of assigning classes to images. This is done by finding similar features in images belonging to different classes and using them to identify and label images.

Dataset Overview:

Data can be downloaded here

1. Dataset (Crop Images) contain 40+ images of each Agriculture crop(Maize, Wheat, jute, rice and sugarcane) .

2. Dataset (kag2) contains 159+ augmented images of Crop Images of each class. Augmentation contain Horizontal flip, roatation, horizontal shift, vertical shift.

3. For every class images vary from arial view to ground view and of their different life cycle.

4. Crop_details.csv include all the images path and crop labels.

Evaluation_metrics :

1. Confusion matrix:

A Confusion matrix is an N x N matrix used for evaluating the performance of a classification model, where N is the number of target classes. The matrix compares the actual target values with those predicted by the machine learning model. This gives us a holistic view of how well our classification model is performing and what kinds of errors it is making.

.

- The **rows** represent the **predicted values** of the target variable

- The **columns** represent the **actual values** of the target variable

			Predicted values		
			Positive	**Negative**	Totals
	Actual Values	**Positive**	TP	FN	**P = (TP + FN) = Actual Total Positives**
		Negative	FP	TN	**N = (FP + TN) = Actual Total Negatives**
		Totals	Predicted Total Positives	Predicted Total Negatives	

2. Accuracy:

Accuracy tells the how many of the points are correctly classified among the total no of points .

It is the measure of how accurate your model's prediction is compared to the true data.

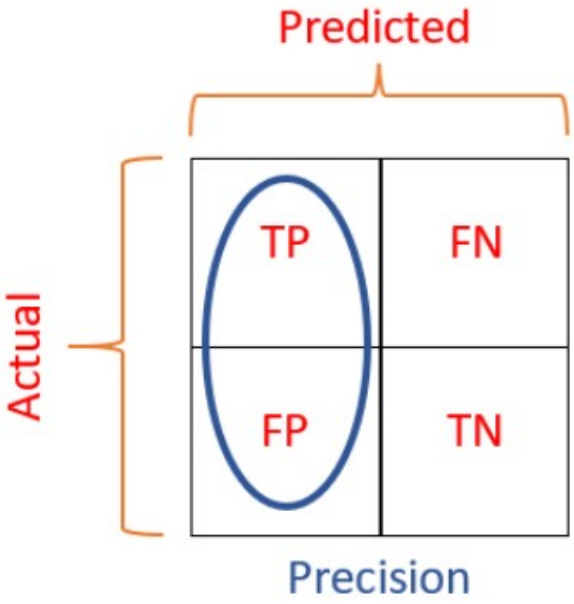
$$\text{Accuracy} = \frac{\text{Number of correct predictions}}{\text{Total number of predictions}}$$

3 . Precision:

Precision tells us how many of the correctly predicted cases actually turned out to be positive.

For our crop classification, one example is “what proportion of predicted rice crop are actually rice ?”

The precision is calculated by dividing the true positives by the sum of true positives and false positives (*triple-p rule*):

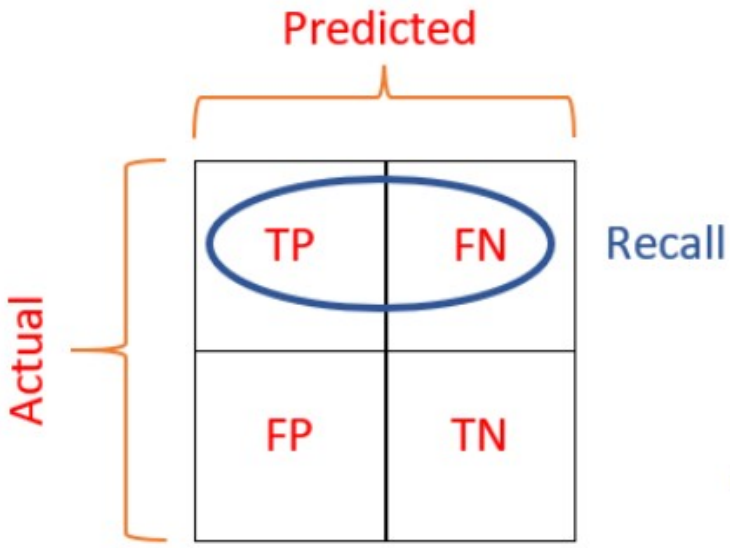


$$\text{precision} = \frac{TP}{TP + FP}$$

4 . Recall :

Recall tells us how many of the actual positive cases we were able to predict correctly with our model.

Recall answers the question of “what proportion of **actual positives** are correctly classified?” It is calculated by dividing the number of true positives by the sum of true positives and false negatives.



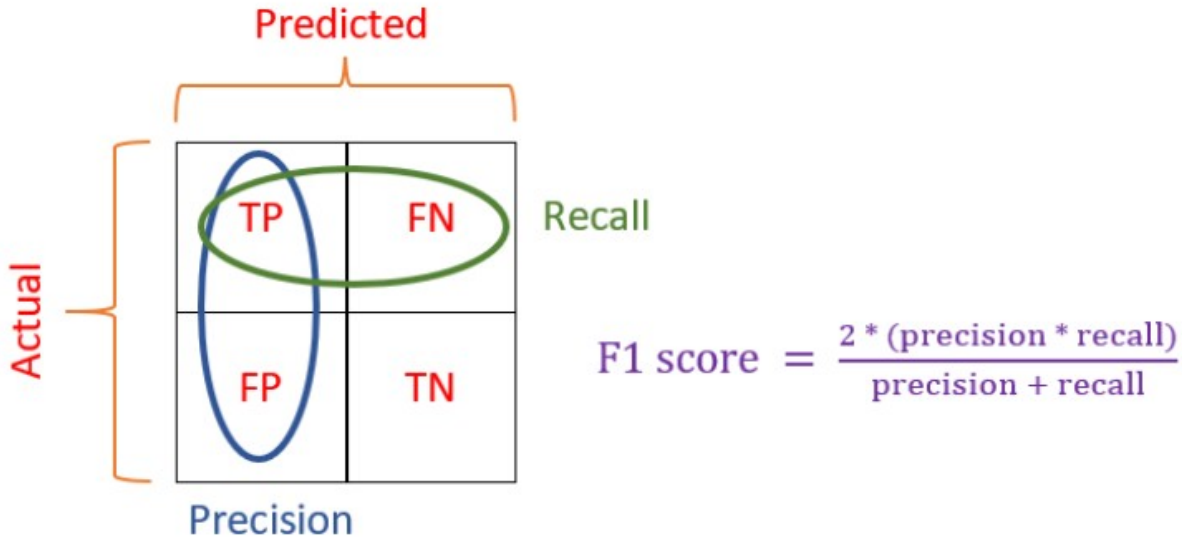
$$\text{recall} = \frac{TP}{TP + FN}$$

5. F1_score :

In practice, when we try to increase the precision of our model, the recall goes down, and vice-versa. The F1-score captures both the trends in a single value:

$$F1 - score = \frac{2}{\frac{1}{Recall} + \frac{1}{Precision}}$$

F1 score is calculated by taking the harmonic mean of precision and recall and ranges from 0 to 1.



- among all the metrics I am using **accuracy** as a metric . My dataset is balanced and multi class classification problem and we need to give the equal importance to all the classes.
- F1_score is used when we need to minimizes the false positives and False Negatives in imbalanced classification dataset.
- Precision is used when we need to decreasing the false positive of a single class.
- Recall is used when we need to decreasing the false negatives of a single class .
- **Categorical Cross-Entropy**: Cross-entropy as a loss function for a multi-class classification task.

Research-Papers/Solutions/Architectures/Kernels

*** Mention the urls of existing research-papers/solutions/kernels on your problem statement and in your own words write a detailed summary for each one of them. If needed you can include images or explain with your own diagrams. ***

1. https://towardsdatascience.com/comprehensive-guide-on-multiclass-classification-metrics-af94cfb83fbd

   https://www.analyticsvidhya.com/blog/2020/04/confusion-matrix-machine-learning/

   These blogs represents the metrics suitable to my multi class classification problem and how they interpreted and how they measured .

2. https://www.analyticsvidhya.com/blog/2020/02/learn-image-classification-cnn-convolutional-neural-networks-3-datasets/

   This blog useful to know how the CNN works on the image classification for different datasets and how those are useful for other refernces.

3. https://builtin.com/robotics/farming-agricultural-robots

   https://www.researchgate.net/publication/349444668_Review_on_Crop_Prediction_Using_Deep_Learning_Techniques

   This blog represents how the AI plays crucial role to solve lot of agriculture problems and to decrease the man power and increase the efficiency.

4. https://www.kaggle.com/aman2000jaiswal/vggmodel-for-agriculture-crop-image-classification

   This kaggle kernel gives the basic assumption and this kernel represents the image classification using the VGG model and performed some basic analysis also. It helps to form my basic assumption.

5. https://towardsdatascience.com/fast-feature-engineering-in-python-image-data-5d3a8a7bf616

This blog represents the different feature engineering techniques of the images data like image augmentation , image scaling ....etc.

6. https://www.analyticsvidhya.com/blog/2020/08/top-4-pre-trained-models-for-image-classification-with-python-code/

   https://www.simplilearn.com/tutorials/deep-learning-tutorial/guide-to-building-powerful-keras-image-classification-models

   These blogs represents the how to prepare the dataset and what are the different models are used for the image classification and basic code snippets for the reference.

First Cut Approach

*** Explain in steps about how you want to approach this problem and the initial experiments that you want to do. ***(MINIMUM 200 words)*** ***

1. Load the data folder which contain the images.
2. Preparing the dataset .
3. I need to load the images .I have kag2,crop_images folders within each of these folders containing images from each class.
4. I will read individual Images from each folder & push them into my image array after converting those images into RGB and perform some basic augmentation techniques.
5. Convert the label column into multiple columns here I need to convert single column into 5 columns based on our class label set.
6. Split the given dataset into the train and test set .
7. By using the image classification models trained the models using the train data. Models like VGG-16 , ResNet-50 , Inception net , Efficient Net ....etc.
8. I need to be experimented with different activation functions and learning rate and optimizers with multiple epochs.
9. Evaluate my trained models based on the accuracy and categorical cross entropy.
10. Save the best model using callbacks.

11. By using the best model predict the classes of the testing images set.

Notes when you build your final notebook:

1. You should not train any model either it can be a ML model or DL model or Countvectorizer or even simple StandardScalar
2. You should not read train data files
3. The function1 takes only one argument “X” (a single data points i.e 1*d feature) and the inside the function you will preprocess data point similar to the process you did while you featurize your train data
    a. Ex: consider you are doing taxi demand prediction case study (problem definition: given a time and location predict the number of pickups that can happen)
    b. so in your final notebook, you need to pass only those two values
    c. def final(X):

preprocess data i.e data cleaning, filling missing values etc

compute features based on this X

use pre trained model

return predicted outputs

final([time, location])

    d. in the instructions, we have mentioned two functions one with original values and one without it
    e. final([time, location]) # in this function you need to return the predictions, no need to compute the metric
    f. final(set of [time, location] values, corresponding Y values) # when you pass the Y values, we can compute the error metric(Y, y_predict)
4. After you have preprocessed the data point you will featurize it, with the help of trained vectorizers or methods you have followed for your train data
5. Assume this function is like you are productionizing the best model you have built, you need to measure the time for predicting and report the time. Make sure you keep the time as low as possible
6. Check this live session: https://www.appliedaicourse.com/lecture/11/applied-machine-learning-online-course/4148/hands-on-live-session-deploy-an-ml-model-using-apis-on-aws/5/module-5-feature-engineering-productionization-and-deployment-of-ml-models