ZERO DEFORESTATION MISSION

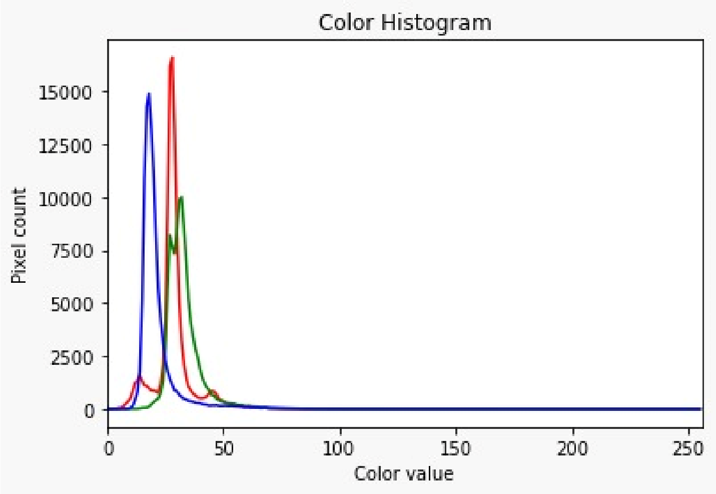
Sai Thejeshwar, Abhay Joshi

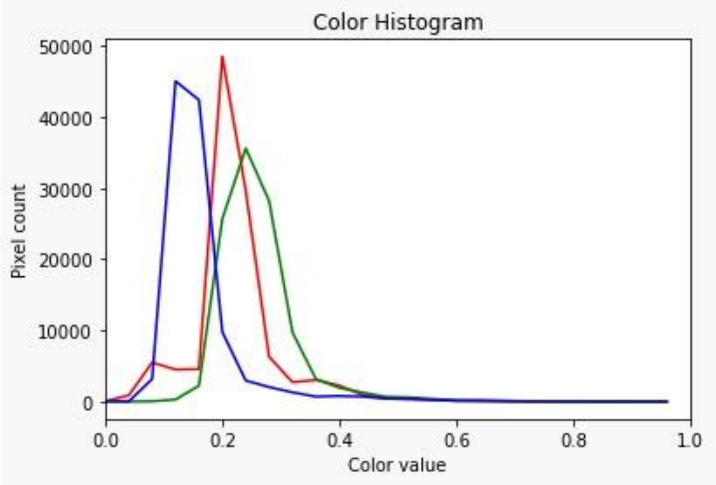
EXECUTIVE PROJECT SUMMARY

The hackathon presented an opportunity to work with a real-time captured satellite imagery data to detect signs of early deforestation in protected areas.

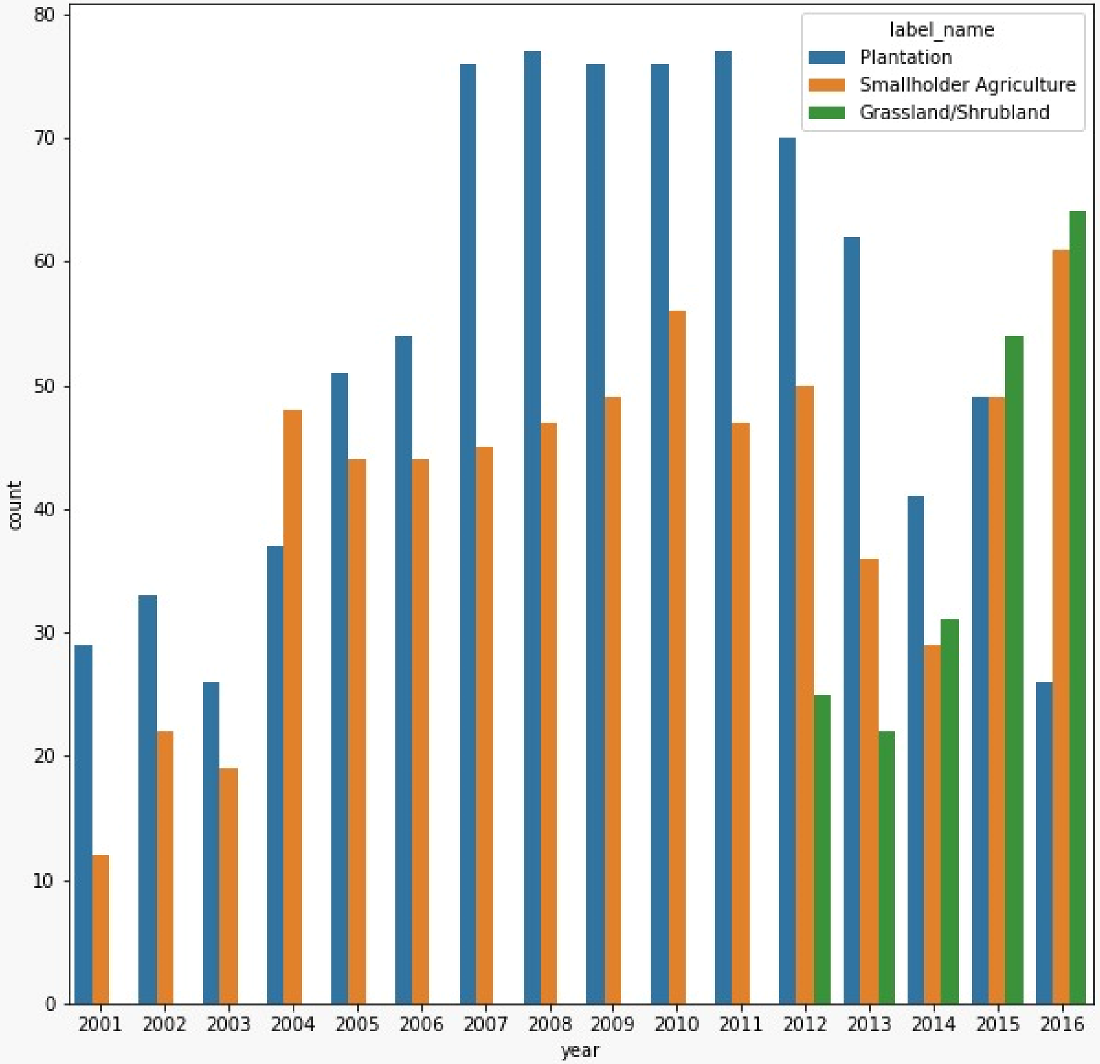
The initial architecture was based on utilizing a home-brewn CNN. However, as the obtained F1-score was quite low (0.32), we decided to use explore the possibility of using pre-trained models such as ResNet and DenseNet.

The pre-trained models (SVM, resnet34, resnet50, densenet121, vgg16), augmented by ensemble learning led to a satisfactory **F1-score of 0.95.**

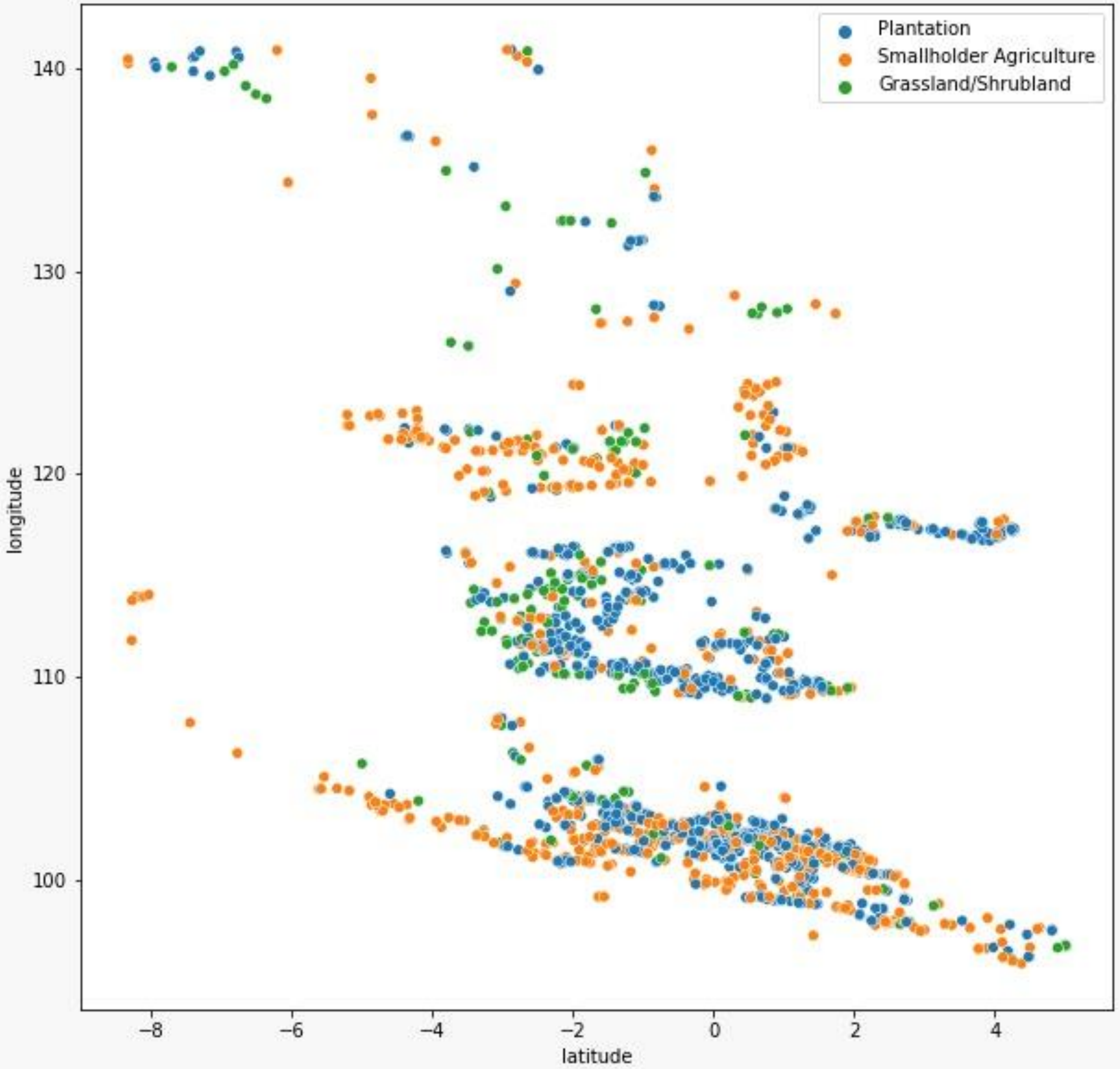




1. DATASET VISUALIZATION



distribution over a period of time

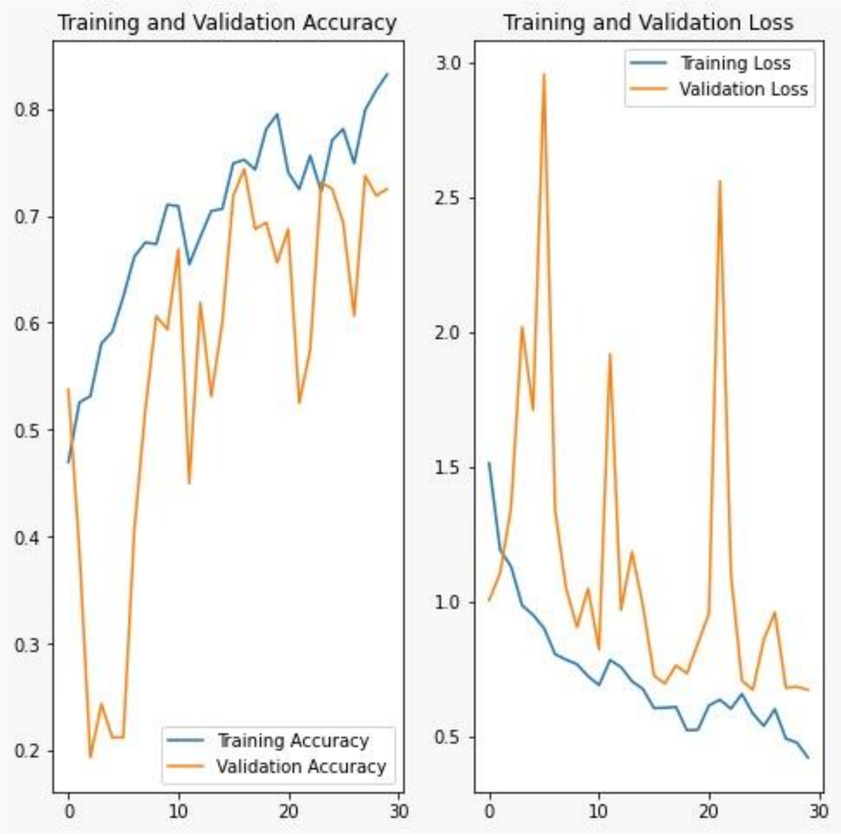


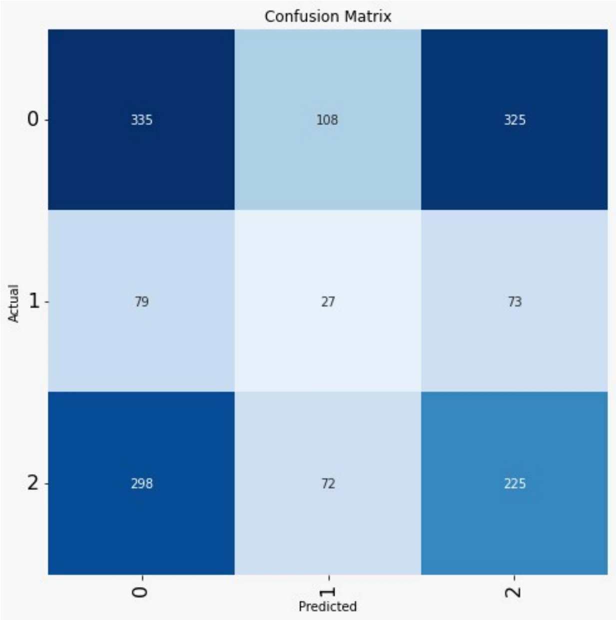
distribution based on lat. & longitude

2. CONSTRUCTING A CNN WITH 17 LAYERS

```
Model: "sequential_12"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_32 (Conv2D)          (None, 298, 298, 32)      896

 batch_normalization_40 (Bat  (None, 298, 298, 32)     128
 chNormalization)

 max_pooling2d_30 (MaxPoolin  (None, 149, 149, 32)     0
 g2D)

 dropout_40 (Dropout)        (None, 149, 149, 32)      0

 conv2d_33 (Conv2D)          (None, 147, 147, 64)      18496

 batch_normalization_41 (Bat  (None, 147, 147, 64)     256
 chNormalization)

 max_pooling2d_31 (MaxPoolin  (None, 73, 73, 64)       0
 g2D)

 dropout_41 (Dropout)        (None, 73, 73, 64)        0

 conv2d_34 (Conv2D)          (None, 71, 71, 128)       73856

 batch_normalization_42 (Bat  (None, 71, 71, 128)      512
 chNormalization)

 max_pooling2d_32 (MaxPoolin  (None, 35, 35, 128)      0
 g2D)

 dropout_42 (Dropout)        (None, 35, 35, 128)       0

 flatten_10 (Flatten)        (None, 156800)            0

 dense_20 (Dense)            (None, 512)               80282112

 batch_normalization_43 (Bat  (None, 512)              2048
 chNormalization)

 dropout_43 (Dropout)        (None, 512)               0

 dense_21 (Dense)            (None, 3)                 1539

=================================================================
Total params: 80,379,843
Trainable params: 80,378,371
Non-trainable params: 1,472
```

The obtained training accuracy was 83.22%, while the validation accuracy was 72.50% - albeit with a low F1-score





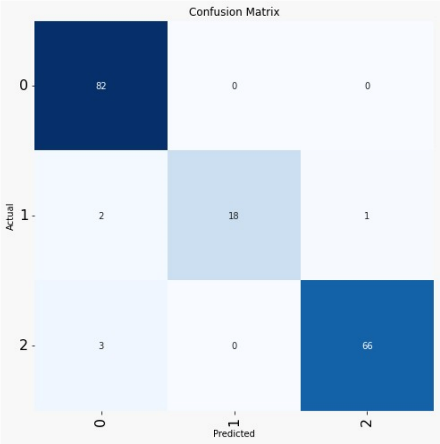

```
Classification Report:
----------------------
              precision    recall  f1-score   support

           0       0.47      0.44      0.45       768
           1       0.13      0.15      0.14       179
           2       0.36      0.38      0.37       595

    accuracy                           0.38      1542
   macro avg       0.32      0.32      0.32      1542
weighted avg       0.39      0.38      0.38      1542
```

3. CONSTRUCTING AN ENSEMBLE MODEL

The obtained training accuracy and validation accuracy was around 97% - with a satisfactory F1-score of 0.95

ensemble model layers

```
prediccionesSVC=clasificadores.predict(Xval)
#VGG16
learnerV16=load_learner("model/vgg16_bn.pkl", cpu=False)
prediccionesV16=[]
#Resnet34
learnerR34=load_learner("model/resnet34.pkl", cpu=False)
prediccionesR34=[]
#Resnet50
learnerR50=load_learner("model/resnet50.pkl", cpu=False)
prediccionesR50=[]
#Densenet121
learnerD121=load_learner("model/densenet121.pkl", cpu=False)
prediccionesD121=[]
```




```
Classification Report:
----------------------
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        82
           1       1.00      0.86      0.92        21
           2       0.99      0.96      0.97        69

    accuracy                           0.97       172
   macro avg       0.98      0.94      0.95       172
weighted avg       0.97      0.97      0.96       172
```

"

The most profound technologies are those that disappear.
They weave themselves into the fabric of everyday life until they are indistinguishable from it.

- Mark Weiser

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