Classification of Natural Scenes for Unmanned Aerial Vehicles (UAVs)

By Team - **4 Folds**

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Outline

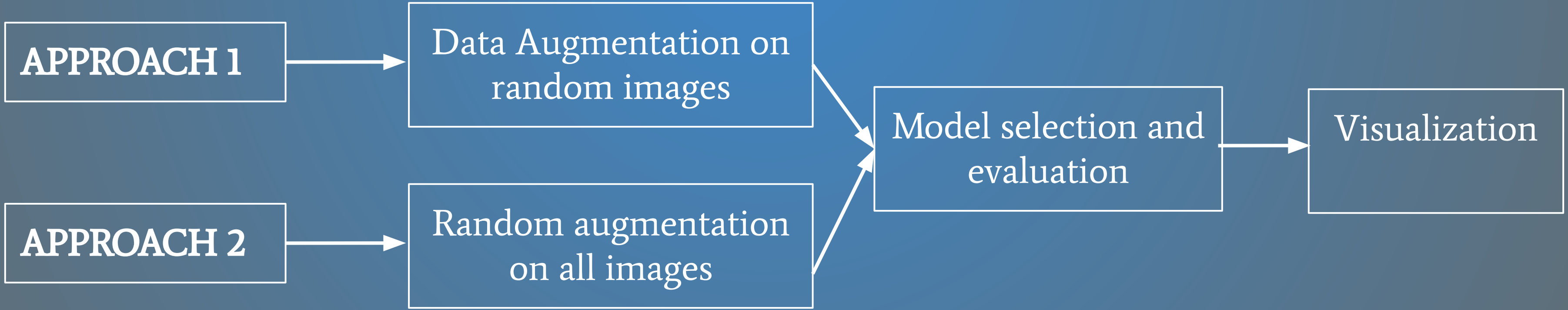
- Introduction
- Methodology
- Results
- Conclusion
- Future Scope

Introduction

Problem Statement -

To predict the natural scenes around the flying object to tune the unmanned aerial systems.

Approach towards the problem statement -



Introduction

Model Architectures -

MODEL_1

6 Conv2D layers

MaxPooling Layers

Dropout Layers

Total Parameters
8,808,614 = 8.8M

MODEL_2

8 Conv2D layers

BatchNormalization

MaxPooling Layers

Dropout Layers

Total Parameters
1,439,974 = 1.4M

MODEL_3

Pre-trained VGG Model

Total Parameters
15,240,774 = 15M

Methodology

Dataset Description -

This original data was released by Intel Corp and contains around 14k training images, 3k images for test and some images for prediction of size 150x150 distributed under 6 categories of natural scenes.

Data Preparation - Augmentations (Rotation, Brightness, Shear, Night Vision and Zoom)

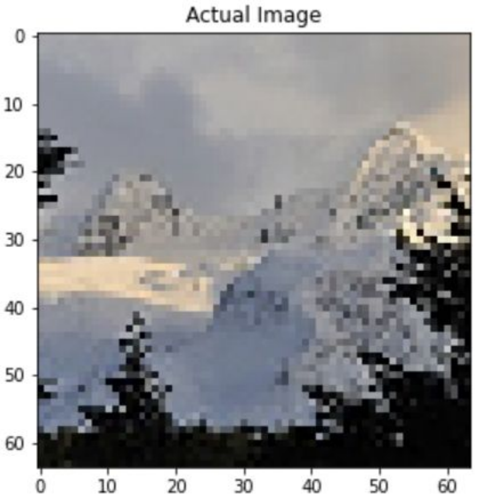
1	2
Resized images to 64 X 64 and loaded it in array	Random augmentations on all images and stored it in directory
5 Augmentations on 1200 images (200 of each class)	Used flow_from_directory to load 150X150 images
Merged training and augmented images. Total of **14k + 6K** images	Total Images for training = **14k+14k**

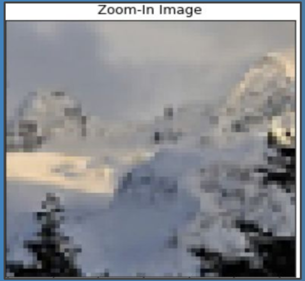
Original Class Distribution

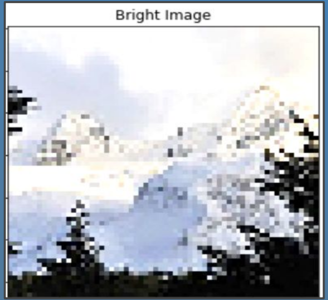
Methodology

Modules Used - TensorFlow | tf.keras.preprocessing

Data Augmentation - Approach 1 (Data Augmentation on random images)



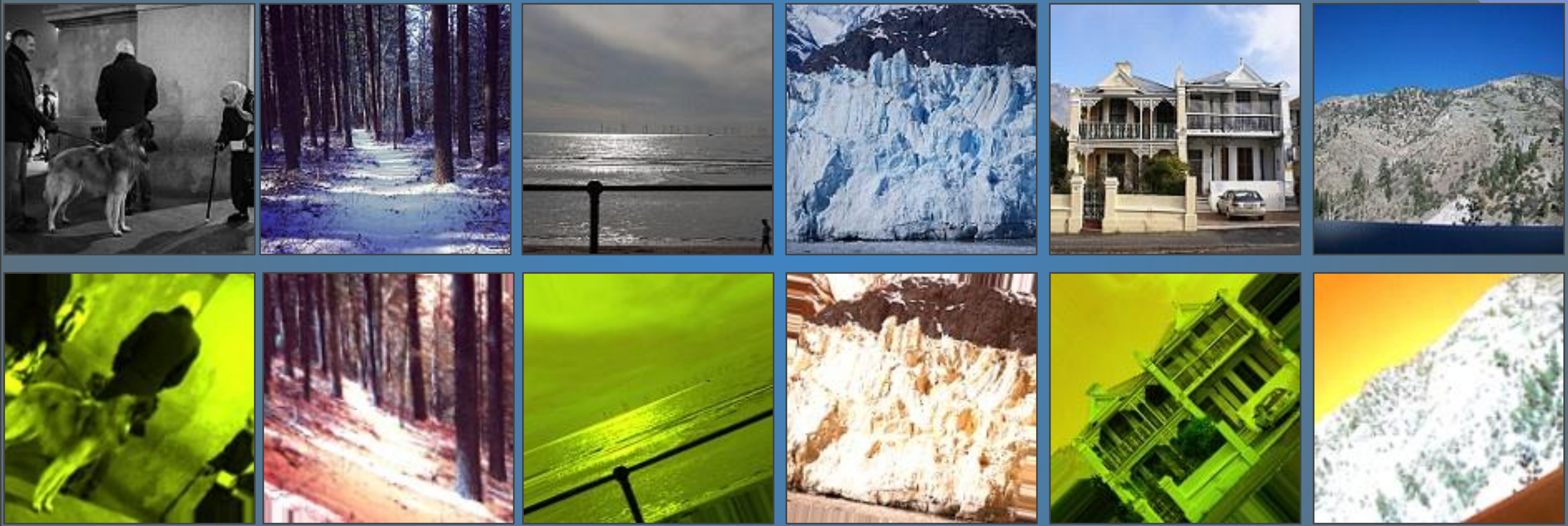




Methodology

Data Augmentation - Approach 2

(Random Augmentation on each image)



Street | Forest | Sea | Glacier | Building | Mountain

Results

Comparison of models using accuracy and losses:

	Train Acc.	Test Acc.	Train Loss	Test Loss
Model_1	0.85	0.82	0.40	0.53
Model_2	0.77	0.77	0.59	0.59
Model_3 (VGG)	0.77	0.79	0.59	0.57
Model_1 (On approach 2 data)	0.96	0.74	0.11	1.33

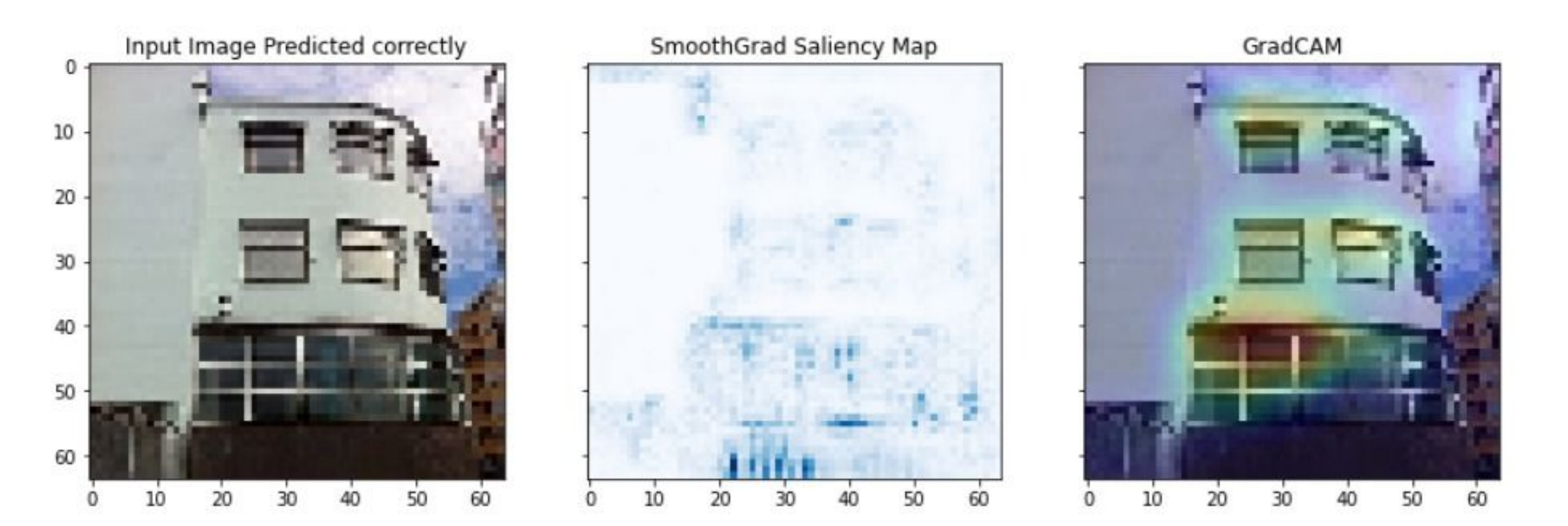
Classification Report of Best Model - Model_1

CLASSIFICATION REPORT OF MODEL 1

	precision	recall	f1-score	support
0	0.82	0.78	0.80	437
1	0.93	0.96	0.94	474
2	0.77	0.78	0.77	553
3	0.78	0.76	0.77	525
4	0.77	0.86	0.81	510
5	0.88	0.81	0.84	501
accuracy			0.82	3000
macro avg	0.83	0.82	0.82	3000
weighted avg	0.82	0.82	0.82	3000

Results

Best Model (Model_1) Visualizations



Conclusion

We have focused to achieve minimum loss and maximum accuracy as well as avoid overfitting by using Dropout layers and using BatchNormalization for regularisation. We tried 2 approaches, and found that first approach Model_1 is better and giving a good accuracy.

Future Work

Object detection and action automation is the next task in this project with different dataset of objects in the natural/compact scenes and we observe their is slight misclassification between (mountains and glaciers), (street and buildings). Even though they fall in similar geographical locations but classification can be improved.