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Homework-4: Classification of the remote sensing data set

Data set: the NWPU aerial data set contains approximately 45 categories of 700 images for each category in 256x256 RGB format. The data set can be downloaded from:

https://umkc.box.com/s/fxvzh5qq2tiob6eklfxfwn89kg3e1io1

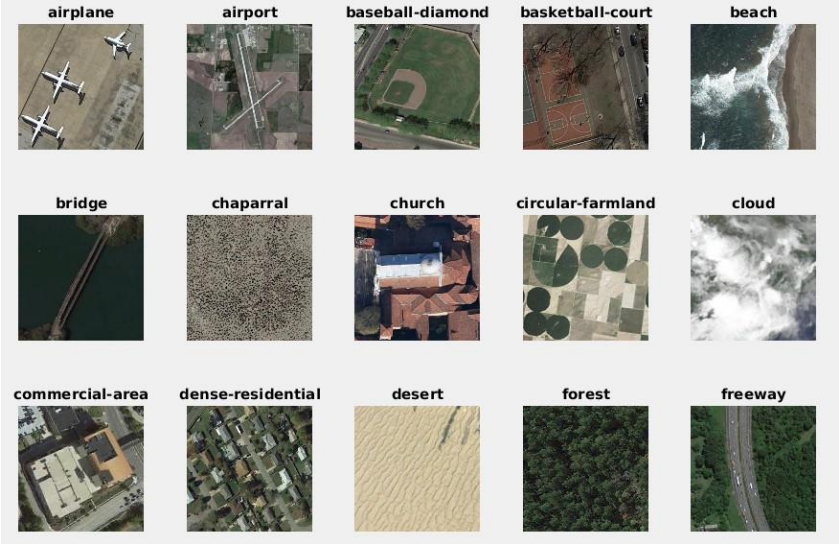
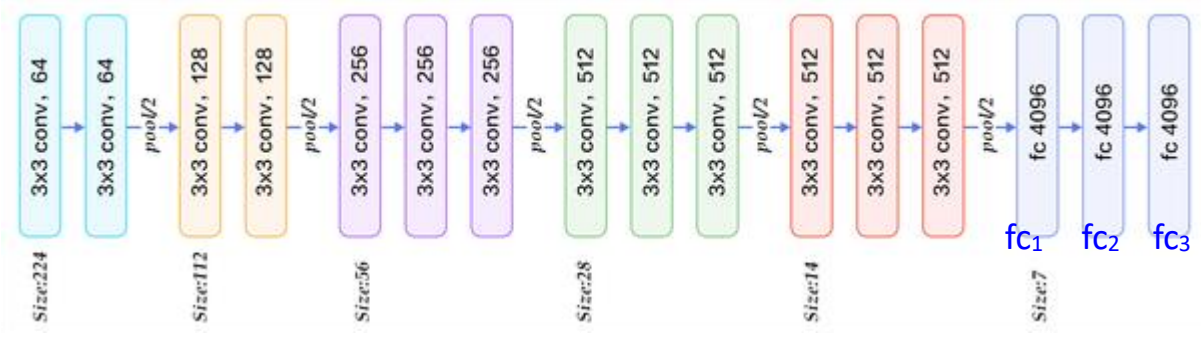


Figure 1. Examples of the images and labels

More details of the dataset can be found at:

http://www.escience.cn/people/JunweiHan/NWPU-RESISC45.html

For the HW-4 and Project, we only deal with the first 15 categories shown in Fig. 1 here. The data set should be partitioned into training (500 images), validation (100 images), and test (100 images) for each category.



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(1) Use pretrained VGG16 network FC features, find its low dimension embedding of fc1, fc2, and fc3 via PCA+LDA, and compute baseline accuracy with 1-NN classifier, plot the 100x100 affinity map also : (50pts)

See Q1 folder in GitHub repo for associated files.

HW4 Q1 – Get Features.ipynb: a Colab notebook. FC1, FC2, and FC3 embeddings are derived from the corresponding layers of the VGG16 model and saved to a file. (Files not included, as they are too large).

HW4 Q1 – NN Classifier.ipynb: a Colab notebook. Here, the embeddings are transformed into a low-dimensional embedding using PCA and LDA, and then used to train a K-NN Classifier. The accuracy is calculated for each embedding, and the 100 x 100 affinity map of the embeddings are plotted.

Q1 AffinityMaps: a folder of images. Contains saved affinity maps for FC1, FC2, and FC3 embeddings.

(2) Use (PCA +) Laplacian embedding and 1 vs the rest SVM and compute the top-1 accuracy for fc1, fc2 and fc3, find out which combination gives the best results. (50pts)

See Q2 folder in GitHub repo for associated files.

HW4 Q2 – SVM.ipynb: a Colab notebook. The FC1, FC2, and FC3 embeddings are transformed to a lower embedding using PCA and Laplacian (via SpectralEmbedding). They are then fit upon a OneVsRestClassifier that utilizes an SVM. The top-1 accuracy is calculated for all three models.

```
FC1_model, FC1_features, FC1_labels = getLaplacianAndSVM('/content/drive/MyDrive/ComputerVision/Q1Features/FC1_features.pkl',
0.50)
pickle.dump(FC1_model, open('/content/drive/MyDrive/ComputerVision/FC1_model.sav', 'wb'))

FC1_accuracy = getTop1Accuracy(FC1_features, FC1_labels, FC1_model)
print(FC1_accuracy)
```

```
0.9276190476190476
```

```
FC2_model, FC2_features, FC2_labels = getLaplacianAndSVM('/content/drive/MyDrive/ComputerVision/Q1Features/FC2_features.pkl',
0.50)
pickle.dump(FC2_model, open('/content/drive/MyDrive/ComputerVision/FC2_model.sav', 'wb'))

FC2_accuracy = getTop1Accuracy(FC2_features, FC2_labels, FC2_model)
print(FC2_accuracy)
```

```
0.8980952380952381
```

```
FC3_model, FC3_features, FC3_labels = getLaplacianAndSVM('/content/drive/MyDrive/ComputerVision/Q1Features/FC3_features.pkl',
0.50)
pickle.dump(FC3_model, open('/content/drive/MyDrive/ComputerVision/FC3_model.sav', 'wb'))

FC3_accuracy = getTop1Accuracy(FC3_features, FC3_labels, FC3_model)
print(FC3_accuracy)
```

```
0.7609523809523809
```

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