16720: Homework 1

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Q1.0

There are 33 filters in 3 key groupings. These groupings are Gaussian, derivative of Gaussian and Laplacian of Gaussian (second derivative of Gaussian).

There are 9 Gauss filters. These are all the same shape but are at varying sizes: 1.4142, 2.8284, 5.6569, 2, 4, 8 and 11.3137. There do appear to be some repeats which may represent various variances.

There are 12 Laplacian of Gaussian and 12 Derivative of Gaussian filters at the same scales as the normal Gaussian filters. There do appear to be some repeats which may represent various variances.

Q2.5

The confusion matrix:

```
 9     0     0     0     3     2     0     6
 0    12     0     0     1     0     5     2
 0     1    18     0     0     0     1     0
 2     1     1    13     1     2     0     0
 1     3     0     1    14     0     1     0
 0     0     0     7     1    10     1     1
 0     3     2     0     1     0    14     0
 1     2     0     0     0     0     2    15
```

The 8 classes are in the order indexed above: airport, auditorium, bamboo_forest, campus, desert, football_field, kitchen, sky

This represents 65.63% accuracy with $K = 100$ and $\alpha = 50$.

Q2.6

For the extra credit I replaced the distance measure for classification with a neural network. My basic assumption was that a neural network would better handle a non-linear relationship between feature space and class. I was able to get better performance (68.75%) with confusion matrix below. I used the same parameters as above for knn and

α with 1 hidden layer of 100 neurons. 100 neurons were picked as this had the highest correct classification rate for my testing data (77%) over 10 (67%), 50 (73%), 200 (78%) and 500 (57%) neurons.

The main file that I added was `buildClassificationModel.m` which trains an ANN and saves it to `model.mat`. The `evaluateRecognitionSystem.m` script then uses this model.

```
 9     0     0     3     4     0     0     4
 0    16     0     0     0     0     3     1
 0     2    15     2     0     0     1     0
 1     0     1    17     1     0     0     0
 0     1     0     0    16     0     2     1
 0     0     3    10     0     6     0     1
 0     2     1     0     2     0    15     0
 0     2     0     1     0     0     1    16
```