test

May 16, 2018

1 Define Dependencies

In [1]:
```
# Import the necessary libraries
from sklearn.decomposition import PCA
import os
import scipy.io as sio
import numpy as np
from keras.models import load_model
from keras.utils import np_utils
from sklearn.metrics import classification_report, confusion_matrix
import itertools
import spectral
```

```
Using TensorFlow backend.
```

In [2]:
```
# Global Variables
windowSize = 5
numPCAcomponents = 30
testRatio = 0.25
```

2 Define the neccesary functions for later use

In [3]:
```
def loadIndianPinesData():
    data_path = os.path.join(os.getcwd(),'data')
    data = sio.loadmat(os.path.join(data_path, 'Indian_pines.mat'))['indian_pines']
    labels = sio.loadmat(os.path.join(data_path, 'Indian_pines_gt.mat'))['indian_pines_

    return data, labels


def loadHSIData():
    data_path = os.path.join(os.getcwd(), 'HSI_data')
    data = spectral.open_image(os.path.join(data_path, '92AV3C.lan')).load()
    data = np.array(data).astype(np.int32)
    labels = spectral.open_image(os.path.join(data_path, '92AV3GT.GIS')).load()
    labels = np.array(labels).astype(np.uint8)
```

```
        labels.shape = (145, 145)
        return data, labels


    def reports (X_test,y_test):
        Y_pred = model.predict(X_test)
        y_pred = np.argmax(Y_pred, axis=1)
        target_names = ['Alfalfa', 'Corn-notill', 'Corn-mintill', 'Corn'
                   ,'Grass-pasture', 'Grass-trees', 'Grass-pasture-mowed',
                    'Hay-windrowed', 'Oats', 'Soybean-notill', 'Soybean-mintill',
                   'Soybean-clean', 'Wheat', 'Woods', 'Buildings-Grass-Trees-Drives',
                   'Stone-Steel-Towers']


        classification = classification_report(np.argmax(y_test, axis=1), y_pred, target_na
        confusion = confusion_matrix(np.argmax(y_test, axis=1), y_pred)
        score = model.evaluate(X_test, y_test, batch_size=32)
        Test_Loss =  score[0]*100
        Test_accuracy = score[1]*100

        return classification, confusion, Test_Loss, Test_accuracy


    def applyPCA(X, numComponents=75):
        newX = np.reshape(X, (-1, X.shape[2]))
        pca = PCA(n_components=numComponents, whiten=True)
        newX = pca.fit_transform(newX)
        newX = np.reshape(newX, (X.shape[0],X.shape[1], numComponents))
        return newX, pca

    def Patch(data,height_index,width_index):
        #transpose_array = data.transpose((2,0,1))
        #print transpose_array.shape
        height_slice = slice(height_index, height_index+PATCH_SIZE)
        width_slice = slice(width_index, width_index+PATCH_SIZE)
        patch = data[height_slice, width_slice, :]

        return patch
```

In [4]:
```
PATH = os.getcwd()
print (PATH)
```

```
/home/danquxunhuan/course/prml/lab2/Indian_pines_classification
```

In [5]:
```
X_test = np.load("./predata/XtestWindowSize"
                 + str(windowSize) + "PCA" + str(numPCAcomponents) + "testRatio" + str
y_test = np.load("./predata/ytestWindowSize"
                 + str(windowSize) + "PCA" + str(numPCAcomponents) + "testRatio" + str
```

In [6]:
```
X_test  = np.reshape(X_test, (X_test.shape[0], X_test.shape[3], X_test.shape[1], X_test
y_test = np_utils.to_categorical(y_test)
```

In [7]:
```
# load the model architecture and weights
model = load_model('./model/HSI_model_epochs100.h5')
```

```
WARNING:tensorflow:Variable *= will be deprecated. Use variable.assign_mul if you want assignme
```

In [8]:
```
classification, confusion, Test_loss, Test_accuracy = reports(X_test,y_test)
classification = str(classification)
confusion = str(confusion)
file_name = './result/report' + "WindowSize" + str(windowSize) + "PCA" + str(numPCAcomp
with open(file_name, 'w') as x_file:
    x_file.write('{} Test loss (%)'.format(Test_loss))
    x_file.write('\n')
    x_file.write('{} Test accuracy (%)'.format(Test_accuracy))
    x_file.write('\n')
    x_file.write('\n')
    x_file.write('{}'.format(classification))
    x_file.write('\n')
    x_file.write('{}'.format(confusion))
```

```
2592/2592 [==============================] - 0s 98us/step
```

In [9]:
```
# load the original image
# X, y = loadIndianPinesData()
X, y = loadHSIData()
```

```
/home/danquxunhuan/software/anaconda3/envs/tf/lib/python3.6/site-packages/ipykernel_launcher.py
  # This is added back by InteractiveShellApp.init_path()
/home/danquxunhuan/software/anaconda3/envs/tf/lib/python3.6/site-packages/ipykernel_launcher.py
  del sys.path[0]
```

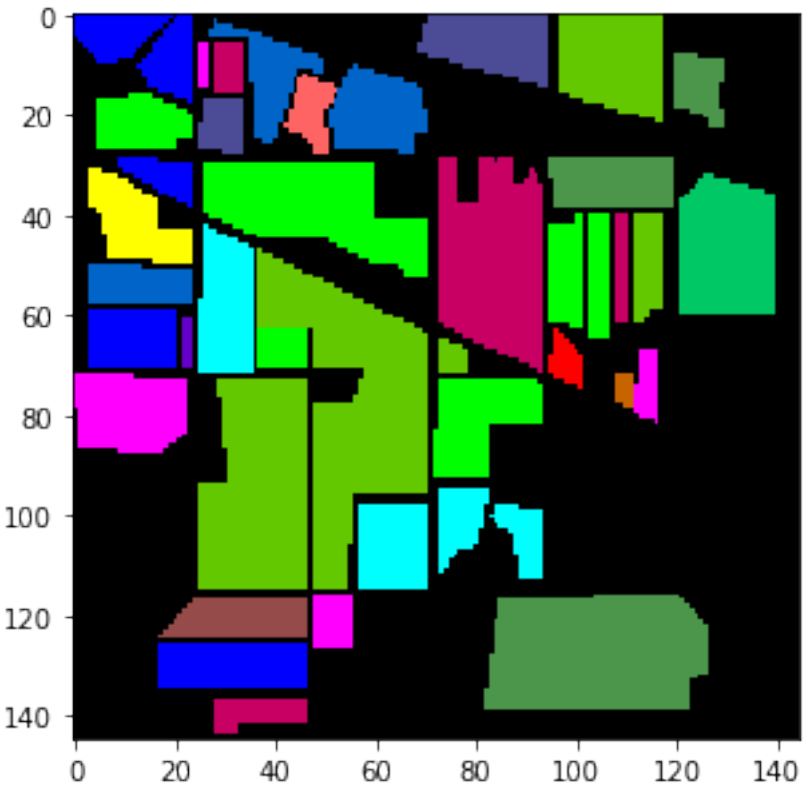
In [10]:
```
X, pca = applyPCA(X,numComponents=numPCAcomponents)
```

In [11]:
```
height = y.shape[0]
width = y.shape[1]
PATCH_SIZE = 5
numComponents = 30
```

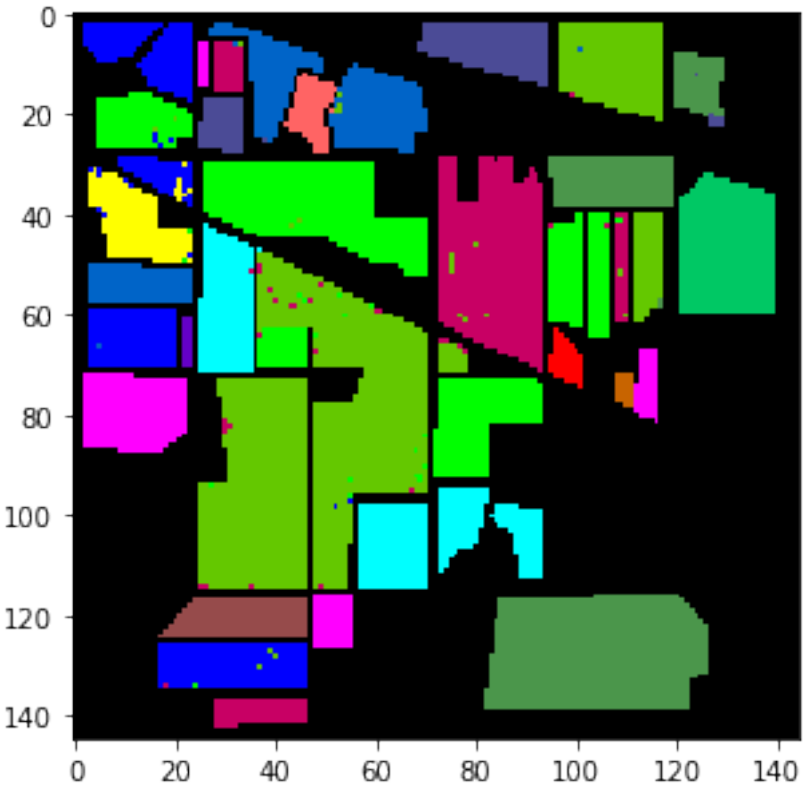
In [12]:
```
# calculate the predicted image
outputs = np.zeros((height,width))
for i in range(height-PATCH_SIZE+1):
    for j in range(width-PATCH_SIZE+1):
        p = int(PATCH_SIZE/2)
        # print(y[i+p][j+p])
```

```
            # target = int(y[i+PATCH_SIZE/2, j+PATCH_SIZE/2])
            target = y[i+p][j+p]
            if target == 0 :
                continue
            else :
                image_patch=Patch(X,i,j)
                # print (image_patch.shape)
                X_test_image = image_patch.reshape(1,image_patch.shape[2],image_patch.sha
                prediction = (model.predict_classes(X_test_image))
                outputs[i+p][j+p] = prediction+1
```

In [15]:
```
ground_truth = spectral.imshow(classes=y, figsize=(5, 5))
```



In [14]:
```
predict_image = spectral.imshow(classes=outputs.astype(int), figsize=(5, 5))
```


0
20
40
60
80
100
120
140
0
20
40
60
80
100
120
140