Classification Report

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1. **Collect data.** We manually select data for soil, leaves, rocks, grass and roads.
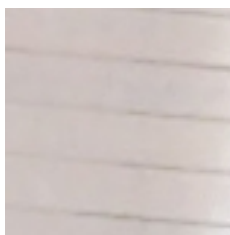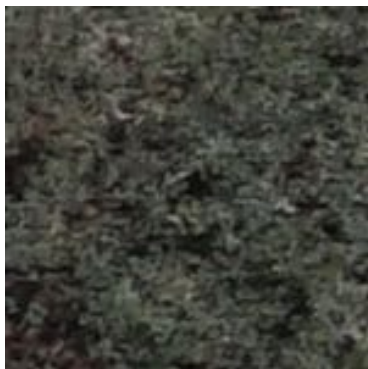
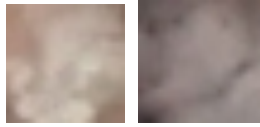Soil: 32 images

Grass: 100 images

Road: 100 images

Leaves 105 images

Rocks: 200 images (these images are much smaller because we assume rock is very small compared with other things, I am not very sure the method to collect rock data is appropriate.)

2. Train/test separation. Separate train and test images. For this problem, we have collected 537 images. Randomly permute images. Make 400 of them as the training images and 137 of them as the test images.

3. Leung-Malik (LM) Filtering.   (Leung-Malik (LM) Filter Bank consists of 48 different filters)

For each image;

A. Change it from the RGB to grayscale.

B.   Resize the image to certain size (64*64)

C. Use the Leung-Malik (LM) Filter to convolve the image.

D. After filtering, we get 48 Leung-Malik images for each image, one for each filter. Resize the images to a smaller size (8*8). Then convert each image to one vector and catenate the vectors to one feature vector for that image.

E. Do zscore on the feature vector.

Convert the vector to be a vector with 0 mean and standard deviation.

F. Principle Component Analysis.

For the training data, do PCA on the feature vectors and reduce the dimensionality of feature vector.(from 3072 dimension to 100 dimension) .

4. Now we successfully extract feature vectors for train and test data. Then do nonlinear SVM on the train data to generate the classifier. (I am also interested in designing a simple neural network to do the classification, maybe 3 or 4 layers with one or two hidden layers)

5. Test on train and test data.

Train Accuracy = 99.5% (398/400)

Test Accuracy = 99.2701% (136/137)

Because the LM filter can extract the texture features. And the texture features are the standard which can be used to do the classification.

6. Give scores to each whole image.

Slide the small window on the image, classify each window based on the SVM classifier. Then we give scores to the image   based on the classification.