16-720 Computer Vision: Homework 1
Spatial Pyramid Matching for Scene Classification
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1 Representing the World with Visual Words

Q1.0 (10 points): In Figure 3 of problem writeup, filters in row 1 are Gaussian filters, which pick up low frequency features; filters in row 2 are Laplacian of Gaussian, which pick up edges in an image; filters in row 3 are derivatives in x direction, which pick up edges in x direction of an image; filters in row 4 are derivatives in y direction, which pick up edges in y direction of an image.

1.1 Extracting Filter Responses

Q1.1 (10 points): Please refer to file `extractFilterResponses.m` in `matlab/` for implementation.

1.2 Creating Visual Words

Q1.2 (15 points): Please refer to file `getFilterBankAndDictionary.m` in `matlab/` for implementation.

1.3 Computing Visual Words

Q1.3 (15 points): Please refer to file `getVisualWords.m` in `matlab/` for implementation.

2 Building a Recognition System

2.1 Extracting Features

Q2.1 (10 points): Please refer to file `getImageFeatures.m` in `matlab/` for implementation.

2.2 Multi-resolution: Spatial Pyramid Matching

Q2.2 (20 points): Please refer to file `getImageFeaturesSPM.m` in `matlab/` for implementation.

2.3 Comparing images

Q2.3 (10 points): Please refer to file `distanceToSet.m` in `matlab/` for implementation.

2.4 Building A Model of the Visual World

Q2.4 (15 points): Please refer to file `buildRecognitionSystem.m` in `matlab/` for implementation.

2.5 Quantitative Evaluation

Q2.5 (15 points): Please refer to file `evaluateRecognitionSystem.m` in `matlab/` for implementation.

The confusion matrix is in Table 1.

	A	B	C	D	E	F	G	H
A	13	3	1	1	1	0	0	1
B	4	14	1	0	0	1	0	0
C	2	5	10	0	2	0	1	0
D	2	1	0	7	1	3	4	2
E	0	3	1	0	12	0	4	0
F	0	0	0	1	2	9	5	3
G	0	1	0	4	1	1	9	4
H	2	0	0	1	0	0	1	16

Table 1: Confusion matrix. A:airport; B:auditorium; C:bedroom; D:campus; E:desert; F:football stadium; G:landscape; H:rainforest

Individual category accuracies and overall accuracy are summarized in Table 2.

	Accuracy(%)
airport	65.00
auditorium	70.00
bedroom	50.00
campus	35.00
desert	60.00
football stadium	45.00
landscape	45.00
rainforest	80.00
Overall	**56.25**

Table 2: Accuracy result

2.6 Find out the failed cases (Optional Extra Credit, upto 10 points)

2.7 Improving Performance (Optional Extra Credit, upto 20 points)