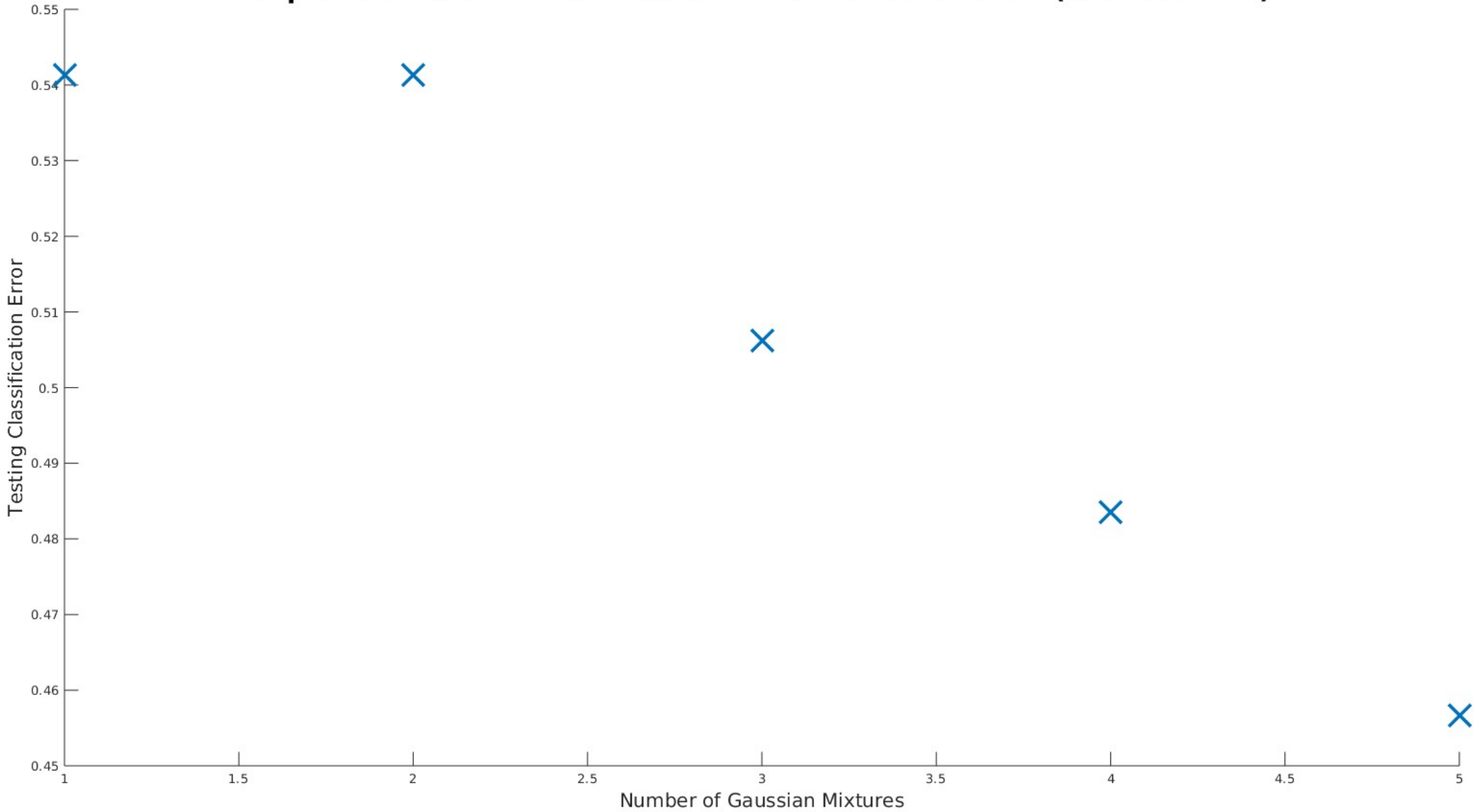# Machine Learning HW#5

Javier Salazar
1001144647

Testing Misclassification Plot

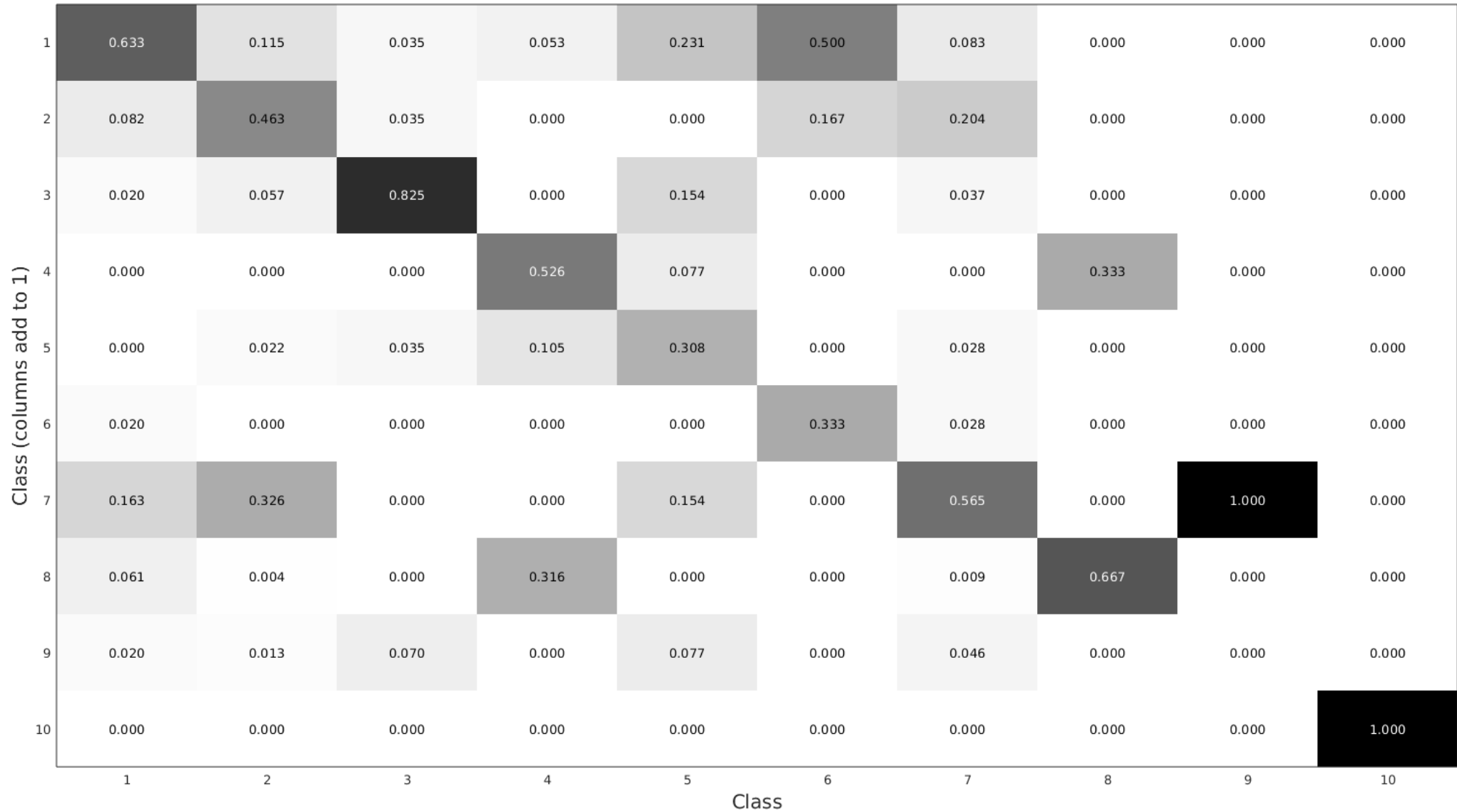Expectation-Maximization on Gaussian Mixture Models (Classification)

Problem 1 Analysis

- **Default sigma of 1 was very large in comparison to training data values so I brought it down to 0.1 to get better results**

- **For Q = 5 gaussians, we have misclassification error probability of 0.46 so performing EM on GMM correctly classified data 54% of the time which is better than the 10% classification rate if we flip a 10-sided die**

Confusion Matrix

Confusion Matrix (5 gaussians per class)

Class (columns add to 1)	1	2	3	4	5	6	7	8	9	10
1	0.633	0.115	0.035	0.053	0.231	0.500	0.083	0.000	0.000	0.000
2	0.082	0.463	0.035	0.000	0.000	0.167	0.204	0.000	0.000	0.000
3	0.020	0.057	0.825	0.000	0.154	0.000	0.037	0.000	0.000	0.000
4	0.000	0.000	0.000	0.526	0.077	0.000	0.000	0.333	0.000	0.000
5	0.000	0.022	0.035	0.105	0.308	0.000	0.028	0.000	0.000	0.000
6	0.020	0.000	0.000	0.000	0.000	0.333	0.028	0.000	0.000	0.000
7	0.163	0.326	0.000	0.000	0.154	0.000	0.565	0.000	1.000	0.000
8	0.061	0.004	0.000	0.316	0.000	0.000	0.009	0.667	0.000	0.000
9	0.020	0.013	0.070	0.000	0.077	0.000	0.046	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000

Class

Problem 1 Analysis

- **Matrix visualization code to plot matrices taken from here:**
  https://stackoverflow.com/questions/3942892/how-do-i-visualize-a-matrix-with-colors-and-values-displayed

- **We can see that the matrix is mostly the largest along diagnal so classes are usually identified correctly except for class 9 and 6 that had higher misclassification**

- **Not sure if the matrix is transposed or not but I have it so that the columns of the matrix add up to 1 like how Matlab has it in their confusionmat(.) function documentation**