

B657 - Project 1

Due: Tuesday February 12 before class.

The purpose of this assignment is to implement an EM algorithm with Gaussian Mixture Models and apply it to image segmentation. The images you should work with can be accessed here:

<http://www.indiana.edu/~dll/B657/horse.jpg>

<http://www.indiana.edu/~dll/B657/fruits.jpg>

<http://www.indiana.edu/~dll/B657/frog.jpg>

<http://www.indiana.edu/~dll/B657/girl.jpg>

In this project, you are to implement the following functions:

1. Implement the EM algorithm to estimate the parameters in mixture Gaussians.
2. Randomly generate two data sets, each with 300 2-dimensional data points. Each data set is generated by 3 Gaussian distributions with certain means. You need to maintain the same means of 3 Gaussians but assign 2 sets of variances.
3. Report your results (correct %) and compare your results of two Gaussian datasets.
4. Visualize the assignments of data points as PRML Figure 9.5(c). (hint: use three primary colors and map $p(k|x)$ to those colors)
5. Apply the EM algorithm and Gaussian models to four images.
6. Add spatial information in your segmentation program.
7. Visualize the results of image segmentation.
8. Write a readme on how to run your programs.
9. Write a report including:
 - a. A description of your implementation.
 - b. A comparison between K-means and Gaussian Mixture Models on both synthesized data and image data.
 - c. Discussions on how your algorithm can be improved.

You will hand in your Matlab code and report. You will need to zip/tar/rar all the files into one with the name B657_(hw #)_(your last name).zip(or tgz/rar), and send it to chenyu@indiana.edu.