

Pattern Recognition with Applications to Biomedical Images

Independent Study in Mathematics – CSUN Spring 2006

Module 3 - Simple implementation

P. Perona & K. F. Stevenson

January 22, 2007

Design simple system for Classification & Training applicable to urine database and implement with Matlab. Here the type of classifier will be given. Students will determine the best w (the boundary) based on training and then run on test set. Compare error rates. What are the possible types of errors? Are all types of errors equal?

Exercise 0.1. Feature selection - *Make yourself familiar with the code provided: `explore_features.m`. if you feel the urge, implement a few features of your own. Select two features that appear to work well together.*

Classifier training – by hand - *Eyeball the training data, as it appears on the 2-dimensional feature plane, and select by hand linear classifiers that appear to work well. Do not worry too much about fine-tuning them, you will do this later. The linear classifier will be built as in the exercise you carried out last week. Write matlab code to implement the classifier. Your code will take the images in the training set and output points in feature space, then assign classes to the points.*

Classify - *Now modify your code to run your classifier on the test data. Collect the estimated class labels that were produced by the classifier.*

Measure the error - *Compare the estimated labels with the true underlying labels. Plot your errors as discussed last week. (confusion matrix).*

OK, you built your first system for classifying particles in human urine. It is not perfect, but from now on it will only improve! Just so that you are calibrated, on the following pages are some images generated by our solution to this exercise:

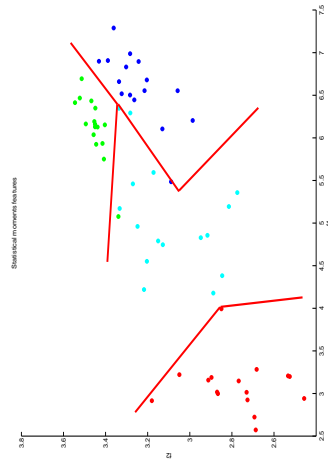


Figure 1: Here are the Training images plotted in Feature space. Also there are some decision boundaries (too many!).

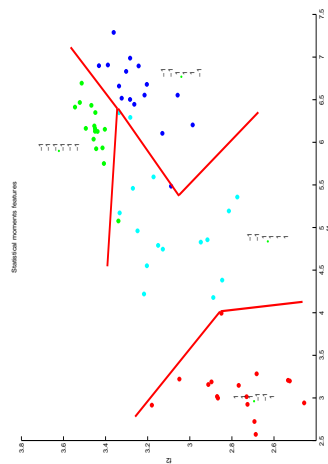


Figure 2: Here are the points in Feature space with boundary lines, and sample "codes".

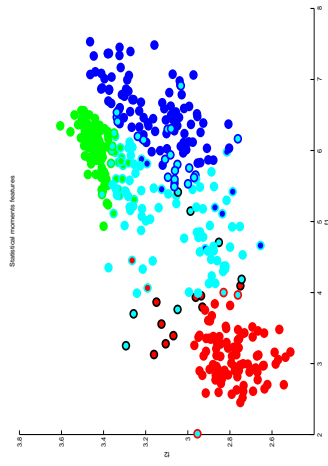


Figure 3: Here are the Test images mapped into feature space and classified. The exterior color is the known class, and the interior color is the classification.

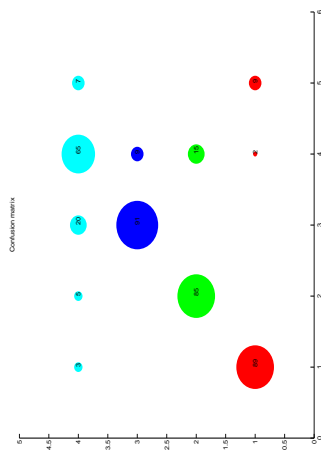


Figure 4: This is a picture of the errors: Confusion matrix