

ECE 759 – Pattern recognition and machine learning

Project-Part 2

After your extensive experimenting in Part 1 of the project, your goal here is to build on that work to further our understanding of both the data as well as the machine learning techniques you have recently taken up and whose properties were discussed and you have studied.

1. Using the understanding you have acquired in your learning the properties of the training images used in Part I
 - a. Propose a Neural Network with an appropriate number of nodes and hidden layers to delineate the “water” regions and subsequently the segmentation of imagery. Evaluate the performance.
 - b. How does this achieved performance compare with that obtained with the Bayes approach? Whatever may be the case, explain and justify what your assessment of performances. Be detailed and clear.
 - c. Propose an SVM machine with the proper parameters learned using the training data from above. Evaluate as above, the performance of classification of water to be subsequently used in the segmentation of imagery.
 - d. How does the performance of SVM compare to that of the Neural Network? Explain and justify this comparison. Be detailed, precise and clear.
2. Viewing the problem of detecting and classifying “water” versus “non-water” regions in your imagery data, you can proceed to identify features (e.g. PCA, or others) of relevance in these two classes.
 - a. Define these.
 - b. Reformulate this problem as that of a binary classification problem, and use the Scatter matrices approach, to evaluate the discrimination effectiveness of identified features, and quantify the performance of this approach.
 - c. Can you define more than 2 classes characterizing the set of images? Explain if Yes and if No.
3. In comparing the achieved performance in question (2b) above, to that obtained in Project Part I using a Bayes’s approach, explain any

differences or the lack thereof. Be detailed and clear, i.e. using **theoretical** together with **qualitative arguments** if need be.

4. Consider again the “water” and “non-water” regions you selected manually in project 1, and now assume that you do not have labels for each region. Propose *an unsupervised classification* technique to classify the regions in two clusters and evaluate the performance of your technique. Illustrate all the steps of your proposed approach including data pre-processing, feature selection technique, and classification/clustering method you applied.