

ECE8560 Spring 2017

Takehome #3

(Canvas submission only)

Assigned 3/28/2017; Due 4/20/2017 11:59PM

1 Overview

This is another multipart take-home assignment which follows and builds upon Takehome #1 and Takehome #2 and uses the same dataset (H and S_T). **This is to be done individually.** I recommend you start as soon as possible; it is highly unlikely you can achieve a credible result by starting a few days before the due date. One of the obstacles to success may be acquiring/learning to use SVM software. We will also discuss this in class.

2 Tasks

The specific tasks are:

1. Apply SVM to the training data (H) for two of the classes (**specifically** w_1 **and** w_2), to test SVM discrimination ability. Test using the w_1 and w_2 samples from S_T . As I noted in class, you may use an SVM software package, but be sure you take the time to learn how to correctly use it. There are numerous decisions you will need to make.
 - (a) Clearly indicate, justify and describe the SVM software tool you have chosen for the solution.
 - (b) Consider linear and rbf models.
 - (c) Show the resulting support vector set.
 - (d) Show the corresponding hyperplane parameters (**This is important**).

- (e) Determine the classification performance with this SVM.
- (f) Compare these results with your results from Takehomes #1 and #2.

Note: I need to see all of these desired results clearly described in your documentation.

2. Apply crisp c-means to (all of) H , and determine if there is any natural clustering. **Write your own c-means implementation (i.e., do not use 'canned' software).**
 - (a) Use $c = 2$, $c = 3$, $c = 4$, and $c = 5$.
 - (b) Determine, justify and use at least 2 distance measures.
 - (c) Compare these results see if any clusters naturally develop.
 - (d) Assess whether the clusters found above are related to the known (estimated) class means.

3 Key Remarks

1. Do all parts of the quiz. Use this document as a checklist for your submission.
2. Open book and notes, but **no collaboration**. (This is an individual effort.)
3. **Submit to Canvas by the deadline.**
4. **Clarity and completeness of the presentation (in addition to technical correctness) counts significantly.**

4 Format of the Results Report

This aspect is critical. If you make it difficult for me to asses your effort, I won't. The final report must be in your solution archive in a PDF-format file named `<yourname>-takehome3.pdf`. The report results **must be in the following order**:

1. p. 0: Title page (<name>, <CU username>, ECE 8560, Takehome #3)
2. p. 1: Description of SVM software used.
3. p. 2: SVM results with a linear (dot-product) kernel. This includes:
 - Show the support vector set.
 - Show the hyperplane parameters (**This is important**).
 - Determine the classification performance with this SVM.
 - Compare these results with your results from Takehomes #1 and #2.
4. p. 3: SVM results with a rbf kernel. This includes:
 - Show the support vector set.
 - Show the hyperplane parameters (**This is important**).
 - Determine the classification performance with this SVM.
 - Compare these results with your results from Takehomes #1 and #2.
5. p. 4-5: Results of crisp c-means applied to (all of) H , and determine if there is any natural clustering. Specifically:
 - Use $c = 2$, $c = 3$, $c = 4$, and $c = 5$.
 - Determine, justify and use at least 2 distance measures.
 - Compare these results see if any clusters naturally develop.
 - Assess whether the clusters found above are related to the known (estimated) class means.
6. Pages 6 and beyond: Anything else you feel is relevant.

5 Additional Notes and Constraints

5.1 Format of the Electronic Submission

The final **zipped archive** is to be named <yourname>-takehome3.zip, where <yourname> is your (CU) assigned user name. You must upload

this to the ECE8560 Canvas page prior to the deadline for your solution to be considered.

The minimal contents of this archive are described below.

1. Include a `readme.txt` file listing the contents of the archive and a brief description of each file. Include 'the pledge' here. Here's the pledge:

Pledge:

On my honor I have neither given nor received aid on this exam.

2. Put all results in a single directory.
3. Include **all** (your) source code used in your simulations. Especially critical is the SVM simulation.
4. **Indicate your engineering decisions and solution derivations for each part.**
5. All documentation must be in pdf with the format of Section 4 and in a file named `<yourname>-takehome3.pdf` The quality and structure of the documentation is very important.