

CS570: Artificial Intelligence and Machine Learning

Programming Assignment 4

Due Date: Thursday 23:59, June 12

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Summary

In this assignment, you will implement two different approaches that learn a binary linear discriminant. You will implement Support Vector Machine (SVM) algorithm using linear kernel (in this assignment, you consider the linear kernel case only, and do not have to consider the non-separable cases). Key idea of SVM is the finding the optimal separating hyperplane. This can be represented as follows:

$$\text{Minimize } ||w||: \min(\frac{1}{2} ||w||^2) \text{ subject to } r^t(w^T x^t + w_0) \geq +1, \forall t$$

Where w and w_0 are parameters of hyperplane, t is instance index of data, x is data

This is quadratic programming problem.

(You can assume that the classes of the data are linearly separable)

The assignment involves developing two function in MATLAB

- ① Implement the function of ***svm.m***. It should return the parameters w_0 and w using quadratic programming (You can use `quadprog` function in matlab). It also return indices of support vectors.
- ② Implement the function of ***svmonebyone.m***, you can easily implement this function by using `svm.m` function. This function should run svm algorithm when classes are `num1` and `num2` in argument of function. And it should return the parameters w_0 and w and indices of support vectors

Template for these functions is given. **You should upload your MATLAB code along with summary document of your experiments (studentid_name.pdf) within zip file to KLMS.**

Ex) 20142014_BongseokGoh.zip

(svm.m, svmonelyone.m and 201421014_BongseokGoh.pdf are in this zip file)

Delayed submission won't be allowed. Please submit before the due time.

(Sending to T.A. won't be also allowed.)

Datasets

Dataset has three variables and 60 instances. Two variables that names are "x" and "y" are the value of coordinate x and y axis. The variable that name is "c" is the class number of each instance. Data has three class numbers.

Your document must include followings :

- ① Explain how svm algorithms works and explain why the result comes out (explain the comparing result of onebyone function and onebyall function).
- ② Answer this question: Suppose you want to classify an instance into one of N classes. How can you build a single multi-class classifier based on your binary discriminants?
- ③ Graphs that you can get when you run the svmTest.m script