Issued: Feb 15, 2024   ISE 789/OR 791 HW #1   Due: Feb 29, 2024 3:00 PM

Given 2 binary-class data sets, data1.csv and data2.csv on the course webpage, use the SVM models we learned in the class to solve the following classification problems.

1. (40 points)
   Consider the data set, data1.csv.

   (a) (10 points) Use the model on page 16 of Lecture 4 to classify the data in data1.csv. Find the classification hyperplane H1 and supporting vectors.

   (b) (10 points) Use the model on page 23 of Lecture 4 to classify the data in data1.csv. Find the classification hyperplane H2 and supporting vectors.

   (c) (10 points) Use the model on page 31 of Lecture 4 to classify the data in data1.csv. Find the classification hyperplane H3 and supporting vectors.

   (d) (5 points) Visualize H1 and H2 with the data. Are H1 and H2 the same? Are their supporting vectors the same? If not, why are they different? Which one do you prefer to use in practice? Why?

   (e) (5 points) Visualize H1 and H3 with the data. Are H1 and H3 the same? Are their supporting vectors the same? If not, why are they different? Which one do you prefer to use in practice? Why?

2. (60 points)
   Consider the data set, data2.csv.

   (a) (10 points) Try to use the model on page 16 of Lecture 4 to classify the data in data2.csv. Can you find a classification hyperplane? If not, can you explain the reason.

   (b) (10 points) Use the model on page 31 of Lecture 4 to classify the data in data2.csv. Find the classification hyperplane H4.

   (c) (15 points) Use the model on page 45 of Lecture 4 to classify the data in data2.csv, with $C = 0, 1, 10, 100, 10000$. Find the classification hyperplane H5 in each case.

   (d) (15 points) Use the model on page 49 of Lecture 4 to classify the data in data2.csv, with $C = 0, 1, 10, 100, 10000$. Find the classification hyperplane H6 in each case.

   (e) (5 points) Visualize H4 and H5 with the data. Are H4 and H5 the same? If not, why are they different? Which one do you prefer to use in practice? Why?

   (f) (5 points) Visualize H5 and H6 with the data, with $C = 0, 1, 10, 100, 10000$. Are the hyperplanes the same? If not, why are they different? How are they related?