

Homework: RBFs and Matlab Structures

Assigned April 14/15. Due Tuesday, April 19.

Exercise 1

Construct a Matlab function that takes in a set of vectors as the columns of a matrix X , and a matrix of columns in Y and outputs the result of our OLS algorithm. There is a template online you can start with, `HW13A.m`.

What to turn in: Email me this function once you've finished.

Exercise 2

Here we are going to use Matlab's built-in OLS training to find an RBF for a given data set. In this case, we will be building a model to predict the number of sunspots. If s_i is the number of sunspots for year i , then we will define the mapping as:

$$s_{12} = f(s_1, s_2, \dots, s_{11}), \quad s_{13} = f(s_2, s_3, \dots, s_{12}), \quad s_{14} = f(s_3, s_4, \dots, s_{13}), \quad \text{and so on.}$$

The file `yearssn.dat` on the class website has two columns: The first column is the year, from 1700 to 2010. The second column is the number of sunspots. To see the raw data, use the `plotspots.m` file that is on the class website (not necessary).

The data for the RBF is given in `Sunspot11.mat`. Load this data into Matlab and you see two data sets: Matrix H is 11×300 - This is the sunspot data in columns- For example, the first column is $[s_1, s_2, \dots, s_{11}]^T$. The array T holds the desired targets- The number of sunspots for the *next* year. For example, $T(1) = s_{12}$, $T(2) = s_{13}$, etc.

What you should do:

1. Separate the data into training and testing sets. We'll use the first 150 years to approximate the sunspots for the next 150 years or so.
2. Build the RBF using Matlab's `newrb` command. You may use a fairly large error, like 10.
 - (a) If you don't specify the radius of the Gaussian, Matlab assumes it to be 1. Train the RBF using this width and comment on the output.
 - (b) Try using a width defined by the following: If M is the maximum norm of the columns of H , use a width about half that size. Train the RBF using this width and comment on the result.
 - (c) Finally, locate the matrix of centers in the RBF data structure, and label the result "Centers". Locate the "weight" matrix, and label it "Weights".

The script file `HW13B.m` is available online as a template.

What to turn in: Email me your script file. You can comment directly on the script if you would like (to answer 2(a), (b)).