Université de Genève

Chapitres choisis
14X060

TP : Gaussian Processes

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Intro

Point A is located in coordinates (0,0), and be is at (22,22).
The locations for which we know the depth are: ((coordinate), depth)

location 1 ((1,1),-1)

location 2 ((6,6),10)

location 3 ((11,11),5)

location 4 ((16,16),-10)

location 5 ((21,21),1)

A and B are outside the range of points!

Proposed solution

We start by implementing the kernel code seen in class for 2D coordinates.
We define the X known locations and the corresponding Y depths. As follows:

$n = 5$
$X < -matrix(nrow = 2, ncol = 5)$
$X[1, 1 : n] < -c(1, 6, 11, 16, 21)$
$X[2, 1 : n] < -c(1, 6, 11, 16, 21)$
$Y < -c(1, 2, 1, 0, -1)$

Then we define the points to which we wish to compute the depth, in here we will keep inside the plain formed by A and B, bottom left corner is at coordinates A = (0,0), and top right corner is at coordinates B = (22,22). The points to which we wish to compute the depth, are every point in the plain, which means we need compute from (0,0),(0,1), ... ,(0,22),(1,0), ...,(22,22).
This is done by using a double for() in the code, we create a matrix of 2 rows and 22*22-1 columns, and input the good values at each column/row.

We have everything we need to start our Gaussian Process, we compute all the covariance matrices required for the computation of A and b:

$sigma\_yy < -kernel_S E_2(X, X)$
$sigma\_yy\_inv < -solve(sigma\_yy)$
$sigma\_yey < -kernel\_SE\_2(X\_e, X)$
$sigma\_yeye < -kernel\_SE\_2(X\_e, X\_e)$

Finally we compute A and b, using the formula seen in class.

Last thing that is left to do is to sample a number of functions. each sample will return a predicted depth for each coordinate X_e. One can compute the average depth at each coordinate, the more functions we sample, the better our value is.

One can split the values of our plain in rows or columns, lets split in rows, it means that from A=(0,0), we can go to any coordinate in the column where x coordinates are 1, so : [(1,0), (1,2), ...,(1,22)]. From there we do the same for x coordinates 2, we do this until we reach B = (22,22).

To make sure we lay cable on shore line, we will accept a depth between -1 and 1.

Problems

I didn't have enough time to compute the actual length of the cable. Right now I have an average depth at every coordinate inside the plain from (0,0) to (22,22), the more samples I take the better the solution will be. I think I could have finished if I had more practice with the language R.
My final result is the average depth at every coordinate, this is stored in matrix avg_Y_e, the first value is the avarage depth at coordinates (0,1), the second is at coordinates (0,2) ..., the 23th value is at corresponds to coordinates (1,0) and so on ..