Assignment 3

Construct the training set T = { $(x_1,y_1),(x_2,y_2),\ldots\ldots,(x_{400},y_{400})$} using the relation

$Yi = \sin(2\pi(||x_i||) + \epsilon_i$ where $\epsilon_i \sim N(0,0.25)$ and $x_i = (x_i^1, x_i^2)$ where x_i^1, x_i^2 are from U[0,1].

In the similar way construct a testing set of size 200

I,e. Test = { $(x'_1,y'_1),(x'_2,y'_2),\ldots\ldots,(x'_{200},y'_{200})$}

i. Obtain the prediction on testing set and compute the RMSE for regularized least squares kernel regression model with the RBF kernel $K(x,y) = \exp(-(||x-y||^2/\sigma)$. using the direct method. Study the behavior of the kernel parameter σ and regularization λ on prediction in terms of RMSE.

ii. Obtain the prediction on testing set and compute the RMSE for regularized polynomial regression models for order M =1,2 , 5 and regularized least squares kernel regression model using the gradient descent method.

iii. Obtain the prediction on testing set and compute the RMSE for regularized polynomial regression models for order M =1,2 , 5 and regularized least squares kernel regression model using the k-mini batch stochastic gradient descent method.

iv. Compare the obtained solution by the gradient and stochastic gradient algorithm with the solution obtained by the direct method (solving the normal equation) in each case.

v. Study the behavior of the chosen step length eta regarding the convergence to actual solution in case of all used algorithms.