Project Report

1. Task 4 - Maximum a Posteriori - Regularizing weights with hyperparameter alpha

   In this task, we will consider a zero-mean isotropic Gaussian governed by a single precision parameter Îś. here we will take ground truth value of beta as 11.1 as calculated. By putting various values of alpha, we can get lambda for task 2. Maximization of this posterior distribution with respect to w is equivalent to the minimization of the sum-of-squares error function with the addition of a quadratic regularization term.

2. $$lnp(w,t) = \left(\frac{\beta}{2}\right)\sum(\mathbf{t_n} - w^T\Phi(\mathbf{x_n}))^2 + \left(\frac{\alpha}{2}\right)w^Tw + const$$

   Having determined the parameters w and putting some values for alpha, we can use equations of task 2 and we can observe the curve for various values of M. for alpha = 1.6905e-07 and beta = 11.1 (ground truth)

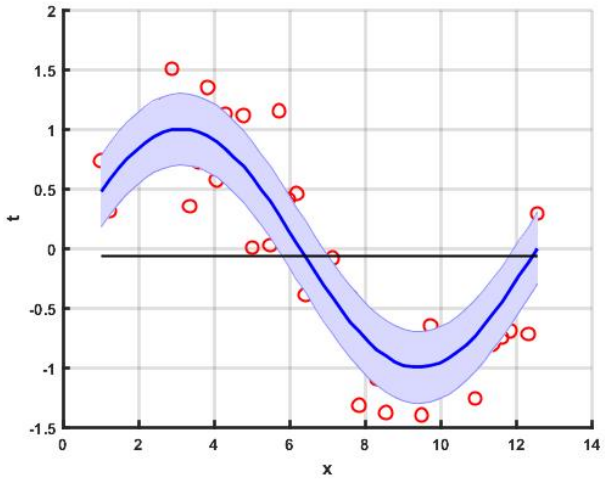

Figure 1: Case 1: (M = 0) w* = [-0.0501]

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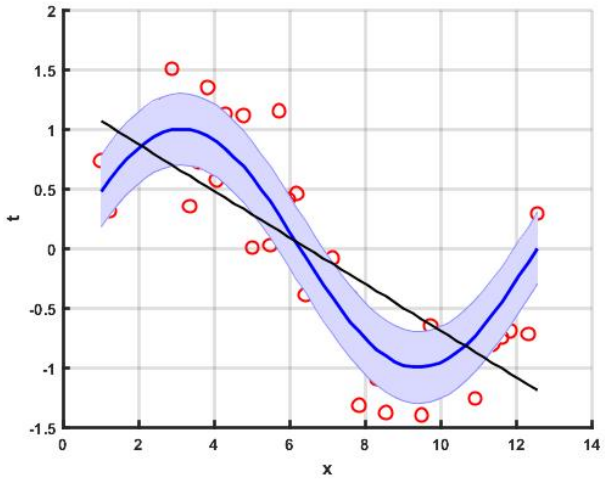

Figure 2: Case 2: (M = 1) w* =[1.2014, -0.1848]

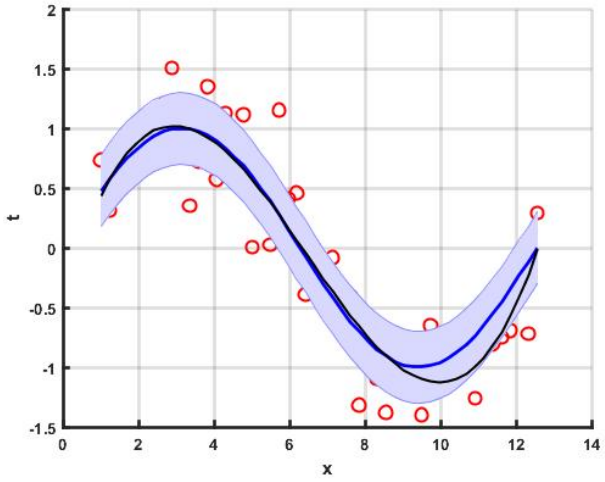

Figure 3: Case 3: (M = 3) w* =[0.1922, 0.7061,-0.1813, 0.0099]

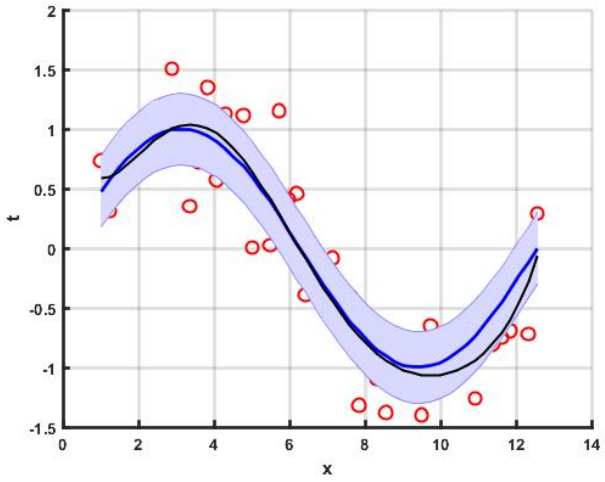

Figure 4: Case 4: (M = 6) w* = [-0.3129, 1.6050,-0.7302, 0.1619,-0.0209, 0.0014,-0.0000]

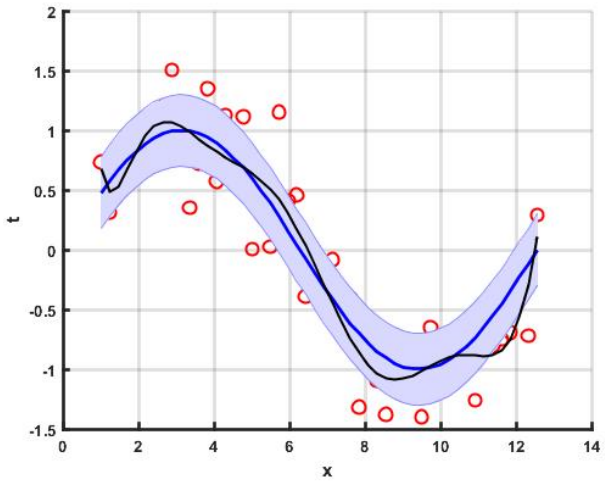

Figure 5: Case 5: (M = 9) w* = [-9.4270, 25.7526,-25.9357, 13.8811, -4.3654, 0.8423, -0.1007, 0.0073, -0.0003, 0.0000]

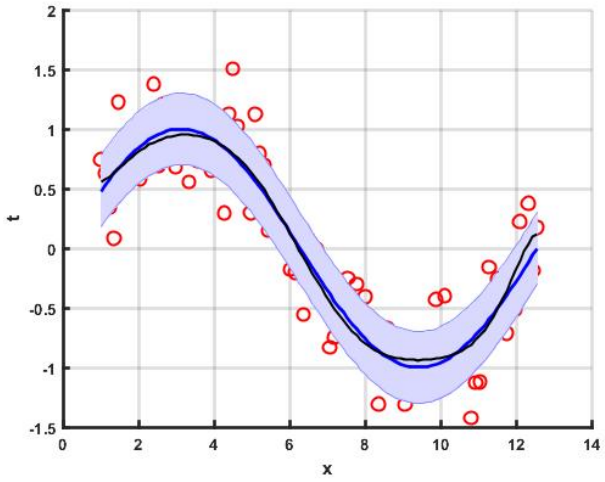

Figure 6: Case 6: (N=100)

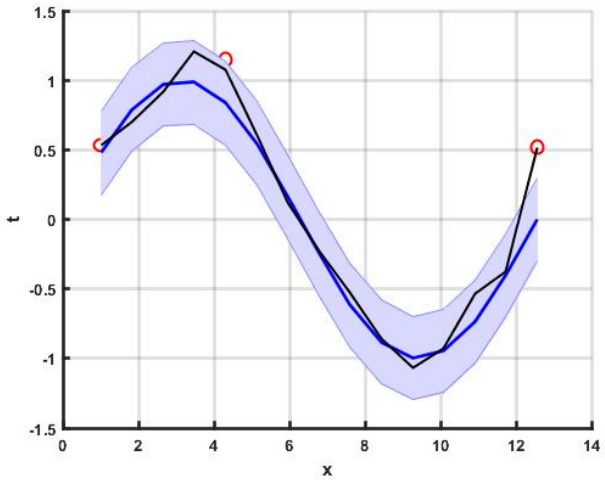

Figure 7: Case 7: (N=15, We can see, for N = 15 we have M and N are almost same so curve is trying to over-fit)