Statistics 745

Assignment 3

1. Solve:

   (a) Determine θ_0 from the following optimization problem (loess $d = 0$):

   $$\min_{\theta_0} \sum_{i=1}^{n} K_\lambda(x_0, x_i)(y_i - \theta_0)^2$$

   (b) Determine θ_0 and θ_1 from the following optimization problem (loess $d = 1$):

   $$\min_{\theta_0, \theta_1} \sum_{i=1}^{n} K_\lambda(x_0, x_i)(y_i - \theta_0 - \theta_1 x_i)^2$$

2. Solve:

   (a) Let $H = x(x^T x)^{-1} x^T$. Show that $\hat{f} = x\hat{\beta}^{(ls)} = Hy$. Also, what is $\mathrm{tr}(H)$?

   (b) Let $H_\lambda = x(x^T x + \lambda I)^{-1} x^T$. Show that $\hat{f} = x\hat{\beta}_\lambda^{(ridge)} = H_\lambda y$. What is $\mathrm{tr}(H_\lambda)$ and how does it relate to $\mathrm{tr}(H)$?

3. **Individual Part:**

   (a) Program in **R** the loess estimators using the attached base code with $\lambda = \{0.01, 0.1, 0.5, 1, 100\}$.

   (b) Provide some explanation for the effect of λ on the result. Also what kind of difference did loess $d = 1$ make compared to $d = 0$?