Bachelor of Science in Computational Business Analytics

Exam: Computational Statistics

Semester: Winter 2022

Lecturer: Prof. Dr. Jens Witkowski

Examination date: 24.10.2022

Solutions for Q3, Q31, Q34, and Q35.
(All other solutions are found in Canvas.)

Question 3:

Consider *df1* again. You randomly sampled points 1, 3, and 5 into the validation set. What is the validation MSE of the linear regression model predicting Y from X? Provide your calculations for partial credit.

Solution:

Training set is (2,4) and (4,4), resulting in linear fit at y=4.

The validation MSE is thus (1/3)*(3*(4-1)^2) = 3^2 = 9

Question 31:

In the lecture, we have seen that we can implement truthful forecasting competitions by giving the prize to forecaster i with probability

$$f_i = \tfrac{1}{n} + \tfrac{1}{n}\left(R_q(y_i, x) - \tfrac{1}{n-1}\sum_{j \neq i} R_q(y_j, x) \right).$$

For $x = 0$, compute the probability that forecaster 1 receives the prize when she reported $y_1 = 0.5$ and the other two forecasters reported $y_2 = y_3 = 0.0$.

Solution:

  1/3 + 1/3 * ((1-(0.5-0)^2) - 1/2 * ((1-(0-0)^2 + (1-(0-0)^2)

= 1/3 + 1/3 * (3/4 - 1/2*(2))

= 1/3 + 1/3 * (-1/4)

= 1/3 - 1/12

= 1/4

= 0.25

Question 34:

What is the expected quadratic score of the truthfully-reporting forecaster if she does not learn the outcome of H (i.e., if she does not have access to the hygrometer)? (The numerical result alone is sufficient but you can provide your calculation for partial credit; use **at least three decimals** in your calculations wherever possible.)

Solution:

*0.75 * (1-(0.75-1)^2) + 0.25*(1-(0.75-0)^2)*

*= 0.75 *(1-0.25^2) + 0.25*(1-0.75^2)*

= 0.8125

Question 35:

The forecaster still seeks to predict the probability of R=1 and is still reporting truthfully. Her expected quadratic score following H=1 is 103/121 = 0.851, her expected quadratic score following H=0 is 37/49 = 0.755.

What is the forecaster's expected improvement in quadratic score from learning the outcome of H? (The numerical result alone is sufficient but you can provide your calculation for partial credit; use **at least three decimals** in your calculations wherever possible.)

Solution:

*Expected score after learning outcome of H: 0.825*0.851+(1-0.825)*0.755 = 0.8342*

Expected improvement of learning outcome of H: 0.8342-0.8125 = 0.0217