

Assignment Part III

Silpa Soni Nallacheruvu (19980824-5287) Hernan()

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set.seed(980824)

Summary

Task 1

Approach :

To calculate the AIC, the formula

$$2*k - 2*l(\hat{\theta})$$

was applied where k is the number of parameters in the theta. To calculate the leave-one-out cross-validation, the formula

$$l(\hat{\theta}) + \sum_{i=1}^n ((S_i(\theta_i)^T) * (\theta_i - \hat{\theta}))$$

was applied where θ_i is $\hat{\theta}(X_{-i})$, (X_{-i}) is one observation (X_i) is left out and n is the total number of observations. These values were then compared with the AIC from R in the provided summary.

Code :

```
# ---- Task_1 ----

# Compute AIC = 2k - 2l(theta_ml)
n <- nrow(X)
theta0 = rep(0, ncol(X))
k <- length(theta0)
theta_estimate <- NR(theta0, 3, y, X)
log_likellihood <- l(theta_estimate, y, X)
aic_computed <- 2*k - 2*log_likellihood

#AIC output from R summary
r_summary_aic <- summary(modell)$aic

# Compute n*k_cv = l(theta_ml) + sum((S_i(theta_i))T*(theta_i - theta_ml))
# Here, theta_i = theta_ml(X_{-i})
nk_cv <- log_likellihood
for(i in 1:n) {
  X_minus_i <- X[-i, , drop=FALSE]
  y_minus_i <- y[-i, , drop=FALSE]
  theta_i <- NR(theta0, 3, y_minus_i, X_minus_i)
  score <- S(theta_i, y_minus_i, X_minus_i)
```

```

subset_sum <- t(score) %*% (theta_i - theta_estimate)
nk_cv <- nk_cv + subset_sum
}

# Creating a comparison data frame
comparison_aic_values <- data.frame(
  "AIC_R_model" = r_summary_aic,
  "AIC_computed" = aic_computed,
  "NK_CV_computed" = -2*nk_cv
)

```

Output :

```

comparison_aic_values

##   AIC_R_model AIC_computed NK_CV_computed
## 1    1302.397    1302.397    1294.397

```

Task 2

Approach :

Code :

```

# ---- Task_2 ----

```

Output :

Observation :

Task 3

Approach :

Code :

```

# ---- Task_3 ----

```

Output :

Observation :