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Sunday, November 7, 2021 4:10 PM

Section 1

MANE 6313

Subsection 1

Week 12, Module E

Student Learning Outcome

- Select an appropriate experimental design with one or more factors,
- Select an appropriate model with one or more factors,
- Evaluate statistical analyses of experimental designs,
- Assess the model adequacy of any experimental design, and
- Interpret model results.

Module Learning Outcome

Assessing linear regression model diagnostics.

Resources for the Week 12, Module E micro-lecture are:

- Week 12, Module E Micro-lecture
- Week 12, Module E Marked Notes

Assessing Linear Regression Model Diagnostics

provide table of contents

R^2

- The coefficient of multiple determination is defined to be

$$R^2 = \frac{SS_R}{SS_T} = 1 - \frac{SS_E}{SS_T}$$

- R^2 is the reduction in variability (in the data) due to using the regressor variables $x_1, x_2, \ldots, x_k$ (the model).

- A larger R^2 value indicates more of the total variability is explained by the model; **however it does not imply that the model is a GOOD model**
- R^2 always increases as the number of terms in the model is increased
- Adjusted R^2 is   { x_1, x_2, x_3, tide SOI, DJI } . .

$$R^2_{\text{adj}} = 1 - \frac{SS_E/(n-p)}{SS_T/(n-1)} = 1 - \left(\frac{n-1}{n-p}\right)\left(1 - R^2\right)$$

- penalty for unnecessary terms in the model
- R^2 & R^2_{adj} are close

Model Assumptions and Residuals

- Least squares estimation requires that $E(\varepsilon) = 0$ and $V(\varepsilon) = \sigma^2$ and the $\{\varepsilon_i\}$ are uncorrelated
- To perform statistical hypothesis tests, we further assume that $\varepsilon \sim \text{NID}(0, \sigma^2)$
- These assumptions are validated by examining the residuals
- Perform same analyses previously used for the fixed effects model

Minitab Demonstration

Sunday, November 7, 2021 4:16 PM

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
4.80885	98.37%	97.14%	93.47%

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