Data 8, Lab 9

Residuals and Regression Inference

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Spring 2020

24 April 2020

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Review: Linear Regression Overview

- Predict the value of a **continuous** random variable
  - Example: predict the number of students attending lab (dependent variable) using the air quality (independent variable)
- Dependent variable on the *x* axis, independent variable on the *y* axis
- Fit a regression line to represent the points on the graph
- Can use regression line to **predict** the *y* value for points on the *x* axis

Review: Linear Regression Equation

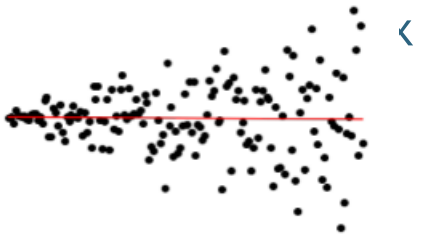
estimate of y = slope * x + intercept

$$\text{Slope} = r * \frac{Standard\ Deviation\ of\ y}{Standard\ Deviation\ of\ x}$$

Intercept = Average of y – Slope * Average of x

Residuals

- Residual = Actual Value of y – Predicted Value of y
- The residual plot of a good regression (a linear model) shows no patterns in the graph of the residuals
  - Will look like formless cloud if linear regression is a good model
- Average of residuals is always 0
- Heteroscedastic: Uneven variation of residuals around the horizontal line at 0
  - This means that the regression estimates are not equally accurate! For example, this model is better at x values are small than when x values are large:



Standard Deviation of Residuals

- SD of the Residuals = np.sqrt(1-r**2) * SD_of_y
- The SD tells us how good the linear predictor is
  - The smaller the SD of Residuals, the closer the residuals are to their mean
  - Mean of Residuals is always 0
  - Example: If r=1 (perfect correlation), there SD of residuals is 0 since we have a perfect linear relationship between X and y
- SD of Predicted Values = |r| * SD of y

Announcements

- Project 3:
  - Checkpoint is due this Friday 4/24
  - Project is due 5/1
- Watch year's lecture on privacy here
  - Material will be on the final!