

### 3.3.6: $r^2$ , The Correlation of Determination

The Regression ANOVA hypothesis test can be used to determine if there is a **significant** correlation between the independent variable ( $X$ ) and the dependent variable ( $Y$ ). We now want to investigate the **strength** of correlation.

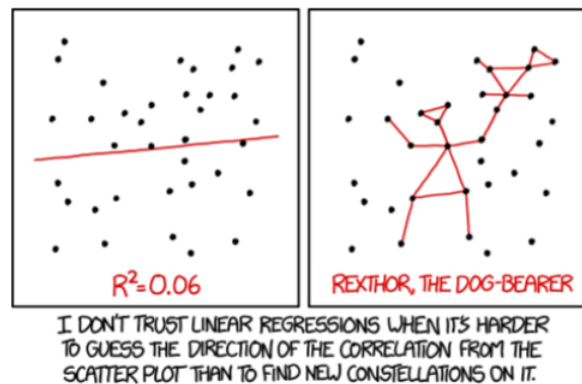
In the earlier chapter on descriptive statistics, we introduced the correlation coefficient ( $r$ ), a value between -1 and 1. Values of  $r$  close to 0 meant there was little correlation between the variables, while values closer to 1 or -1 represented stronger correlations.

In practice, most statisticians and researchers prefer to use  $r^2$ , the coefficient of determination as a measure of strength as it represents the proportion or percentage of the variability of  $Y$  that is explained by the variability of  $X$ .<sup>87</sup>

$r^2$

$$r^2 = \frac{SS_{\text{regression}}}{SS_{\text{Total}}} \quad 0 \leq r^2 \leq 100\%$$

$r^2$  represents the percentage of the variability of  $Y$  that is explained by the variability of  $X$ .



We can also calculate the correlation coefficient ( $r$ ) by taking the appropriate square root of  $r^2$ , depending on whether the estimate of the slope ( $b_1$ ) is positive or negative:

$$\text{If } b_1 > 0, r = \sqrt{r^2}$$

$$\text{If } b_1 < 0, r = -\sqrt{r^2}$$

#### ✓ Example: Rainfall and sales of sunglasses

For the rainfall data, the coefficient of determination is:

$$r^2 = \frac{341.422}{380} = 89.85\%$$

89.85% of the variability of sales of sunglasses is explained by rainfall.

We can calculate the correlation coefficient ( $r$ ) by taking the appropriate square root of  $r^2$ :

$$r = -\sqrt{.8985} = -0.9479$$

Here we take the negative square root since the slope of the regression line is negative. This shows that there is a strong, negative correlation between sales of sunglasses and rainfall.

3.3.6:  $r^2$ , The Correlation of Determination is shared under a CC BY-SA license and was authored, remixed, and/or curated by LibreTexts.

- 14.6:  $r^2$ , The Correlation of Determination by Maurice A. Geraghty is licensed CC BY-SA 4.0. Original source: <http://nebula2.deanza.edu/~mo/holisticInference.html>.