In the context of understanding the relationship between two variables, the expression for the linear correlation coefficient is given by:

\[
\rho = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}
\]

where \(\rho\) is the correlation coefficient, \(x\) and \(y\) are the variables, and \(\bar{x}\) and \(\bar{y}\) are their respective means.

For a dataset \(\{(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\}\), the calculation is as follows:

1. Calculate the mean of \(x\) and \(y\):
   \[\bar{x} = \frac{1}{n} \sum x_i, \quad \bar{y} = \frac{1}{n} \sum y_i\]
2. Compute the numerator:
   \[\sum (x_i - \bar{x})(y_i - \bar{y})\]
3. Compute the denominator:
   \[\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}\]
4. The correlation coefficient is:
   \[\rho = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}\]

The range of the correlation coefficient is between -1 and 1. A value close to 1 indicates a strong positive linear relationship, while a value close to -1 indicates a strong negative linear relationship. A value close to 0 indicates no linear relationship.

**Graphical Representation**

A scatter plot is used to visualize the relationship between two variables. The plot shows the points \((x_i, y_i)\) for each data point, and the slope of the line of best fit can be used to estimate the correlation coefficient.

**Reference**