



CORRELATION

DESCRIPTIVE STATISTICS

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TOPIC OUTLINE

Covariance

Correlation Coefficient



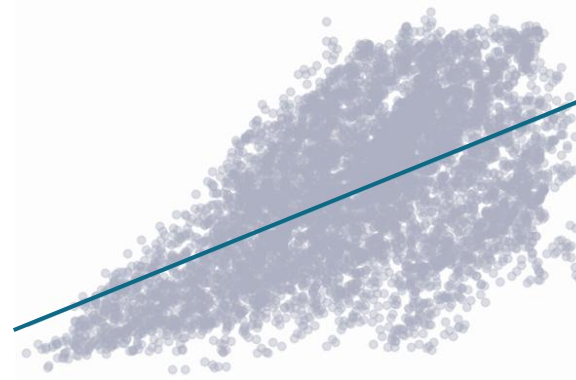
COVARIANCE



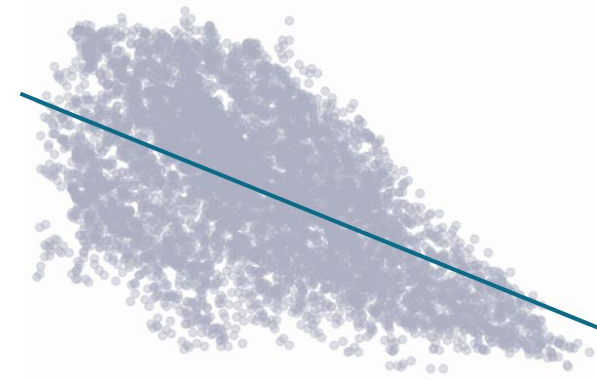
COVARIANCE

Covariance is a statistical measure that quantifies the relationship between two random variables (X, Y).

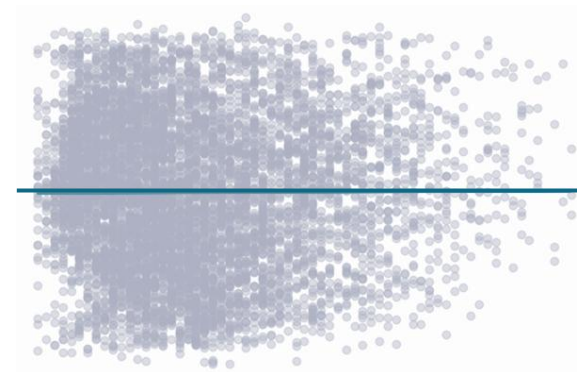
Scatter Plot:



Covariance > 0



Covariance < 0



Covariance $= 0$



COVARIANCE

Covariance is a statistical measure that quantifies the relationship between two random variables (X, Y).

Population Covariance:

$$\sigma_{xy} = \frac{\sum_{i=1}^N (x_i - \mu_x)(y_i - \mu_y)}{N}$$

Sample Covariance:

$$s_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{n - 1}$$



EXERCISE

The given dataset contains five observations of current (A) and corresponding power (W) measurements. Does **current** and **power** consumption have a positive, negative, or no **linear relationship**?

Solution:

Device	
Current	Power
2	100
3.5	200
1.8	90
4.2	210
2.7	110



CORRELATION COEFFICIENT



CORRELATION COEFFICIENT

Correlation coefficient adjusts covariance, so that the relationship between the two variables becomes easy and intuitive to interpret.

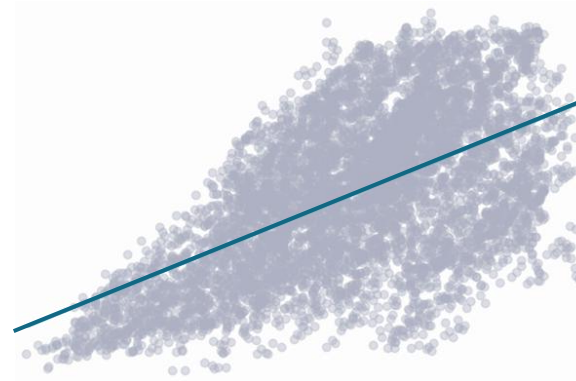
It ranges from -1 to $+1$:

$+1$ indicates perfect positive correlation

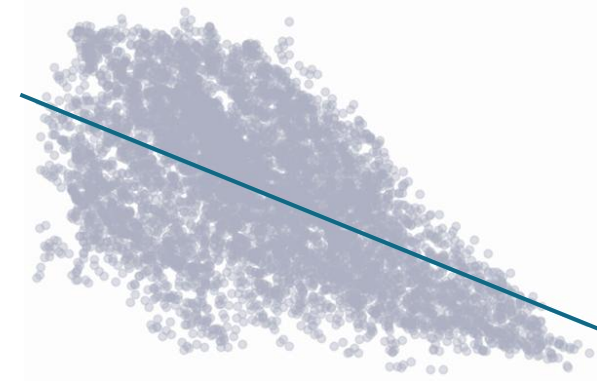
-1 indicates perfect negative correlation

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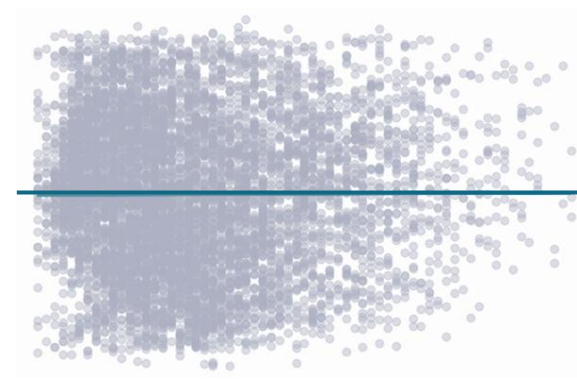
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Correlation > 0



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Correlation $= 0$



CORRELATION COEFFICIENT

Correlation coefficient adjusts covariance, so that the relationship between the two variables becomes easy and intuitive to interpret.

It ranges from **−1** to **+1**:

+1 indicates perfect positive correlation

−1 indicates perfect negative correlation

0 indicates no linear relationship

Population Correlation Coefficient:

$$r = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

Sample Correlation Coefficient:

$$r = \frac{s_{xy}}{s_x s_y}$$



EXERCISE

Determine if each scenario suggests a positive, negative, or no correlation:

1. Ice cream sales and umbrella sales in a city.
2. Hours spent studying and exam scores.
3. A person's shoe size and their IQ.
4. Age of a used car and its resale value.



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LABORATORY

