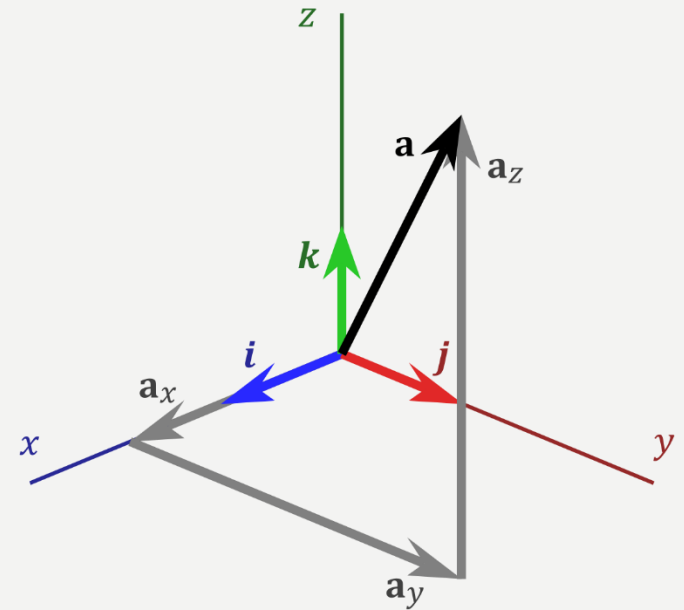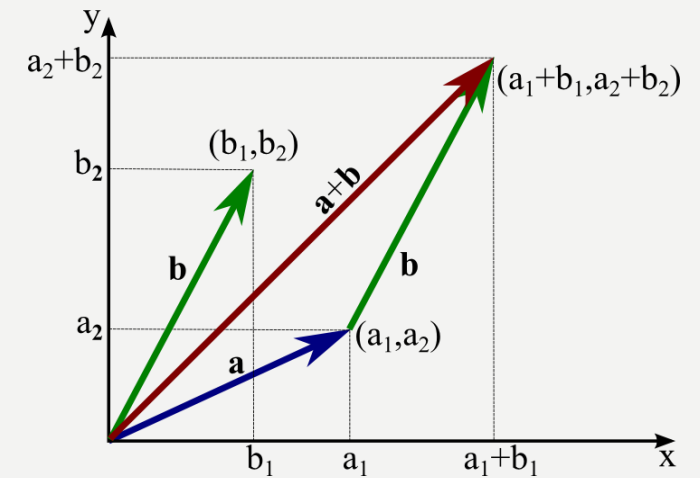# VECTOR OPERATIONS - PART 1

Math for Machine Learning

VECTOR OPERATIONS – PART 1

1. Vector Addition

2. Vector Subtraction

3. Multiplying a vector by a Scalar

4. Angle between 2 Vectors

VECTORS – COMPUTER SCIENCE APPROACH

Scalar

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Vector

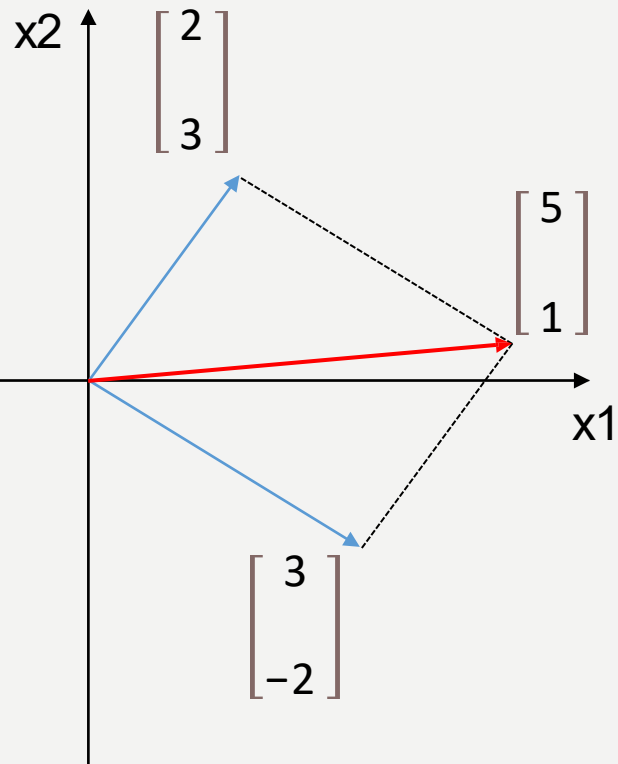$$\begin{bmatrix} 2 & -8 & 7 \end{bmatrix}$$

row

or
column

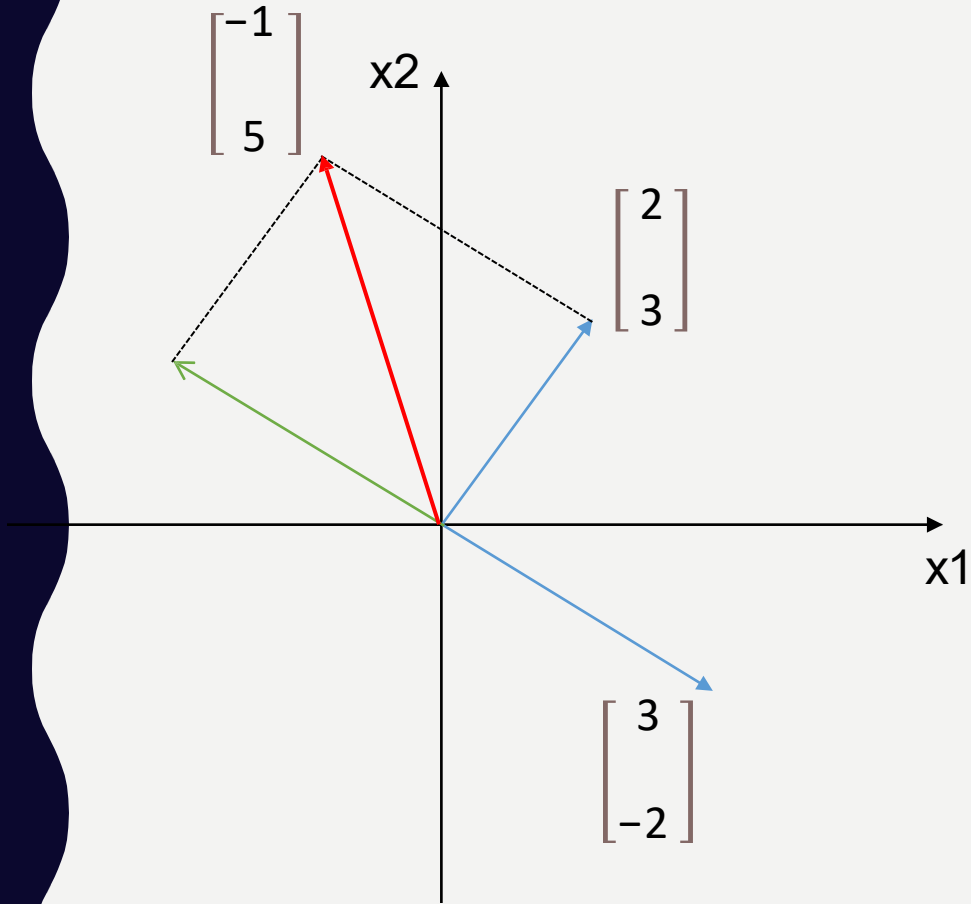$$\begin{bmatrix} -6 \\ -4 \\ 27 \end{bmatrix}$$

[89 66 23 94 28.1]

(Glucose, Blood Pressure, Skin Thickness, Insulin, BMI)

Vector Addition

$$\begin{bmatrix} 2 \\ 3 \end{bmatrix} + \begin{bmatrix} 3 \\ -2 \end{bmatrix} = \begin{bmatrix} 2+3 \\ 3+(-2) \end{bmatrix} = \begin{bmatrix} 5 \\ 1 \end{bmatrix}$$

Vector Subtraction
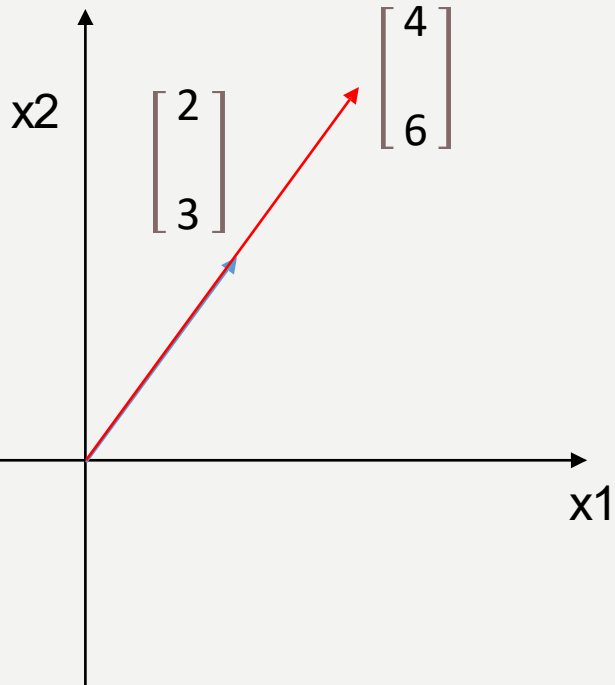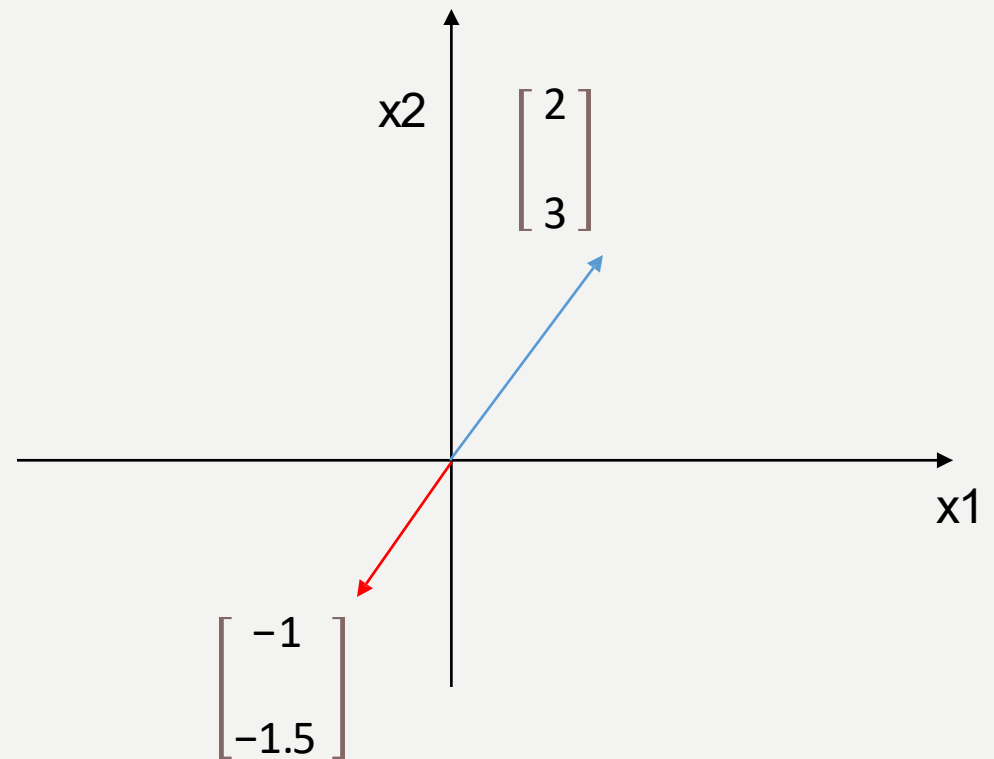

$$\begin{bmatrix} 2 \\ 3 \end{bmatrix} - \begin{bmatrix} 3 \\ -2 \end{bmatrix} = \begin{bmatrix} 2 - 3 \\ 3 - (-2) \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}$$

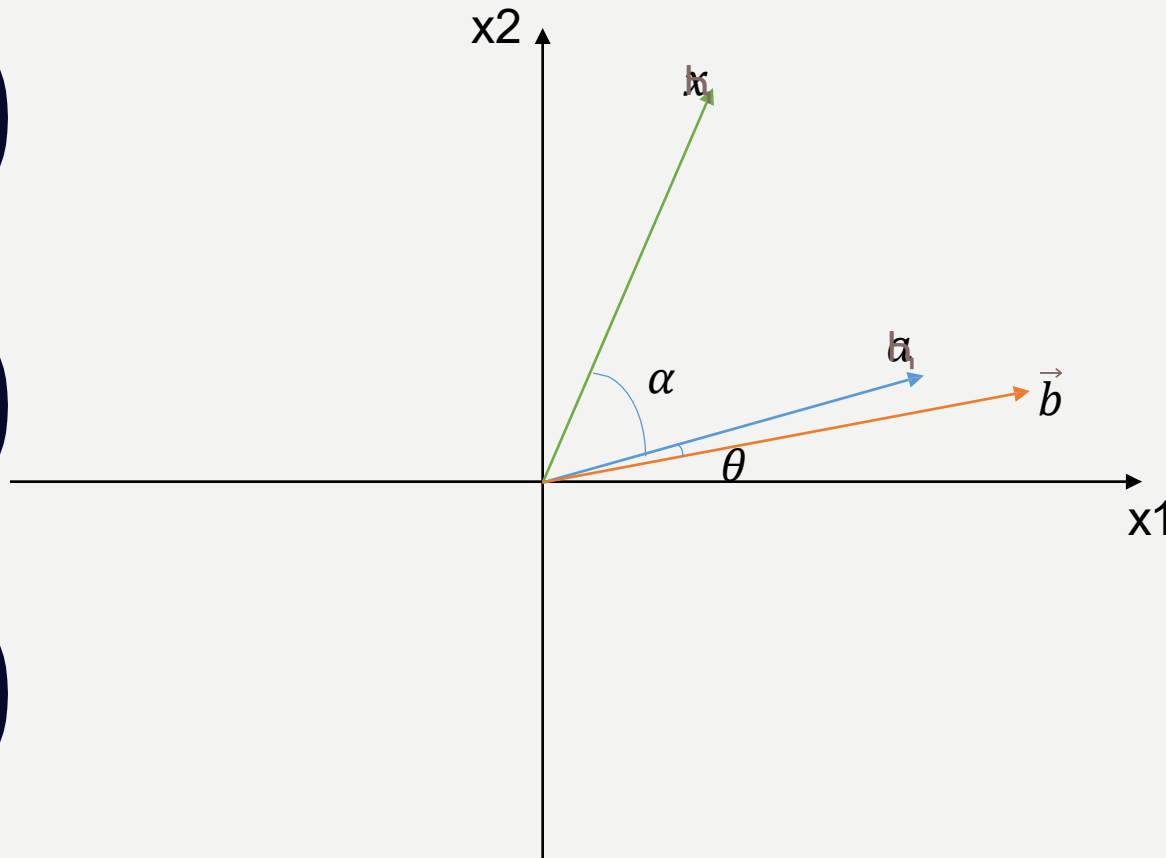# MULTIPLYING A VECTOR BY A SCALAR

$$2 \times \begin{bmatrix} 2 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$$

$$-0.5 \times \begin{bmatrix} 2 \\ 3 \end{bmatrix} = \begin{bmatrix} -1 \\ -1.5 \end{bmatrix}$$
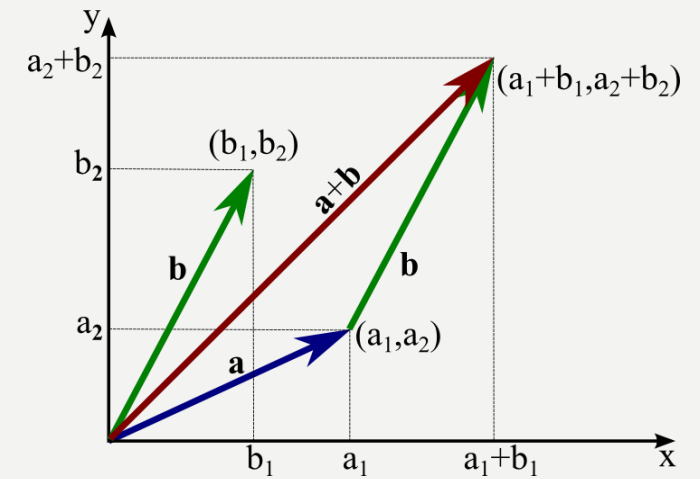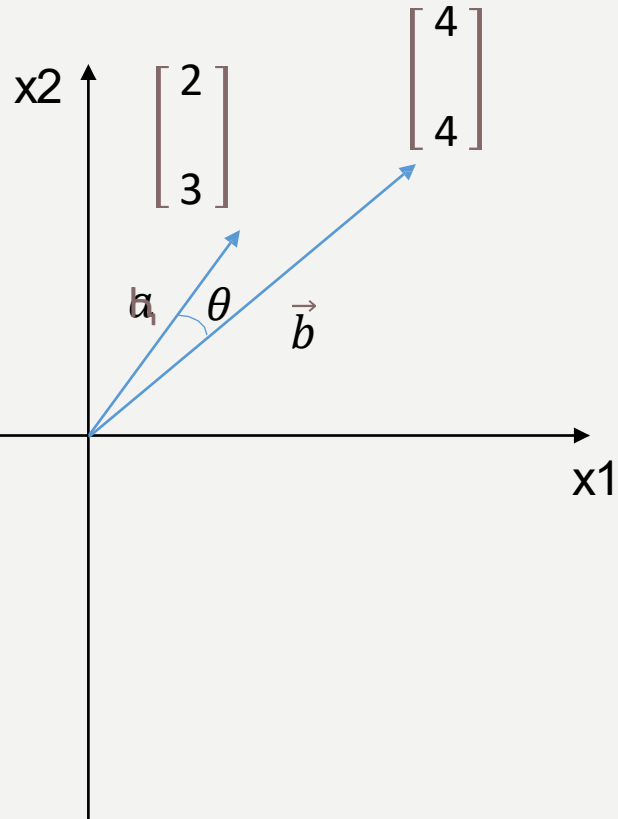
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ANGLE BETWEEN 2 VECTORS

Inference:

- ✓ If the angle between 2 vectors is small, then the 2 vectors are similar.

- ✓ If the angle between 2 vectors is large, then the 2 vectors are very different.

1. Dot Product of 2 Vectors

2. Cross Product of 2 Vectors

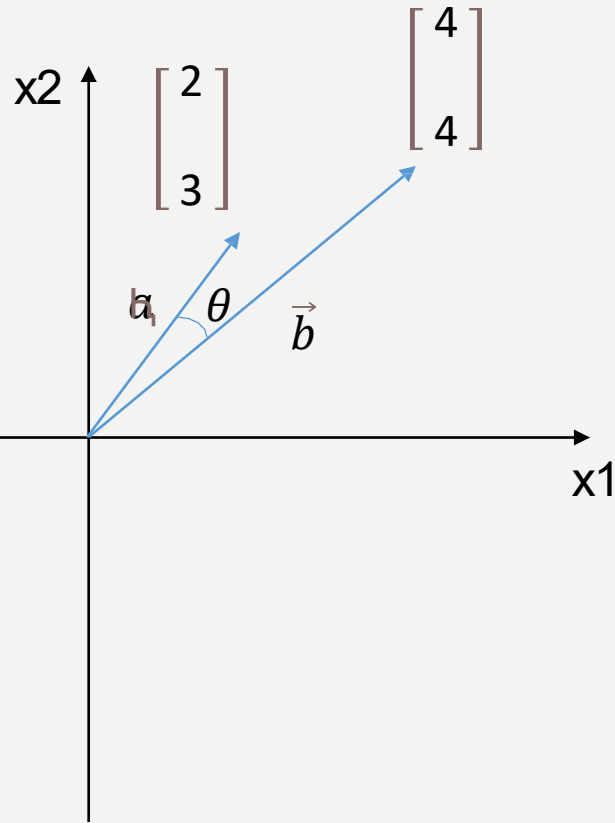3. Projection of vector

DOT PRODUCT OF 2 VECTORS

$$\begin{bmatrix} 2 \\ 3 \end{bmatrix} \bullet \begin{bmatrix} 4 \\ 4 \end{bmatrix} \quad = \quad (2 \times 4) + (3 \times 4) \quad = \quad 20$$

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$$

CROSS PRODUCT OF 2 VECTORS

$$\begin{bmatrix} 2 \\ 3 \end{bmatrix} \qquad \begin{bmatrix} 4 \\ 4 \end{bmatrix}$$

x2

$\vec{a}$ θ $\vec{b}$

x1

$$\vec{a} x \vec{b} = |\vec{a}| |\vec{b}| \sin \theta$$

$$\bar{a} \times \bar{b} = \begin{vmatrix} i & j & k \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = \begin{vmatrix} i & j & k \\ 2 & 3 & 0 \\ 4 & 4 & 0 \end{vmatrix} = i(3 \cdot 0 - 0 \cdot 4) - j(2 \cdot 0 - 0 \cdot 4) + k(2 \cdot 4 - 3 \cdot 4) = i(0 - 0) - j(0 - 0) + k(8 - 12) = \{0; 0; -4\}$$

CORRELATION & CAUSATION

Math for Machine Learning
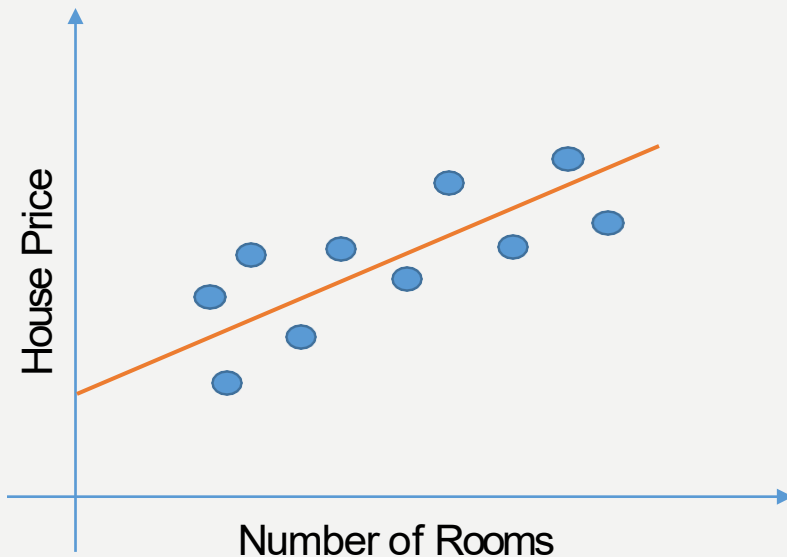
CORRELATION & CAUSATION

Data Analytics

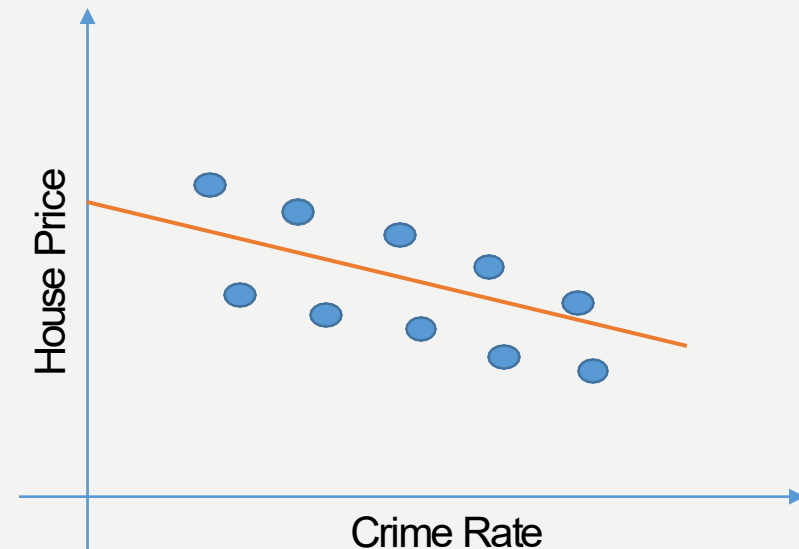*Relationship between the features in a Dataset*

CORRELATION

Correlation is a measure that determines the extent to which two variables are related to each other in a dataset. But it doesn't mean that one event is the cause of the other event.

Positive Correlation

House Price vs Number of Rooms

Negative Correlation

House Price vs Crime Rate

CAUSATION

In statistics, Causation means that one event causes another event to occur. Thus, there is a cause and effect relationship between the two variables in a dataset.