

Covariance matrix of a two-dimensional dataset

TOTAL POINTS 5

1. Compute the covariance matrix for the following dataset

1 / 1 point

$$\mathcal{D} = \left\{ \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 5 \\ 4 \end{bmatrix} \right\}$$

Here, every column vector represents a data point.

Do the exercise using pen and paper.

☒ $\begin{bmatrix} 4 & 2 \\ 2 & 1 \end{bmatrix}$

☐ $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$

☐ $\begin{bmatrix} 2 & 2 \\ 4 & 1 \end{bmatrix}$

✓ Correct
Good job!

2. $\begin{bmatrix} 3 & 2 \end{bmatrix}$

1 / 1 point

✓ Correct
Yes, every element in the covariance matrix is multiplied by 4.

3. Consider the data set $\mathcal{D} = \left\{ \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 7 \\ 4 \end{bmatrix} \right\}$ with covariance matrix $\begin{bmatrix} 9 & 3 \\ 3 & 1 \end{bmatrix}$.

1 / 1 point

Compute the new covariance matrix when we add $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$ to each element in \mathcal{D} .

☐ $\begin{bmatrix} 11 & 5 \\ 5 & 3 \end{bmatrix}$

☒ $\begin{bmatrix} 9 & 3 \\ 3 & 1 \end{bmatrix}$

☐ $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

✓ Correct
Good job!

5. We are looking at a data set \mathcal{D} where every element in \mathcal{D} consists of an x and y coordinate. The data covariance matrix is given by

1 / 1 point

$$\begin{bmatrix} 1 & 0.8 \\ 0.8 & 1 \end{bmatrix}$$

Which of the following statements is correct?

- ☒ x and y are positively correlated, i.e., when x increases then y increases on average, and vice versa.
- ☐ x and y are negatively correlated, i.e., when x increases then y decreases on average, and vice versa.
- ☐ x and y are uncorrelated, i.e., when x increases then y does not change on average (and vice versa).

✓ Correct
Well done!