

Covariance matrix of a two-dimensional dataset

Practice Quiz, 5 questions

5/5 points (100%)

✓ **Congratulations! You passed!**

Next Item



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point

1.
Compute the covariance matrix for the following dataset

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

Here, every column vector represents a data point.

Do the exercise using pen and paper.



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



Correct

Good job!



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



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



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2.
Consider a data set \mathcal{D} with covariance matrix $\begin{bmatrix} 3 & 2 \\ 2 & 4 \end{bmatrix}$.

What is the covariance matrix if we multiply every vector in \mathcal{D} by 2?



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$$\begin{bmatrix} 12 & 8 \\ 8 & 16 \end{bmatrix}$$

Correct

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



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



$$\begin{bmatrix} 16 & 8 \\ 8 & 12 \end{bmatrix}$$



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point

3.

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

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



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

Correct

Well done. The covariance will not change.



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



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



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point

4.

Provide a valid 2x2 covariance matrix by replacing the -1 entries in the code below.

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```
1 def covariance_matrix():
2     """Return a valid 2x2 covariance matrix"""
3     covariance_matrix = np.array([[9, 3],
4                                   [3, 1]])
5     return covariance_matrix
6
7 print(covariance_matrix())
```

5/5 points (100%)

Run

Reset

Correct Response

Good job!



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point

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

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

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.



Correct

Well done!



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).

