

# Projection onto a 1-dimensional subspace

4/5 points (80.00%)

Quiz, 3 questions

✓ **Congratulations! You passed!**

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points

1.

Compute the projection matrix that allows us to project any vector  $\mathbf{x} \in \mathbb{R}^3$  onto the subspace spanned by the basis vector  $\mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$ .

Do the exercise using pen and paper. You can use the formula slide that comes with the corresponding lecture.



$$\frac{1}{9} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 4 & 4 \\ 2 & 4 & 4 \end{bmatrix}$$

**Correct**

Well done!



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



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

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points

2.

Given the projection matrix

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$$\frac{1}{25} \begin{bmatrix} 0 & 0 & 0 \\ 12 & 0 & 16 \end{bmatrix}$$

project  $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$  onto the corresponding subspace, which is spanned by  $\mathbf{b} = \begin{bmatrix} 3 \\ 0 \\ 4 \end{bmatrix}$ .

Do the exercise using pen and paper.



$$\begin{bmatrix} 3 \\ 0 \\ 4 \end{bmatrix}$$



$$\frac{1}{25} \begin{bmatrix} 21 \\ 0 \\ 28 \end{bmatrix}$$

**Correct**

Good job!



$$\frac{1}{25} \begin{bmatrix} 5 \\ 10 \\ 10 \end{bmatrix}$$



$$\begin{bmatrix} 21 \\ 0 \\ 28 \end{bmatrix}$$

0 / 1  
points

3.

Now, we compute the **reconstruction error**, i.e., the distance between the original data point and its projection onto a lower-dimensional subspace.

Assume our original data point is  $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$  and its projection  $\frac{1}{9} \begin{bmatrix} 5 \\ 10 \\ 10 \end{bmatrix}$ . What is the reconstruction error?

0.2

**Incorrect Response**

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