Project 3D data onto a 2D subspace

Practice Quiz, 3 questions

6/6 points (100%)

Congratulations! You passed!

Next Item

4 / 4 points

1.

For a vector $\mathbf{x} = \begin{bmatrix} 6 \\ 0 \\ 0 \end{bmatrix}$ and the subspace U spanned by the basis vectors $\mathbf{b}_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $\mathbf{b}_2 = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$, which of the following statements are true?

You can use the formula slide that comes with the corresponding lecture.

- [ ] The coordinates of the projected point with respect to $\mathbf{b}_1, \mathbf{b}_2$ are $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$.

Un-selected is correct

- [ ] The projection matrix is $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 2 & 4 \end{bmatrix}$

Un-selected is correct

- [ ] The projection of $\mathbf{x}$ onto U is $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

Un-selected is correct

- [x] The projection of $\mathbf{x}$ onto U is $\begin{bmatrix} 5 \\ 2 \\ -1 \end{bmatrix}$

Correct

Well done.

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- [x] The projection matrix is not symmetric.

Un-selected is correct

- [x] The rank of the projection matrix is 1.

Un-selected is correct

- [x] The projection matrix is symmetric.

Correct
Projection matrices are always symmetric.

- [x] The projection matrix is $\frac{1}{6}\begin{bmatrix} 5 & 2 & -1 \\ 2 & 2 & 2 \\ -1 & 2 & 5 \end{bmatrix}$

Correct
Well done!

- [x] The coordinates of the projected point with respect to $\mathbf{b}_1, \mathbf{b}_2$ are $\begin{bmatrix} 5 \\ -3 \end{bmatrix}$.

Correct
Excellent job!

✔ 1 / 1 point

2.

Project $\begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$ onto the subspace spanned by $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$.

You can use the formula slide that comes with the corresponding lecture.

- [ ]

- $\begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$
- $\begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$
- $\begin{bmatrix} 6 \\ 4 \\ 4 \end{bmatrix}$
- $\begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$

Correct
Absolutely! The original vector is already in the subspace, so the projection has no effect.

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1 / 1 point

3.

1. Project $\begin{bmatrix} 12 \\ 0 \\ 0 \end{bmatrix}$ onto the subspace U_1 spanned by $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$.

2. Project the result from 1. onto the subspace spanned by $\begin{bmatrix} -10\sqrt{6} \\ -4\sqrt{6} \\ 2\sqrt{6} \end{bmatrix}$. What is the final projection?

Hint: For step 2. you do not necessarily need to compute anything.

You can use the formula slide that comes with the corresponding lecture.

- $\begin{bmatrix} 5 \\ 2\sqrt{6} \\ -1\sqrt{6} \end{bmatrix}$
- $\begin{bmatrix} 5 \\ 2\sqrt{6}+1 \\ -\sqrt{6}+2 \end{bmatrix}$
- $\begin{bmatrix} 10 \\ 4 \\ -2 \end{bmatrix}$

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Correct

Good job! The first projection already lies in the second subspace. Therefore, the second projection does not do anything.