Congratulations! You passed!

TO PASS 80% or higher

Keep Learning

GRADE 100%

Project 3D data onto a 2D subspace

TOTAL POINTS 6

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? **4 / 4 points**

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

- [ ] The projection of $\mathbf{x}$ onto U is $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$
- [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!
- [x] The projection of $\mathbf{x}$ onto U is $\begin{bmatrix} 5 \\ 2 \\ -1 \end{bmatrix}$

  Correct
  Well done.
- [x] The projection matrix is symmetric.

  Correct
  Projection matrices are always symmetric.
- [ ] The coordinates of the projected point with respect to $\mathbf{b}_1, \mathbf{b}_2$ are $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$.
- [ ] The rank of the projection matrix is 1.
- [ ] The projection matrix is not 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!
- [ ] The projection matrix is $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 2 & 4 \end{bmatrix}$

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

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

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

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

3. **1 / 1 point**

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.

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

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