

Assignment-1

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Abstract—This document explain the concept of projection of vector by solving a problem.

Download all python codes from

<https://github.com/vipulmalik8569/MT-EE5609>

and latex-tikz codes from

<https://github.com/vipulmalik8569/MT-EE5609>

1 PROBLEM

Find the projection of vector $\begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}$ on vector $\begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix}$

2 EXPLANATION

Projection of \mathbf{u} onto \mathbf{v} means the component of \mathbf{u} in the direction of \mathbf{v} .

This is given by the formula :

$$\mathbf{p} = \left(\frac{\mathbf{u}^T \mathbf{v}}{\|\mathbf{v}\|^2} \right) \mathbf{v} \quad (2.0.1)$$

where

$$\mathbf{u}^T \mathbf{v} = u_1 v_1 + u_2 v_2 + \cdots + u_n v_n \quad (2.0.2)$$

and

$$\|\mathbf{v}\|^2 = \sqrt{v_1^2 + v_2^2 + \cdots + v_n^2} \quad (2.0.3)$$

3 SOLUTION

We have,

$$\mathbf{u} = \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}, \mathbf{v} = \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix}$$

Using equation (2.0.1)

$$\mathbf{p} = \left[\frac{\begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}^T \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix}}{\left\| \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \right\|^2} \right] \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} \quad (3.0.1)$$

$$\mathbf{p} = \frac{13}{25} \begin{pmatrix} 7 \\ -1 \\ 8 \end{pmatrix} = \begin{pmatrix} \frac{92}{25} \\ -\frac{13}{25} \\ \frac{21}{5} \end{pmatrix} \quad (3.0.2)$$

Hence the projection of \mathbf{u} on \mathbf{v} is

$$\mathbf{p} = \begin{pmatrix} \frac{92}{25} \\ -\frac{13}{25} \\ \frac{21}{5} \end{pmatrix}$$