

Matrix theory Assignment 13

Shivangi Parashar

Abstract—This document contains the concept of linear transformations.

Download all python codes from

https://github.com/shivangi-975/EE5609-Matrix_Theory/tree/master/Assignment13/Codes

Download latex-tikz codes from

https://github.com/shivangi-975/EE5609-Matrix_Theory/blob/master/Assignment13/Assignment_13.tex

1 PROBLEM

Let \mathbf{T} and \mathbf{U} be the linear operators on \mathbb{R}^2 defined by $\mathbf{T}(x_1, x_2) = (x_2, x_1)$ and $\mathbf{U}(x_1, x_2) = (x_1, 0)$.

Give rules like the ones defining \mathbf{T} and \mathbf{U} for each of the transformations $\mathbf{U} + \mathbf{T}$, \mathbf{UT} , \mathbf{TU} , \mathbf{T}^2 , \mathbf{U}^2 . \mathbb{R}^2 into \mathbb{R}^2 is linear transformation?

2 SOLUTION

Let \mathbf{T} and \mathbf{U} defined by matrices \mathbf{A} and \mathbf{B} such that ,

$$\mathbf{T}(\mathbf{x}) = \mathbf{Ax}; \quad \mathbf{U}(\mathbf{x}) = \mathbf{Bx} \quad (2.0.1)$$

Where,

$$\mathbf{A} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \quad \mathbf{B} = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \quad (2.0.2)$$

Table 0 lists the summary of each Transformations.

Transformations	Matrix	Vector
$\mathbf{U} + \mathbf{T}$	$(\mathbf{B} + \mathbf{A}) = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$	$\begin{pmatrix} x_1 + x_2 \\ x_1 \end{pmatrix}$
\mathbf{UT}	$\mathbf{BA} = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$	$\begin{pmatrix} x_2 \\ 0 \end{pmatrix}$
\mathbf{TU}	$\mathbf{AB} = \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 \\ x_1 \end{pmatrix}$
\mathbf{T}^2	$\mathbf{A}^2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$
\mathbf{U}^2	$\mathbf{B}^2 = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$	$\begin{pmatrix} x_1 \\ 0 \end{pmatrix}$

TABLE 0: Summary