Assignment 1

Venkatesh E

***Abstract*—This document explains the concept of finding the angle between the two vectors**

Download all python codes from

https://github.com/venkateshelangovan/IIT−Hyderabad−Assignments/blob/master/Assignment%201%20Matrix%20Theory%20.ipynb

and latex-tikz codes from

https://github.com/venkateshelangovan/IIT−Hyderabad−Assignments

1 Problem

Find the angle between the vectors $\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$

2 Angle between the two vectors :

Consider the two vectors , a and b ,

Dot product between two vectors a and b is given by ,

$$\mathbf{a}^T\mathbf{b} = \|\mathbf{a}\|\,\|\mathbf{b}\|\cos\theta \tag{2.0.1}$$

Where angle between the vectors a and b is denoted by θ

3 Solution

Let , a=$\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$ b = $\begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$

Angle between the vectors is given by,

$$\theta = \cos^{-1}\left(\frac{\mathbf{a}^T\mathbf{b}}{\|\mathbf{a}\|\|\mathbf{b}\|}\right) \tag{3.0.1}$$

$$\|\mathbf{a}\| = \sqrt{1^2 + (-2)^2 + 3^2} = \sqrt{14} \tag{3.0.2}$$

$$\|\mathbf{b}\| = \sqrt{3^2 + (-2)^2 + 1^2} = \sqrt{14} \tag{3.0.3}$$

$$\mathbf{a}^T\mathbf{b} = (1)(3) + (-2)(-2) + (3)(1) = 10 \tag{3.0.4}$$

$$\theta = \cos^{-1}\left(\frac{10}{(\sqrt{14})(\sqrt{14})}\right) \tag{3.0.5}$$

$$= \cos^{-1}\left(\frac{10}{14}\right) \tag{3.0.6}$$

$$\theta = 44^\circ \tag{3.0.7}$$

***Result* :**

Angle between the vectors a and b is :

$$\theta = 44^\circ$$