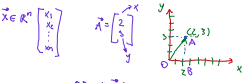
Magnitude and Unit Vectors

Vector length — unit vector —> vector has a length of 1

$\vec{x} \in \mathbb{R}^n \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$ $\vec{A} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$



$OB = \|\vec{A}\|$

$= \sqrt{(OA)^2 + OB^2}$

$= \sqrt{x_1^2 + y_1^2}$

$\|\vec{A}\| = \sqrt{4+9} = \sqrt{13}$

$\vec{v} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ $\|\vec{v}\| = \sqrt{x_1^2 + x_2^2 + x_3^2}$

General formula magnitud of vector

$\|\vec{x}\| = \sqrt{x_1^2 + x_2^2 + \dots + x_n^2}$ → vector length

UNIT VECTOR

$\|\vec{u}\| = 1 \rightarrow \hat{u}$

$\vec{v} = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix} \rightarrow \hat{\mu} \rightarrow \|\hat{u}\| = 1$

$\hat{u} = \frac{1}{\|\vec{v}\|} \cdot \vec{v}$ → this is scalar multiplication

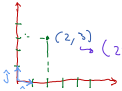
$\vec{v} = \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix} \in \mathbb{R}^3$

$\|\vec{v}\| = \sqrt{1^2 + 2^2 + 0^2} = \sqrt{5}$

$\hat{u} = \frac{1}{\sqrt{5}} \cdot \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} \\ 0 \end{bmatrix}$

$\|\hat{u}\| = \sqrt{\left(\frac{1}{\sqrt{5}}\right)^2 + \left(\frac{2}{\sqrt{5}}\right)^2 + 0^2}$

$= \sqrt{\frac{1}{5} + \frac{4}{5} + 0} = \sqrt{\frac{5}{5}} = 1 = \hat{u}$ unit vector



→ $2\hat{i} + 3\hat{j}$ → unit vectors

NORMALIZATION —> Vector size —> Vector length 1