

演示报告 (内容为示例简述特征向量)
标题小字 (示例全英, 可自行修改为中文)

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- 1 图片与枚举示例
- 2 公式显示示例 Vector in Geometry
- 3 公式显示示例 Determinant in Geometry
- 4 公式显示示例 Eigenvalue in Geometry
- 5 参考文献示例 Refference



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Review of Higher Algebra



■ Full of matrix



Review of Higher Algebra



- Full of matrix
- No geometric graphics at all

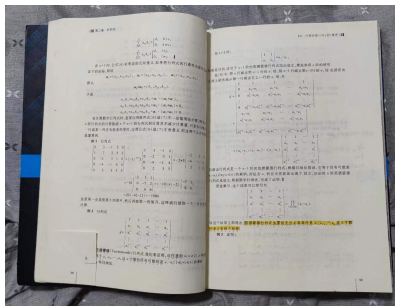


Review of Higher Algebra



- Full of matrix
- No geometric graphics at all
- Not intuitive





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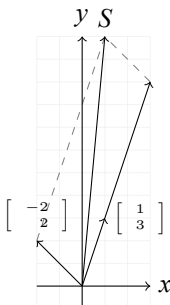
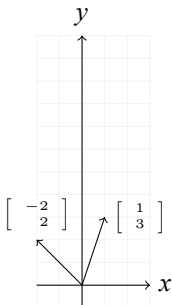


演示报告 (内容为示例简述特征向量)

Vector

Column picture:

$$x \begin{bmatrix} 1 \\ 3 \end{bmatrix} + y \begin{bmatrix} -2 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 \\ 11 \end{bmatrix} \quad (2)$$



Where we take

$$\begin{bmatrix} -2 \\ 2 \end{bmatrix} \text{ and } \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

as vectors,

when $x = 3$, $y = 1$
 ,the $b = \begin{bmatrix} 1 \\ 11 \end{bmatrix}$



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Coefficient matrix

$$\begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \cdots \\ \cdots \end{bmatrix} \text{ or } \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} \cdots \\ \cdots \end{bmatrix}$$

Coefficient matrix $A = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$ is also a rectangular matrix.

$$\det(A) = \begin{vmatrix} 3 & 1 \\ 0 & 2 \end{vmatrix} = 6$$

Obvious matrix A has two vectors: $\begin{bmatrix} 3 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \end{bmatrix}$

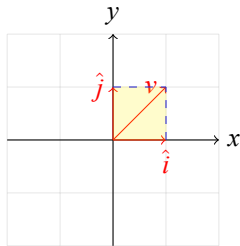


Hence, we can tell that

$$\begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix}$$

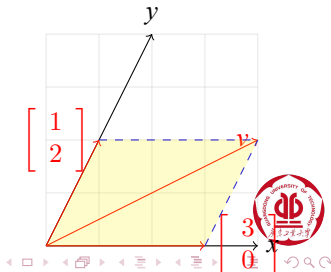
Which is actually the original two-dimensional space of the unit vector is linearly transformed. $\rightarrow \times \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$

$$\hat{i} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \rightarrow \begin{bmatrix} 3 \\ 0 \end{bmatrix}, \quad \hat{j} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \rightarrow \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$



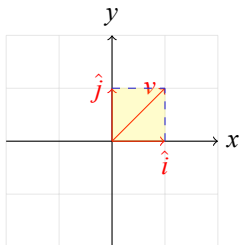
\Rightarrow

Area : $1 \rightarrow 6$



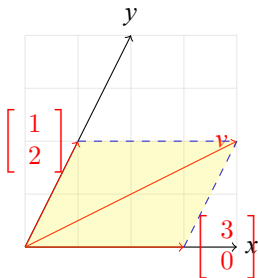
Determinant in Geometry

Since $\begin{vmatrix} 3 & 1 \\ 0 & 2 \end{vmatrix} = 6$, Area : $1 \rightarrow 6$



\Rightarrow

Area scaled
by **6** times.



We can conclude that :

The Determinant in Geometry is how much are areas scaled.

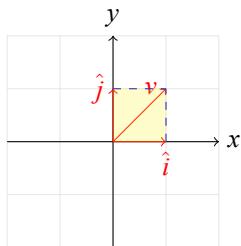


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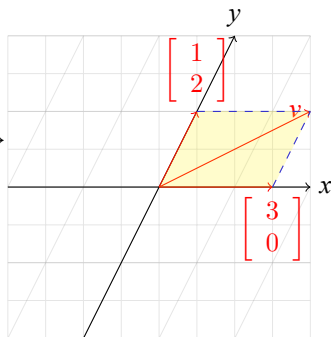


Vectors remain on their own span

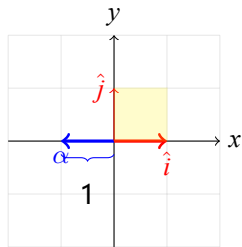


linearly transformed.

$$\rightarrow \times \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \rightarrow$$

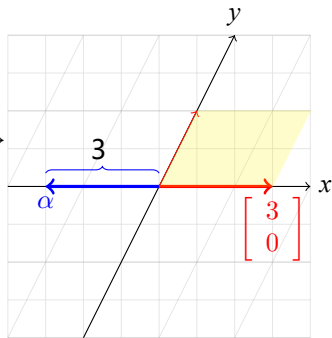


Vectors remain on their own span



linearly transformed.

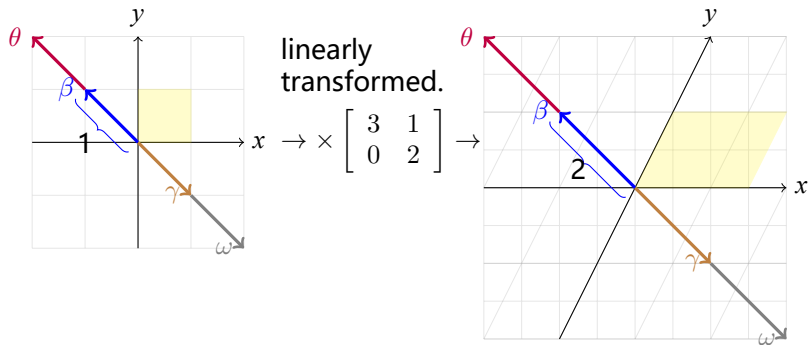
$$\rightarrow \times \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \rightarrow$$



$\vec{\alpha}$ remains on the line of the x-axis, stretched by a factor of 3.



Vectors remain on their own span

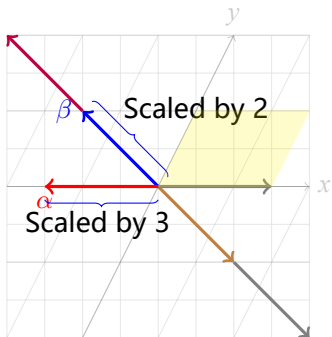


$\vec{\beta}$ remains on the line of the x-axis, stretched by a factor of 2.

The other vectors (γ, θ, ω) on the line are also stretched by a factor of **2**



Eigenvalue & Eigenvector

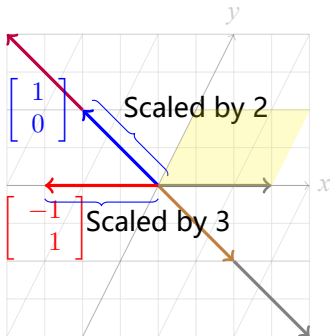


The vector representing these lines are

$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$



Eigenvalue & Eigenvector



$$A = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$$

The vector representing the line is called the eigenvector of the matrix A.

特征向量: $\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

The eigenvalue of the matrix A is just the factor by which it stretched or squashed during the transformation.

特征值: 2, 3



Eigenvalue & Eigenvector

So maybe you can tell why we can get eigenvalue of matrix from this equation:

$$Ax = \lambda x$$



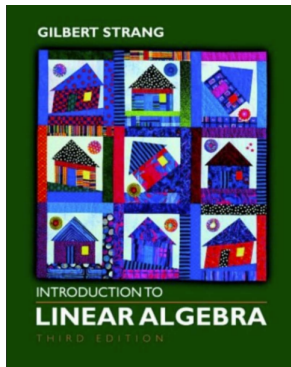
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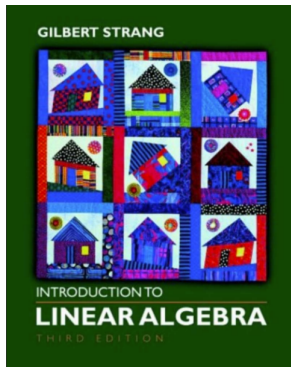
Refference

■ Introduction to Linear Algebra(Strang)



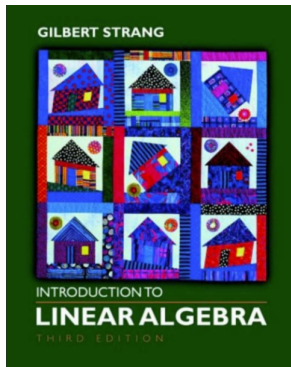
Refference

- Introduction to Linear Algebra(Strang)
- Essense of Linear Algebra @3Blue1Brown



Refference

- Introduction to Linear Algebra(Strang)
- Essense of Linear Algebra @3Blue1Brown
- Linear algebra and its applications 4th



Acknowledgements

Thank you for listening!

