Linear Algebra for Data Science & Machine Learning in Python

Determinants

DETERMINANT

Determinant: is function mapping matrix to real scalars

Determinant: can be computed only for square matrices

Determinant of a 2 x 2 matrix gives the area

Determinant of a 3 x 3 matrix gives the volume

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$$M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$2 \times 2$$

$$M = \begin{bmatrix} 5 & 1 \\ 4 & 2 \end{bmatrix}$$

$$2 \times 2$$

$$det(M) = |M| = a*d - b*c$$

$$det(M) = 5*2 - 1*4$$

$$= 10 - 4$$

$$= 6$$

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DETERMINANT

$$M = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

$$\begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$$

$$3 \times 3$$

$$|M| = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$$

$$|M| = a(e*i - f*h) - b(d*i - f*g) + c(d*h - e*g)$$

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$$M = \begin{bmatrix} 2 & 3 & 4 \\ -1 & 5 & -3 \\ 3 & -1 & 4 \end{bmatrix}$$

$$|M| = 2\begin{vmatrix} 5 & -3 \\ -1 & 4 \end{vmatrix} - 3\begin{vmatrix} -1 & -3 \\ 3 & 4 \end{vmatrix} + 4\begin{vmatrix} -1 & 5 \\ 3 & -1 \end{vmatrix}$$

$$|M| = 2(5*4 - (-3*-1)) - 3(-1*4 - (-3*3)) + 4(-1*-1 - 5*3)$$

$$|M| = 2(20 - 3) - 3(-4 - (-9)) + 4(1 - 15)$$

$$2(20 - 3) - 3(-4 + 9) + 4(1 - 15)$$

$$2(17) - 3(5) + 4(-14) \quad = 34 - 15 - 56 \quad = -37$$

DETERMINANT

Determinant of 2 x 2 matrix:

$$|M| = a * d - b * c$$

Determinant of 3 x 3 matrix:

$using\ |M|of\ 2 \times 2\ submatrices$

Determinant of 4 x 4 matrix:

$using\ |M|of\ 3 \times 3\ submatrices$

Determinant of n x n matrix:

$using\ |M|of\ (n-1) \times (n-1)\ submatrices$

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DETERMINANT

$$M = \begin{bmatrix} a_{11} & a_{12} & . & . & a_{1n} \\ a_{21} & a_{22} & . & . & a_{2n} \\ . & . & . & . & . \\ . & . & . & . & . \\ a_{n1} & a_{n2} & . & . & a_{nn} \end{bmatrix}$$

Its better to select a row or column of matrix which contains many zeros

Determinant: can be positive, negative or zero

A matrix with Determinant as zero is a singular matrix

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