Linear Algebra

 Romeo Kienzler

Scalar

Scalar

1

Scalar

1

5

Scalar

1

5

23

Scalar

1

5

23

42

Scalar

1

5

23.5

23

42

Vector

(0,1,1,2)

Vector

(0,1,1,2)

(3,5,8)

Vector

(0,1,1,2)

(3,5,8,13)

(3,5,8)

Tuple

Tuple

(0,1,1,2)

Tuple

(0,1,1,2)

(0,1,2.1,2.3)

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Matrix

Matrix

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

Matrix

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

(1,5,1,2,7)
(0,1,1,4,2)

Matrix

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

(1,5,1,2,7)
(0,1,1,4,2)

n - columns
m - rows

Matrix

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

(1,5,1,2,7)
(0,1,1,4,2)

n - columns
m - rows

m - by - n

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Matrix

3 - by - 4

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

(1,5,1,2,7)
(0,1,1,4,2)

n - columns
m - rows

m - by - n

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Matrix

3 - by - 4

(0,1,1,2)
(1,5,1,2)
(0,1,1,4)

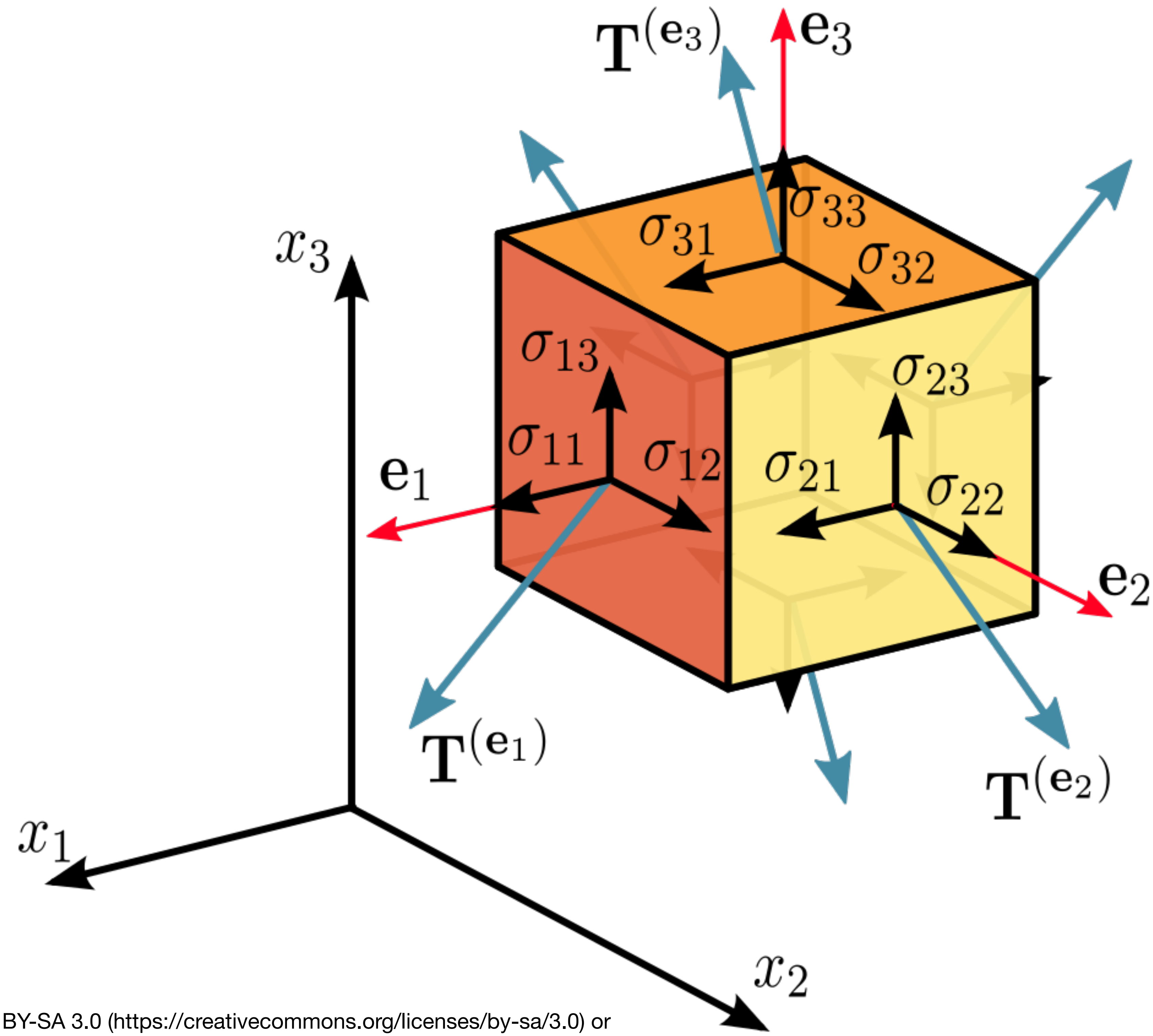
2 - by - 5

(1,5,1,2,7)
(0,1,1,4,2)

n - columns
m - rows

m - by - n

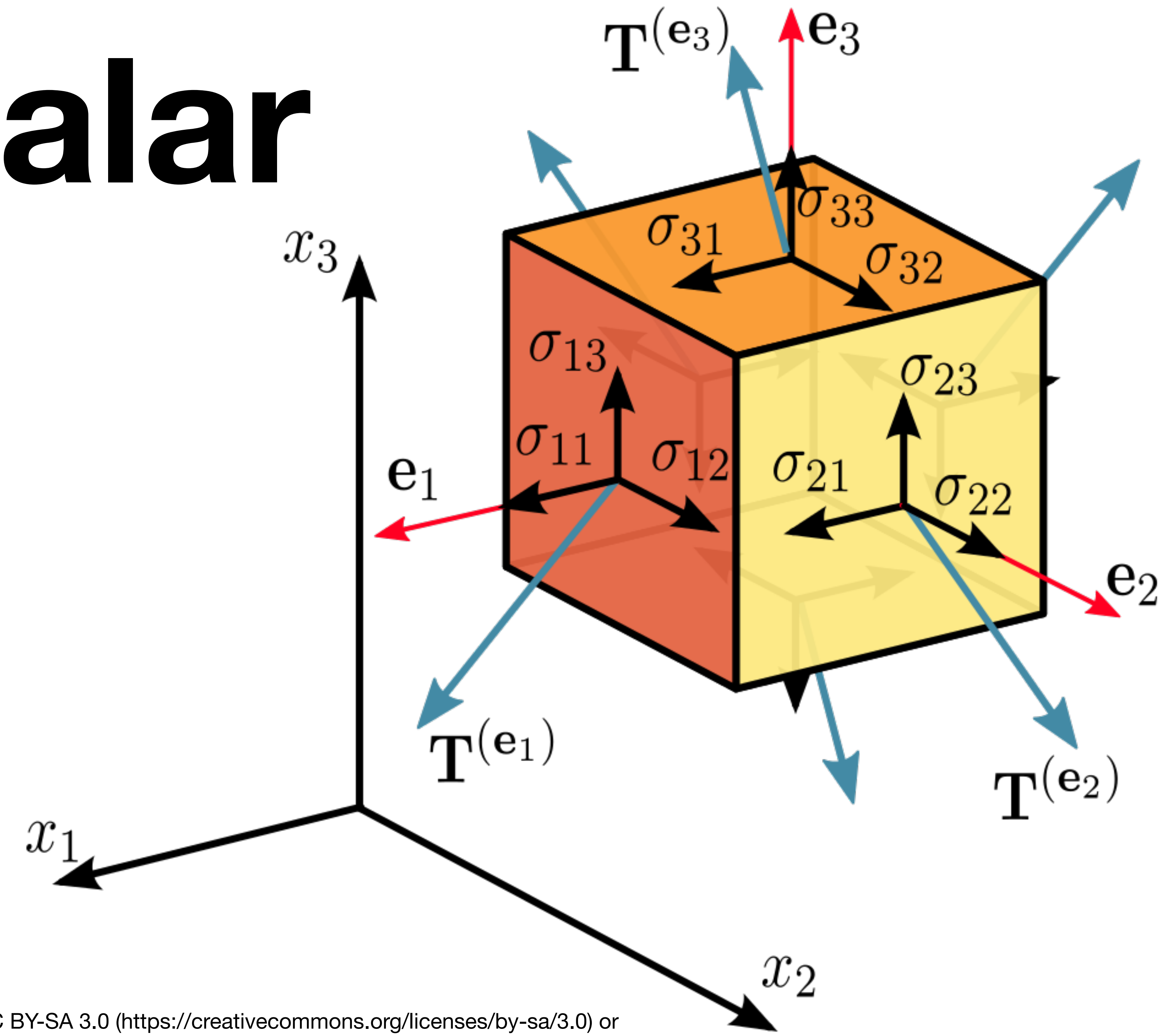
Tensor



$\mathbf{T}^{(\mathbf{e}_3)}$
$\mathbf{e}_3$
σ_{33}
σ_{31}
σ_{32}
x_3
σ_{13}
σ_{23}
σ_{11}
σ_{12}
σ_{21}
σ_{22}
$\mathbf{e}_1$
$\mathbf{e}_2$
$\mathbf{T}^{(\mathbf{e}_1)}$
$\mathbf{T}^{(\mathbf{e}_2)}$
x_1
x_2

Tensor

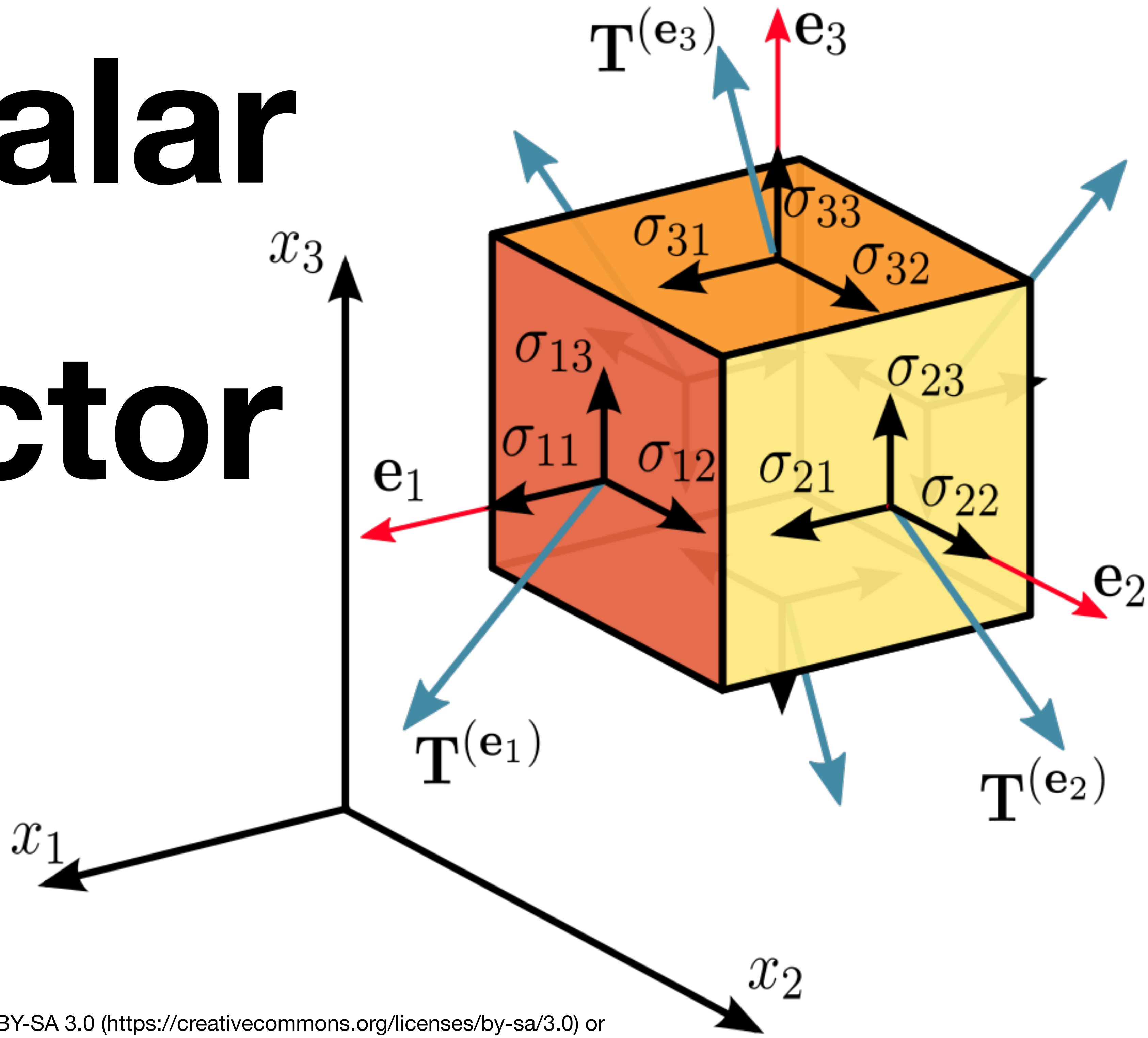
Scalar



Tensor

Scalar

Vector

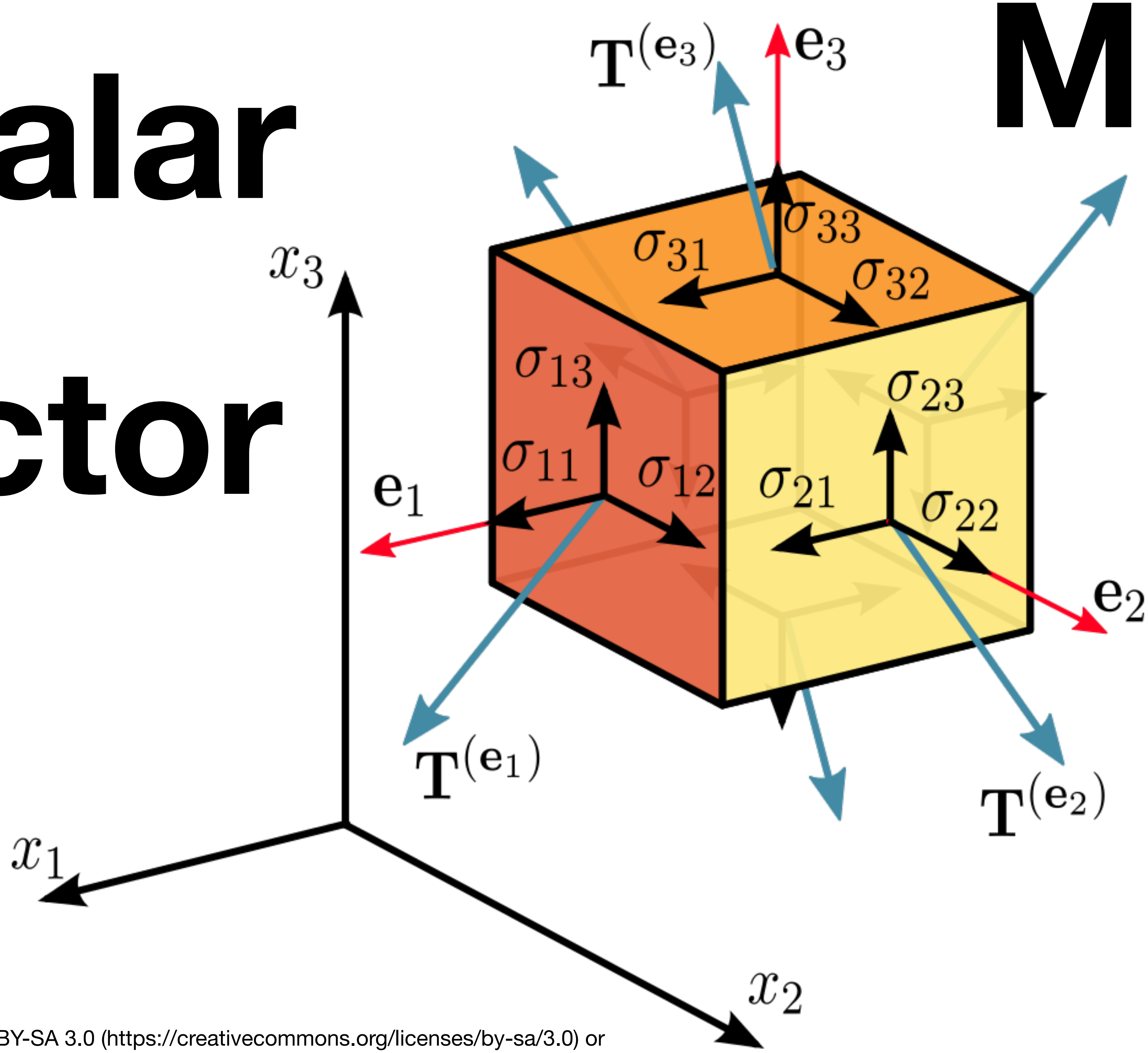


Tensor

Matrix

Scalar

Vector



Multiplication

Scalar Multiplication

$$2 * 3 = 6$$

a3_m1_v1_ex1_1

Scalar Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix}$$

Vector Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix} = 0 * 2$$

Vector Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix} = 0 * 2 \quad 1 * 7$$

Vector Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix} = 0 * 2 \quad 1 * 7 \quad 3 * 13 \quad 6 * 20$$

Vector Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix} = 0 * 2 + 1 * 7 + 3 * 13 + 6 * 20$$

Vector Multiplication

$$\begin{bmatrix} 0 \\ 1 \\ 3 \\ 6 \end{bmatrix} * \begin{bmatrix} 2 \\ 7 \\ 13 \\ 20 \end{bmatrix} = 0 * 2 + 1 * 7 + 3 * 13 + 6 * 20 = 166$$

Vector Multiplication

$$\begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_m \end{bmatrix} * \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_m \end{bmatrix} = a_1 * x_1 + a_2 * x_2 + a_3 * x_3 + a_4 * x_4$$

a3_m1_v1_ex1_2

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1 * 2 \\ \\ \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1 * 2 \\ \\ \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1 * 2 \\ \\ \end{bmatrix}$$

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Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1 * 2 & 1 * 3 & \\ & & \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1*2 & 1*3 & 13*5 \\ & & \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1*2 & 1*3 & 13*5 \\ 6*2 & 1*3 & 17*5 \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1 * 2 + 1 * 3 + 13 * 5 \\ 6 * 2 + 1 * 3 + 17 * 5 \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} 1 & 1 & 13 \\ 6 & 1 & 17 \end{bmatrix} * \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} 1*2+1*3+13*5 \\ 6*2+1*3+17*5 \end{bmatrix} = \begin{bmatrix} 70 \\ 100 \end{bmatrix}$$

Vector Matrix Multiplication

$$\begin{bmatrix} a & b & c \\ \vdots & & \\ d & e & f \end{bmatrix} * \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} a*x+b*y+c*z \\ \vdots \\ d*x+e*y+f*z \end{bmatrix}$$

a3_m1_v1_ex1_3

Deep Feedforward Networks

