



Tensors

Deep Learning Pre-Work

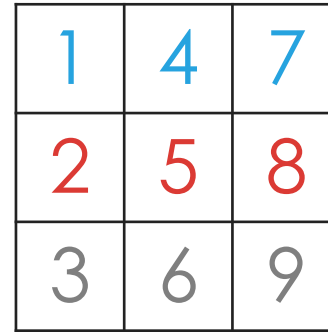
Tensors



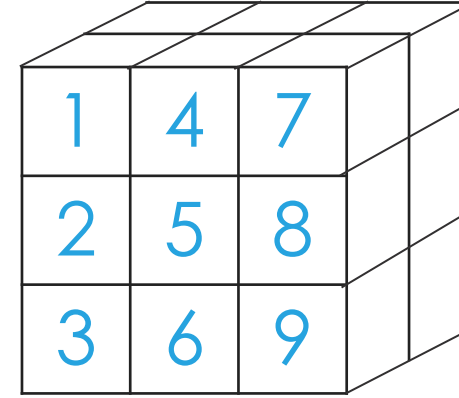
Scalar



Vector



Matrix



Cube

Tensors



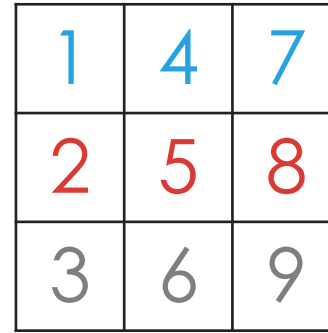
Scalar
Tensor
rank 0

e.g.,



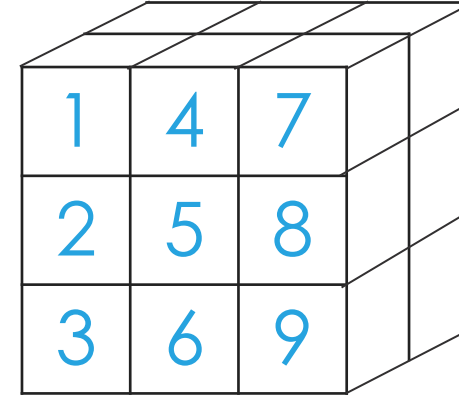
Vector
Tensor
rank 1

[3]



Matrix
Tensor
rank 2

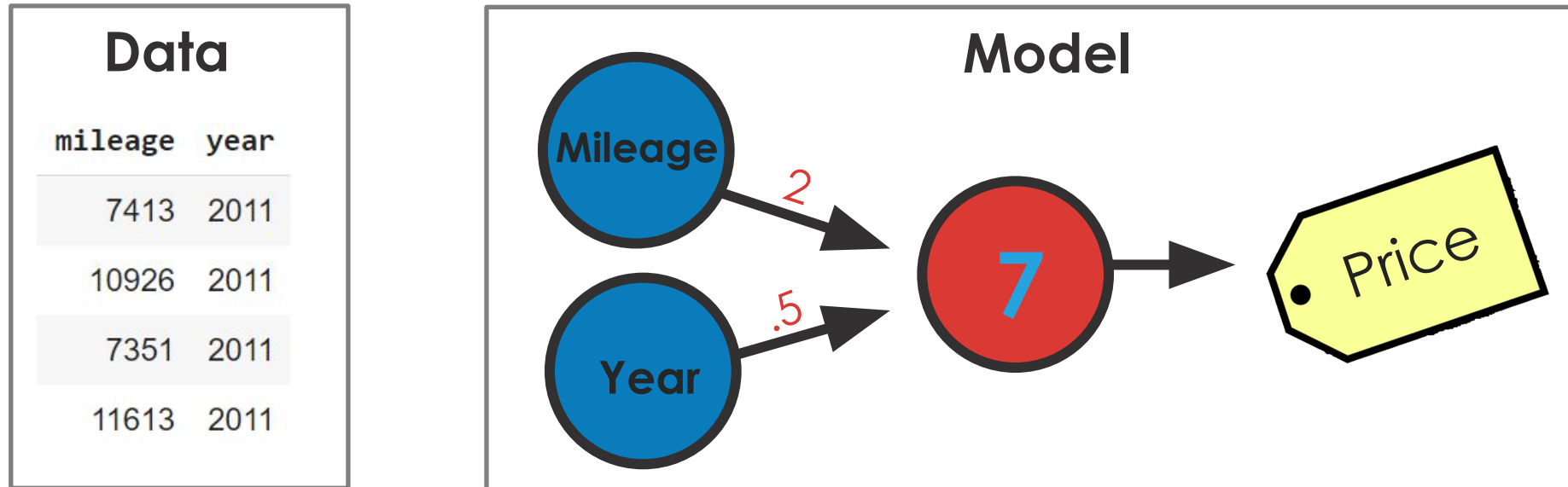
[1,3]



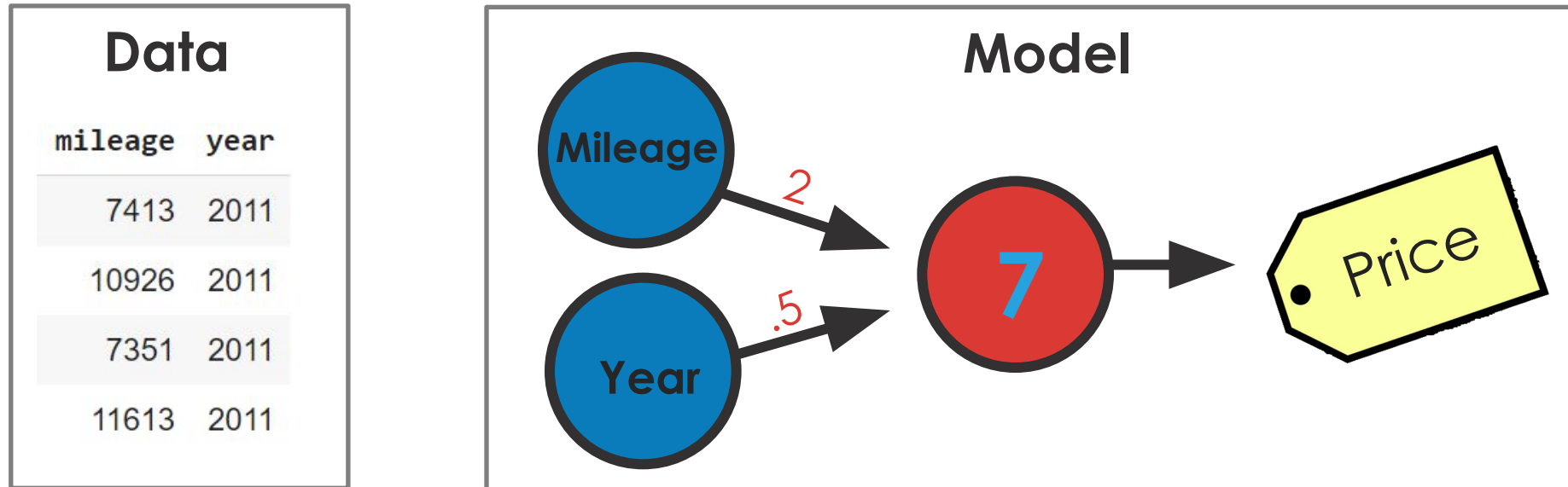
Cube
Tensor
rank 3

[1,3,1]

Tensors in Deep Learning



Tensors in Deep Learning

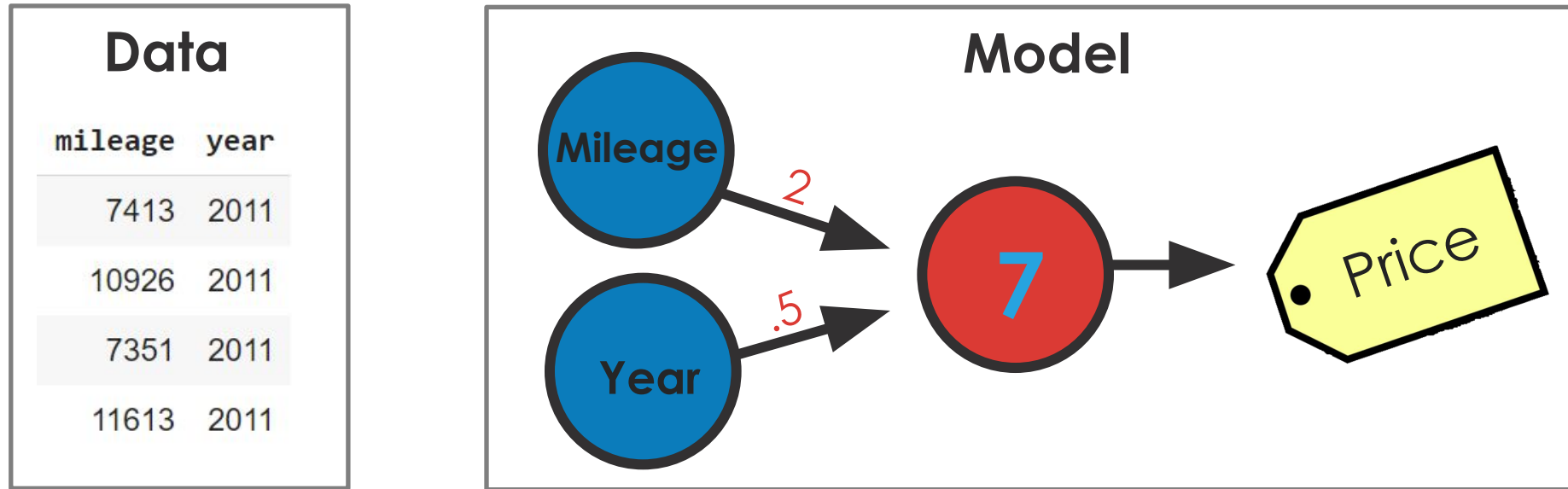


Equation

$$X * \text{Weight} + \text{Bias}$$

$$\begin{pmatrix} 7,413 & 2011 \\ 10,926 & 2011 \\ 7351 & 2011 \\ 11,613 & 2011 \end{pmatrix} * \begin{pmatrix} 2 \\ .5 \end{pmatrix} + 7 = \begin{pmatrix} 15,839 \\ 22,865 \\ 15,714 \\ 22,239 \end{pmatrix}$$

Tensors in Deep Learning



Tensor rank 2

$$\begin{bmatrix} 7,413 & 2011 \\ 10,926 & 2011 \\ 7351 & 2011 \\ 11,613 & 2011 \end{bmatrix}$$

Tensor rank 1

$$\begin{bmatrix} 2 \\ .5 \end{bmatrix}$$

Tensor rank 0

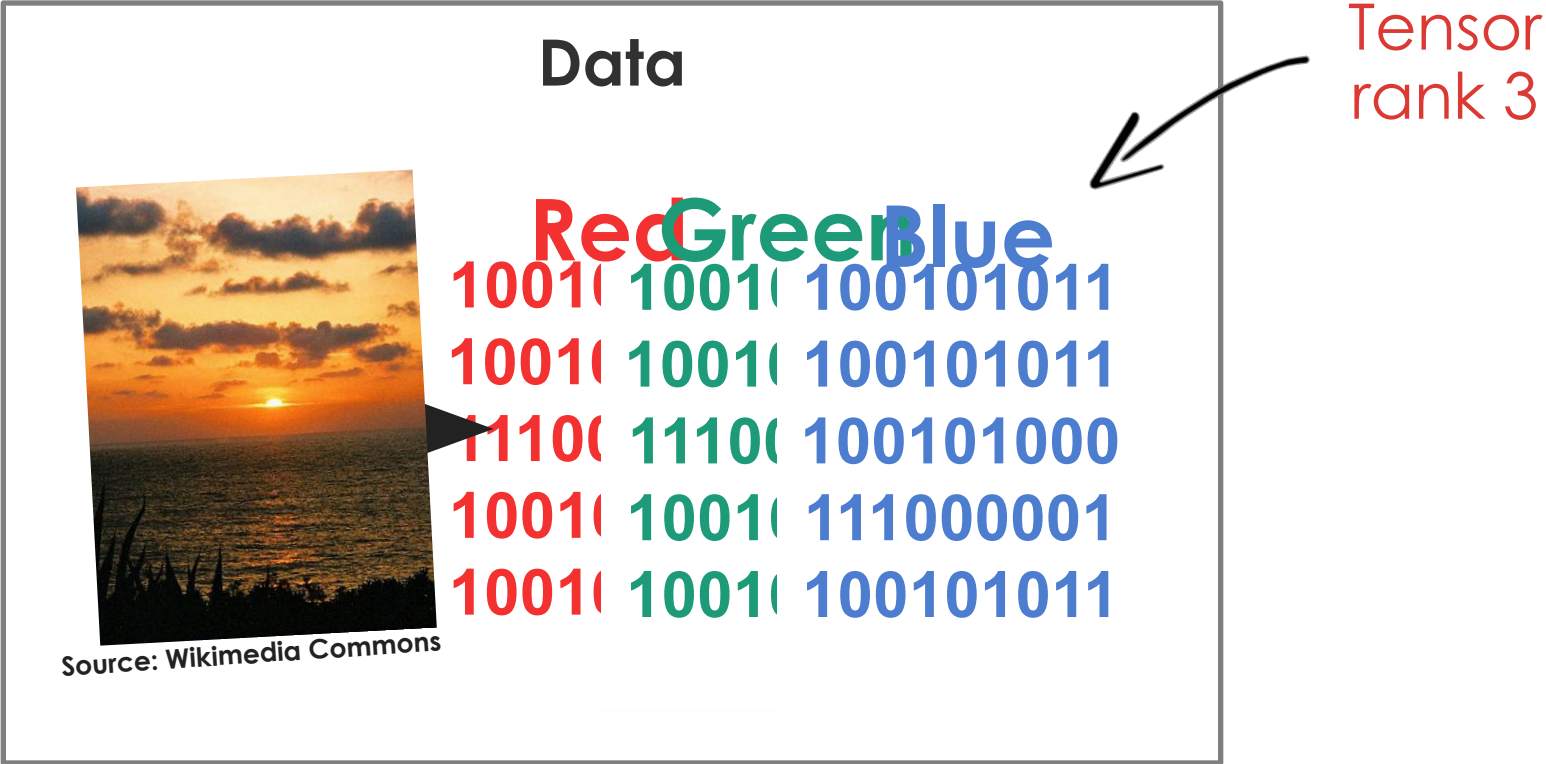
$$+ 7$$

Tensor rank 1

$$= \begin{bmatrix} 15,839 \\ 22,865 \\ 15,714 \\ 22,239 \end{bmatrix}$$

The equation shows the calculation of the Price output. A 4x2 matrix of input data (rank 2) is multiplied by a 2x1 vector of weights (rank 1). The result is a 4x1 vector of values (rank 1), which is then added to a scalar bias of 7 (rank 0) to produce the final Price output vector (rank 1).

Tensors in Deep Learning





Tensor rank 2

Tensor rank 1

Tensor rank 0

Tensor rank 1

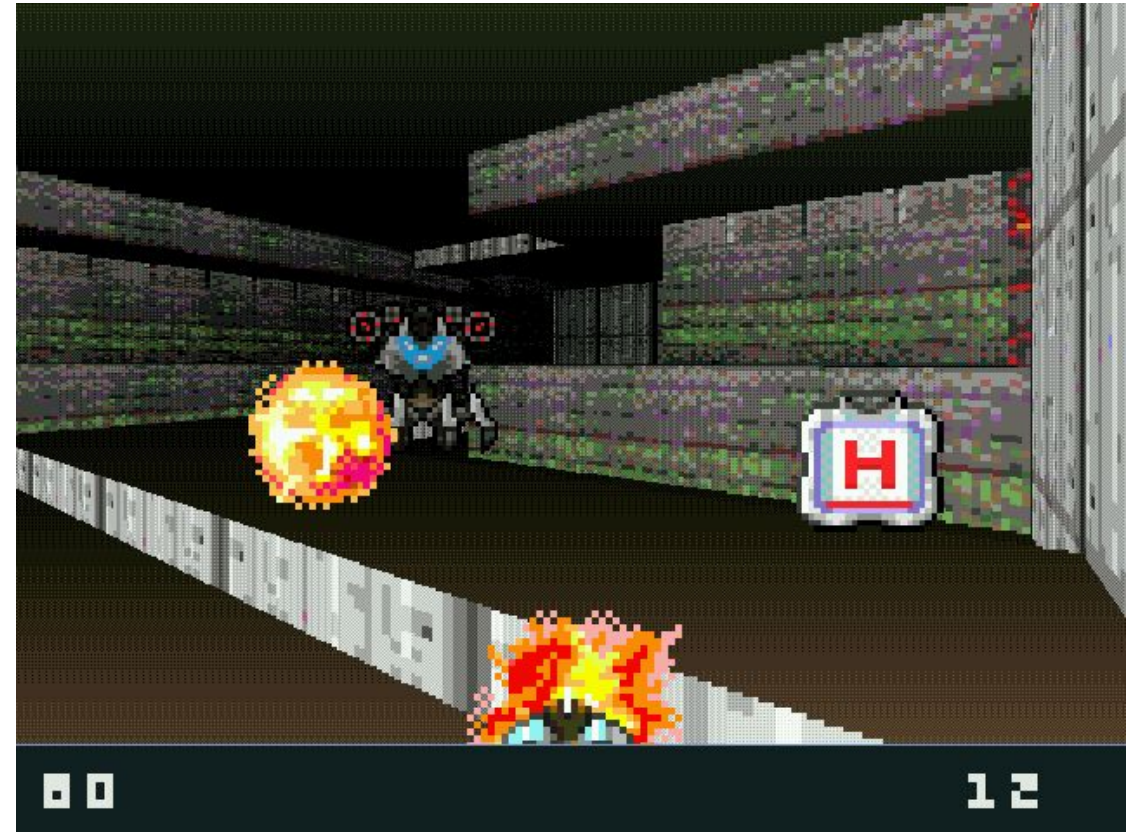
$$\begin{bmatrix} 7,413 & 2011 \\ 10,926 & 2011 \\ 7351 & 2011 \\ 11,613 & 2011 \end{bmatrix} * \begin{bmatrix} 2 \\ .5 \end{bmatrix} + 7 = \begin{bmatrix} 15,839 \\ 22,865 \\ 15,714 \\ 22,239 \end{bmatrix}$$

Graphical Processing Units

GPUs



Source: Wikimedia commons



Source: Wikimedia commons