

## sum, mean

1. dims, dim, size, shape

$$x = \left[ \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}, \begin{pmatrix} 11 & 14 \\ 12 & 15 \\ 13 & 16 \end{pmatrix} \right]$$

$$\therefore x.\text{dims} = 3$$

$$x.\text{dim}(1) = 2$$

$$x.\text{size} = 2 \times 3 \times 2 = 12$$

$$x.\text{shape} = (2, 3, 2)$$

$$x.\text{size}(1, 2) = 2 \times 3 = 6$$

$$x.\text{shape}(1, 2) = (2, 3)$$

2. sum:

2.2  $y = f(x), \quad x = \left[ \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}, \begin{pmatrix} 11 & 14 \\ 12 & 15 \\ 13 & 16 \end{pmatrix} \right]$

①  $\text{sum}(x)$ ,

②  $\text{sum}(x, \text{dims} = (2, 3))$

$$= \text{sum}(x, \text{VecN } d = (2, 3))$$

2.3 backward  $(dy) \Rightarrow dx$

①  $dx = x.\text{new}(x.\text{shape}).\text{fill}(dy)$

②  $\text{dims} = d = (2, 3)$

$$\text{repeats} = [1 \text{ for } i \text{ in range}(x.\text{dims})]$$

$$= [1, 1, 1]$$

$$\text{repeats}(d) = x.\text{shape}(d), \quad \therefore \text{repeats} = (1, 3, 2)$$

$$\therefore dx = dy.\text{repeat\_tensor}(\text{repeats})$$

3. mean:  $y = f(x), \quad x \text{ from 2}$

3.2 ①  $y = \text{mean}(x) = \frac{1}{12} \sum_{i=1}^{12} x_i$

②  $y = \text{mean}(x, d = (2, 3))$

3.3 backward:

①  $dx = x.\text{new}(x.\text{shape}).\text{fill}\left(\frac{dy}{x.\text{size}}\right)$

②  $d = (2, 3), \quad \text{repeats} = [1 \text{ for } i \text{ in range}(x.\text{dims})] = [1, 1, 1]$

$$\text{repeats}(d) = x.\text{shape}(d) = (3, 2), \quad \therefore \text{repeats} = (1, 3, 2)$$

$$\therefore dx = dy.\text{repeat\_tensor}(\text{repeats}).\text{div}(x.\text{size}(d))$$