

矩阵的加减法

矩阵的乘法

$$\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nm} \end{bmatrix} * \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1p} \\ b_{21} & b_{22} & \cdots & b_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ b_{m1} & b_{m2} & \cdots & b_{mp} \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1p} \\ c_{21} & c_{22} & \cdots & c_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ c_{n1} & c_{n2} & \cdots & c_{np} \end{bmatrix}$$

 $n \times p$ 

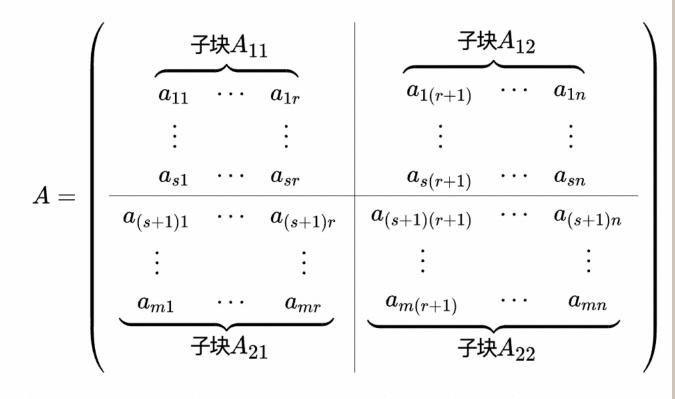
$$c_{ij} = a_{i1}b_{1j} + a_{i2}b_{2j} + \dots + a_{im}b_{mj}$$

 $n \times m$ 

$$c_{ij} = a_{i1}b_{1j} + a_{i2}b_{2j} + \dots + a_{im}b_{mj} = \sum_{k=1}^{m} a_{ik}b_{kj}$$



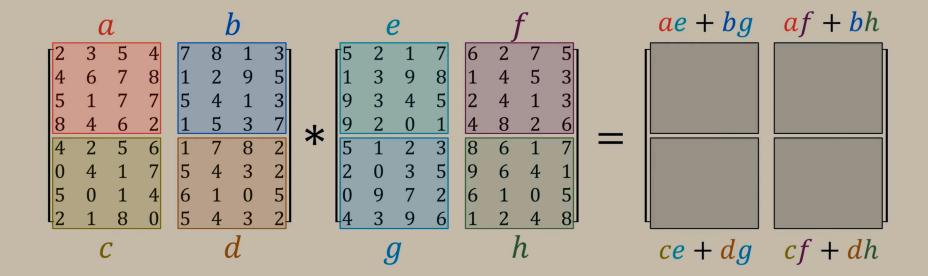
矩阵分块乘法



因此A可以如下改写,其中每个元素都是子块(矩阵):

$$A = egin{pmatrix} A_{11} & A_{12} \ A_{21} & A_{22} \ \end{pmatrix}$$

矩阵分块乘法



1 3 2 2 



ae + bg = 
$$(a+d)(e+h) + d(g-e) - (a+b)h + (b-d)(g+h)$$
  
af + bh =  $a(f-h) + (a+b)h$   
ce + dg =  $(c+d)e + d(g-e)$   
cf + dh =  $a(f-h) + (a+d)(e+h) - (c+d)e - (a-c)(e+f)$ 

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ae + bg = (a+d)(e+h) + d(g-e) - (a+b)h + (b-d)(g+h)
af + bh = a(f-h) + (a+b)h
ce + dg = (c+d)e + d(g-e)
cf + dh = a(f-h) + (a+d)(e+h) - (c+d)e - (a-c)(e+f)
p1=(a+d)(e+h)
                p5=a(f-h)
p2=d(g-e)
                p6=(c+d)e
                p7=(a-c)(e+f)
p3 = (a + b)h
p4=(b-d)(g+h)
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ae + bg = 
$$(a+d)(e+h) + d(g-e) - (a+b)h + (b-d)(g+h)$$
  
af + bh =  $a(f-h) + (a+b)h$   
ce + dg =  $(c+d)e + d(g-e)$   
cf + dh =  $a(f-h) + (a+d)(e+h) - (c+d)e - (a-c)(e+f)$ 

$$p1=(a+d)(e+h)$$
  $p5=a(f-h)$   $c11 = ae+bg = p1+p2-p3+p4$   
 $p2=d(g-e)$   $p6=(c+d)e$   $c12 = af+bh = p5+p3$   
 $p3=(a+b)h$   $p7=(a-c)(e+f)$   $c21 = ce+dg = p6+p2$   
 $p4=(b-d)(g+h)$   $c22 = cf+dh = p5+p1-p6-p7$ 

