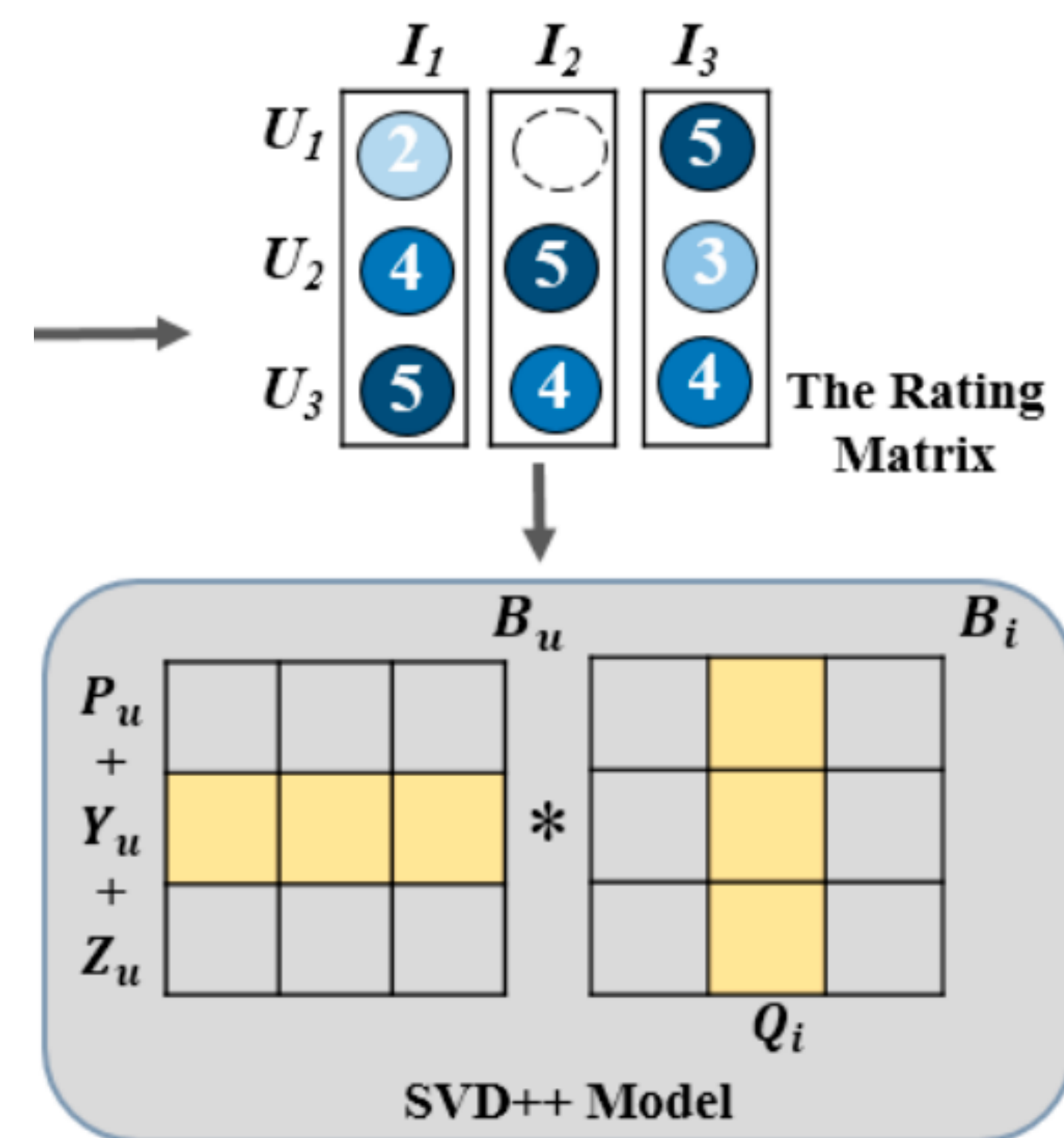# Matrix factorization

Find the factors of a matrix of ratings from user to item

The UV decomposition:

$$\begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{bmatrix} = \begin{bmatrix} u_{11} & \cdots & u_{1k} \\ \vdots & \ddots & \vdots \\ u_{m1} & \cdots & u_{mk} \end{bmatrix} \times \begin{bmatrix} v_{11} & \cdots & v_{1n} \\ \vdots & \ddots & \vdots \\ v_{k1} & \cdots & v_{kn} \end{bmatrix}$$

$$A_{m \times n} \qquad U_{m \times k} \qquad V^{\top}_{k \times n}$$

$R_{10,000 \times 25,000}$ $\quad$ $U_{10,000 \times k}$ $\quad$ $V_{k \times 25,000}$

Finding the right size *k* is very important

https:// Shi, Wenchuan, Wang, Liejun, and Qin, Jiwei. "User Embedding for Rating Prediction in SVD -Based Collaborative Filtering." Symmetry (Basel) 12.1 (2020): 121. Web