

$$\underbrace{\mathbf{V} \in \mathbb{R}_{\geq}^{n \times m}}_{[\mathcal{I}_v(1), \dots, \mathcal{I}_v(m)]} = \underbrace{\mathbf{W} \in \mathbb{R}_{\geq}^{n \times k}}_{[w_1, \dots, w_k]} \times \underbrace{\mathbf{H} \in \mathbb{R}_{\geq}^{k \times m}}_{[h_1, \dots, h_m]}$$

The diagram illustrates the matrix factorization  $\mathbf{V} = \mathbf{W} \mathbf{H}$ , where all matrices are non-negative ( $\mathbb{R}_{\geq}$ ).

- $\mathbf{V} \in \mathbb{R}_{\geq}^{n \times m}$  is the input matrix, visualized as a heatmap. Its columns are labeled  $[\mathcal{I}_v(1), \dots, \mathcal{I}_v(m)]$ .
- $\mathbf{W} \in \mathbb{R}_{\geq}^{n \times k}$  is the weight matrix, visualized as a heatmap. Its columns are labeled  $[w_1, \dots, w_k]$ .
- $\mathbf{H} \in \mathbb{R}_{\geq}^{k \times m}$  is the hidden matrix, visualized as a heatmap. Its columns are labeled  $[h_1, \dots, h_m]$ .