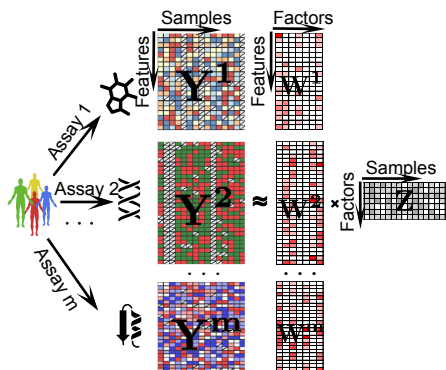
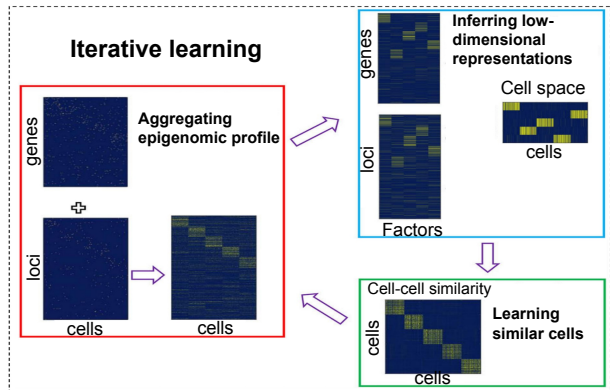


A



B



C

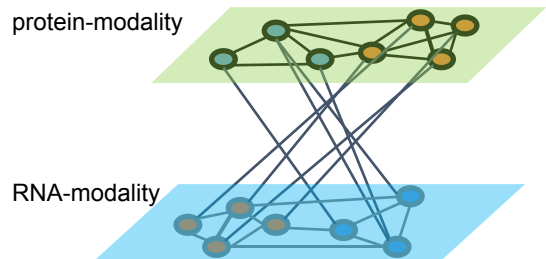
$$\begin{matrix} g+z_1 \text{ features} \\ n_1 \text{ cells} \end{matrix} \begin{bmatrix} E_1 & P_1 \end{bmatrix} \approx \begin{matrix} k \text{ factors} \\ H_1 \end{matrix} \times \left(\begin{bmatrix} V_1 & U_1 \\ W & O \end{bmatrix} \right)$$

$$\begin{matrix} g+z_2 \text{ features} \\ n_2 \text{ cells} \end{matrix} \begin{bmatrix} E_2 & P_2 \end{bmatrix} \approx \begin{matrix} k \text{ factors} \\ H_2 \end{matrix} \times \left(\begin{bmatrix} V_2 & U_2 \\ W & O \end{bmatrix} \right)$$

where z_i is the number of unshared features

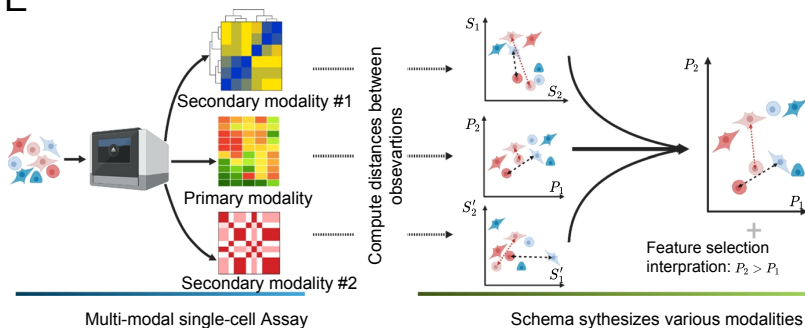
$$\arg \min_{H^i \geq 0, W \geq 0, V^i \geq 0, U^i \geq 0} \sum_i^d \left\| (E^i P^i) - H^i ((W O) + (V^i U^i)) \right\|_F^2 + \lambda_i \sum_i^d \left\| H^i (V^i U^i) \right\|_F^2$$

D



$$\theta_{weighted}(i, j) = w_{rna}(i) \theta_{rna}(r_i, r_j) + w_{protein}(i) \theta_{protein}(p_i, p_j)$$

E



F

$$\begin{aligned} & \begin{matrix} X_h^{(i)} \\ a_h^{(i)} \end{matrix} \quad \begin{matrix} X_h^{(j)} \\ a_h^{(j)} \end{matrix} \\ & \max_{a_h^{(1)}, \dots, a_h^{(Q)}} \sum_{i,j=1, i \neq j}^Q c_{i,j} \text{cov}(X_h^{(i)} a_h^{(i)}, X_h^{(j)} a_h^{(j)}), \\ & \text{s.t. } \|a_h^{(q)}\|_2 = 1 \text{ and } \|a_h^{(q)}\|_1 \leq \lambda^{(q)} \text{ for all } 1 \leq q \leq Q \end{aligned}$$