

C

n_{cells}

$g+z_1$ features

E_1

P_1

\approx

k factors

H_1

\times

$\begin{pmatrix} V_1 & U_1 \\ + \\ W & O \end{pmatrix}$

n_{cells}

$g+z_2$ features

E_2

P_2

\approx

k factors

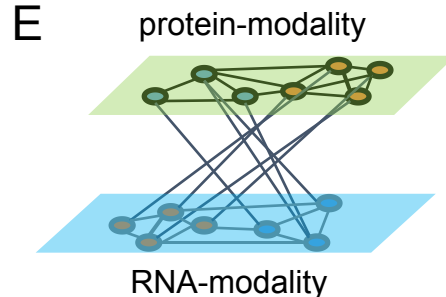
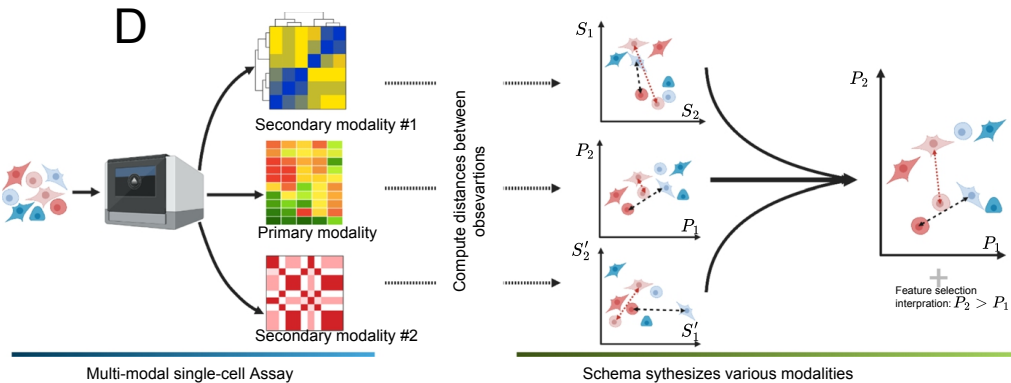
H_2

\times

$\begin{pmatrix} V_2 & U_2 \\ + \\ W & O \end{pmatrix}$

where z_i is the number of unshared features

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



F

$X_h^{(i)}$

$X_h^{(j)}$

$a_h^{(i)}$

$a_h^{(j)}$

$\max_{a_h^{(1)}, \dots, a_h^{(Q)}} \sum_{i,j=1, i \neq j}^Q c_{i,j} \text{cov}(X_h^{(i)} a_h^{(i)}, X_h^{(j)} a_h^{(j)})$

s.t. $\|a_h^{(q)}\|_2 = 1$ and $\|a_h^{(q)}\|_1 \leq \lambda^{(q)}$ for all $1 \leq q \leq Q$

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