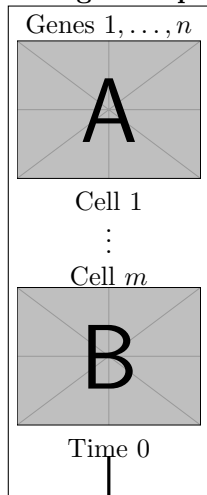


single-cell gene expression data



covariance matrices of genes

□

$$K(t) = (I + tA^\top)K(0)(I + tA) + D$$

$K(0)$

solve A , the GRN

gene expression model

Workflow of the WENDY method. Given single-cell level gene expression data at two time points, where the joint distribution (cell correspondence) between two time points is unknown, first calculate the covariance matrix of gene expression for each time point. Then use the mathematical gene expression model to derive the equation of covariance matrices. Last, transform this into an optimization problem and solve the GRN numerically.

optimization problem

Genes 1, ..., n

$\arg \min_{\mathbf{C}} \frac{1}{2} \sum_{i \neq j} \{ \|K(t) - (I + tA^\top)K(0)(I + tA)_{ij}^2 + \lambda A_{ij}^2\| \}$

Time t

$K(t)$

$K(t)$