

Additional File 4

The function for measuring the effectiveness of regulation

Set the functions for measuring the effectiveness of individual, combinatorial and drug effects on to the i th gene under the model \mathcal{M} as

$$e_a(\mathcal{M}, i) = \mathbf{a}'_i V_{t-1} \mathbf{a}_i - 2\mathbf{v}'_{lag,i} \mathbf{a}_i + 2\mathbf{b}'_i \phi'_{t-1} \mathbf{a}_i + 2\mathbf{g}'_i E'_{t-1} \mathbf{a}_i + 2u_i \mathbf{s}'_{t-1} \mathbf{a}_i, \quad (\text{S3-1})$$

$$e_b(\mathcal{M}, i) = \mathbf{b}'_i \Psi_{t-1} \mathbf{b}_i - 2\phi'_{lag,i} \mathbf{b}_i + 2\mathbf{a}'_i \phi_{t-1} \mathbf{b}_i + 2\mathbf{g}'_i E_{t-1} \mathbf{b}_i + 2u_i \mathbf{s}^2_{t-1} \mathbf{b}_i, \quad (\text{S3-2})$$

$$e_g(\mathcal{M}, i) = \mathbf{g}'_i Z \mathbf{g}_i - 2\mathbf{e}'_{lag,i} \mathbf{g}_i + 2\mathbf{a}'_i E_{t-1} \mathbf{g}_i + 2\mathbf{b}'_i E^2_{t-1} \mathbf{g}_i + 2u_i \mathbf{z}' \mathbf{g}_i, \quad (\text{S3-3})$$

respectively. It should be noted that the functions are derived when calculating $\arg \max_{\mathbf{a}_i} q(\boldsymbol{\theta}|\boldsymbol{\theta}_l)$, $\arg \max_{\mathbf{b}_i} q(\boldsymbol{\theta}|\boldsymbol{\theta}_l)$ and $\arg \max_{\mathbf{g}_i} q(\boldsymbol{\theta}|\boldsymbol{\theta}_l)$, respectively.