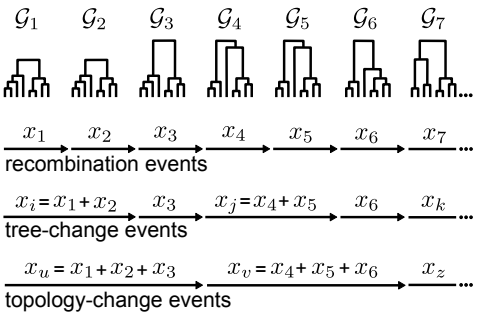
(a) Proposed ARG



(b) Extract genealogies between each event type

$$G_r = [\mathcal{G}_1, \mathcal{G}_2, \mathcal{G}_3, ...] \quad \text{(recombination events)}$$

$$G_g = [\mathcal{G}_1, \mathcal{G}_3, \mathcal{G}_4, ...] \quad \text{(tree-change events)}$$

$$G_t = [\mathcal{G}_1, \mathcal{G}_4, \mathcal{G}_7, ...] \quad \text{(topology-change events)}$$

(c) Extract waiting distances for each event type

$$X_r = [x_1, x_2, x_3, ...] \quad \text{(recombination events)}$$

$$X_g = [x_i, x_3, x_j, ...] \quad \text{(tree-change events)}$$

$$X_t = [x_u, x_v, x_z, ...] \quad \text{(topology-change events)}$$

(d) Calculate MS-SMC rate parameters

$$\Lambda_r = [\lambda_{r1}, \lambda_{r2}, \lambda_{r3}, ...] \quad \text{(recombination events)}$$

$$\Lambda_g = [\lambda_{g1}, \lambda_{g3}, \lambda_{g4}, ...] \quad \text{(tree-change events)}$$

$$\Lambda_t = [\lambda_{t1}, \lambda_{t4}, \lambda_{t7}, ...] \quad \text{(topology-change events)}$$

(e) Calculate likelihoods

$$\mathcal{L}(\Lambda_r | X_r) \quad \text{(recombination events)}$$

$$\mathcal{L}(\Lambda_g | X_g) \quad \text{(tree-change events)}$$

$$\mathcal{L}(\Lambda_t | X_t) \quad \text{(topology-change events)}$$

$$\mathcal{L}(\Lambda_g | X_g) * \mathcal{L}(\Lambda_t | X_t) \quad \text{(tree \& topo-change events)}$$