Work 1: Change point detection for time-correlation data with adaptive sampling

Consider multivariate time series $\mathbf{Y}(t) \in \mathbb{R}^p$ $\quad \mathbf{X}(t) = \mathbf{A}\mathbf{X}(t-1) + \mathbf{w}_t$, $\quad \mathbf{Y}(t) = \mathbf{C}\mathbf{X}(t) + \mathbf{v}_t$

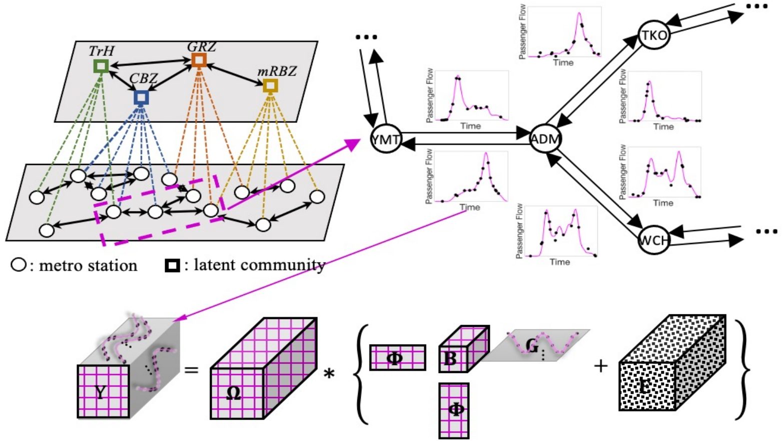
For unknown change point $\boldsymbol{\tau}$ $\quad \mathbf{X}(t) = \mathbf{A}\mathbf{X}(t) + \mathbf{w}_t, t < \tau.$ $\quad IC$ $\quad \mathbf{X}(t) = \mathbf{A}\mathbf{X}(t) + \boldsymbol{f} + \mathbf{w}_t, t \geq \tau.$ $\quad OC$

Partial observable set $\quad Z(t) = [z_{1t}, \dots, z_{pt}]$ and $\sum_{i=1}^{p} z_{it} = m. \quad (m < p)$

arxiv:2404.00220

Work 2:

FEN model：
Network modeling from a functional edge perspective



arxiv:2404.00218

Work 3:

FRCOMA: Nonparametric Regression for Continuous Multi-way Data

- $\{(y_i, \mathbf{x}_i)\}_{i=1}^{n}$ are n pairs of functional samples.
- $y_i \in \mathcal{Y} = \{y : \Omega_y \to \mathbb{R}\}$ is the response function and Ω_y is the compact subset of $\mathbb{R}^{d_y}$.
- $\mathbf{x}_i = (x_i^{(1)}, \cdots, x_i^{(p)})$ are the covariate functions with $x_i^{(l)} \in \mathcal{X}_l = \{x : \Omega_{x_l} \to \mathbb{R}\}$. Ω_{x_l} is the compact subset of $\mathbb{R}^{d_l}, l = 1, \cdots, p$.
- Find a nonlinear function-on-function regression model with variable selection

$$f : \mathcal{X}_1 \times \cdots \times \mathcal{X}_p \to \mathcal{Y}$$
$$s.t. y_i = f(\mathbf{x}_i) + \epsilon_i, \quad i = 1, \cdots, n, \qquad (1)$$

ϵ_i is the white noise function.

arxiv:2406.19021

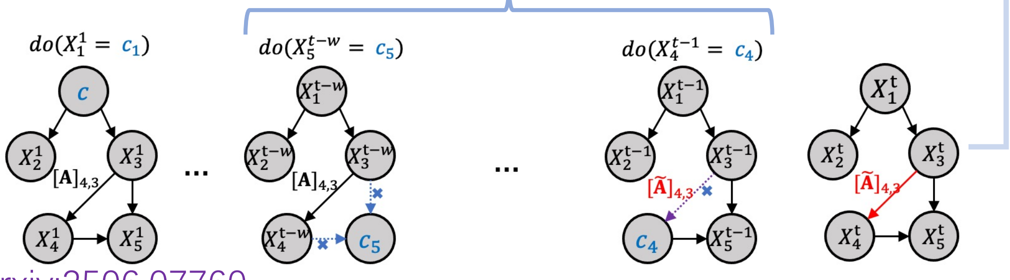
Work 4: Quickest causal change detection by adaptive intervention

- $\boldsymbol{X}^t = \mathbf{A}^t\boldsymbol{X}^t + \boldsymbol{U}^t, \quad \boldsymbol{U}^t \sim N(\boldsymbol{\mu}^t, \boldsymbol{\Sigma}^t),\ \boldsymbol{\Sigma}^t \triangleq \mathrm{diag}(\sigma_1^{t^2}, \dots, \sigma_p^{t^2}).$
- For some unknown τ, $(\mathbf{A}^t, \boldsymbol{\mu}^t, \boldsymbol{\Sigma}^t) = \begin{cases} (\mathbf{A}, \boldsymbol{\mu}, \boldsymbol{\Sigma}), & \text{for } t = 1,2,\dots,\tau-1, \\ (\widetilde{\mathbf{A}}, \widetilde{\boldsymbol{\mu}}, \widetilde{\boldsymbol{\Sigma}}), & \text{for } t = \tau, \tau+1, \dots \end{cases}$

Construct **window-limited CUSUM** statistic $W_{t,A^\circ}(W_{t,A^*})$ $\quad$!! $T_{b,A^\circ}^{\text{multi}}\ (T_{b,A^*}^{\max}) = t$

If $W_{t,A^\circ}(W_{t,A^*}) > b$, then trigger alarm; **Else**, decide the next intervention node(**$\boldsymbol{\varepsilon}$-greedy**).

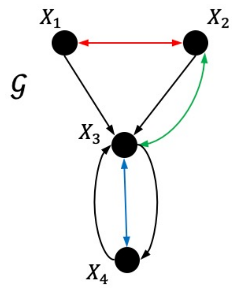
Max-AI (A^*) for short window and single change. **Multi-AI** (A°) for long window and multiple change.



arxiv:2506.07760

Work 5: Design of Experiment for Discovering Directed Mixed Graph

Design $\mathcal{I}$, the collection of $\mathbf{I}$, to discovery DMG $\mathcal{G}$ (using d-separation, σ-separating and do-see test).



■ directed edge (black)
■ non-adjacent bidirected edge (red)
■ single adjacent bidirected edge (green)
■ double adjacent bidirected edge (blue)

	Lower bound of $\max_{\mathbf{I}\in\mathcal{I}} \lvert\mathbf{I}\rvert$	Lower bound of $\lvert\mathcal{I}\rvert$	Unbounded design	Bounded design ($\lvert\mathbf{I}\rvert \leq M$)
■ (black)	$\lvert \mathrm{T}_{l+1}^{\mathcal{G}} \rvert_n + \zeta_{max}^{l+1,\mathcal{G}} - 1$	$\sum_{k=1}^{l+1} \zeta_{max}^{k,\mathcal{G}}$	$\lvert\mathcal{I}\rvert = 2\left\lceil \log_2\left(\chi(\mathcal{G}_r^{obs})\right)\right\rceil + \sum_{k=1}^{l+1} \zeta_{max}^{k,\mathcal{G}}$	$\lvert\mathcal{I}\rvert = \left\lceil\frac{n}{M}\right\rceil \left\lceil \log_{\lceil\frac{n}{M}\rceil} n\right\rceil + \sum_{k=1}^{l+1} \zeta_{max}^{k,\mathcal{G}} + \zeta_{max}^{l+1,\mathcal{G}} \left\lceil \frac{n - \lvert \mathrm{T}_{l+1}^{\mathcal{G}} \rvert_n - \zeta_{max}^{l+1,\mathcal{G}} - 1}{M - \lvert \mathrm{T}_{l+1}^{\mathcal{G}} \rvert_n - \zeta_{max}^{l+1,\mathcal{G}} + 2} \right\rceil$
■ (red)	$\max_{[X,Y]\in\mathbf{B}^N} \lvert Pa_{\mathcal{G}}(X \cup Y) \rvert$	$cc(\mathcal{G}^{uc})$	$\lvert\mathcal{I}\rvert = cc(\mathcal{G}^{uc})$	$\lvert\mathcal{I}\rvert \leq \sum_{k=1}^{K} 1 + \left\lceil \frac{\left(\frac{\lvert\mathbf{C}_k\rvert(\lvert\mathbf{C}_k\rvert-1)}{2} - 1\right)(n - \lvert\mathbf{C}_k\rvert)}{M + 1 - \max_{X,Y\in\mathbf{C}_k, X\neq Y} \mathrm{Pa}_{\mathcal{G}}(\{X,Y\})} \right\rceil$
■ (green)	Not well defined [1]		$\lvert\mathcal{I}\rvert \leq 2\chi_s(\mathcal{G}^u)$	$\lvert\mathcal{I}\rvert \leq 2\sum_{k=1}^{K} 1 + \left\lceil \frac{(\lvert\mathbf{E}_k\rvert - 1)(n - 2\lvert\mathbf{E}_k\rvert)}{M + 1 - \max_{[XY]^u\in\mathbf{E}_k'} Pa_{\mathcal{G}}(\{X, Y\})} \right\rceil$
■ (blue)	Difficult to identify but have limited impact			