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

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

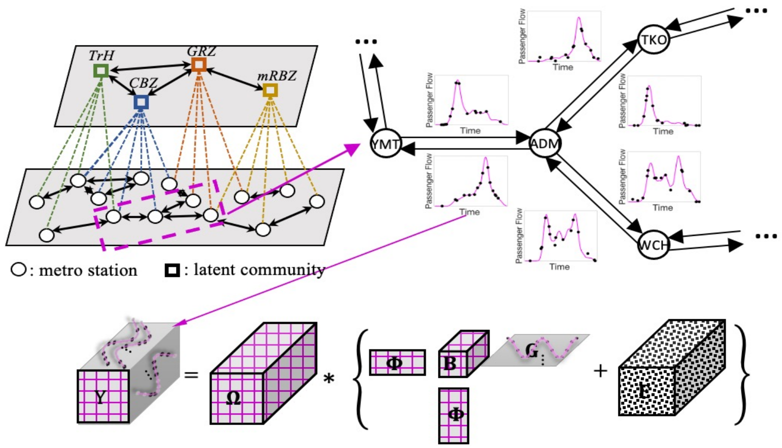
For unknown change point τ $\quad \mathbf{X}(t) = \mathbf{A}\mathbf{X}(t) + \mathbf{w}_t, t < \tau. \quad IC$ $\quad \mathbf{X}(t) = \mathbf{A}\mathbf{X}(t) + \boldsymbol{f} + \mathbf{w}_t, t \geq \tau. \quad OC$

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

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

ϵ_i is the white noise function.

arxiv:2406.19021

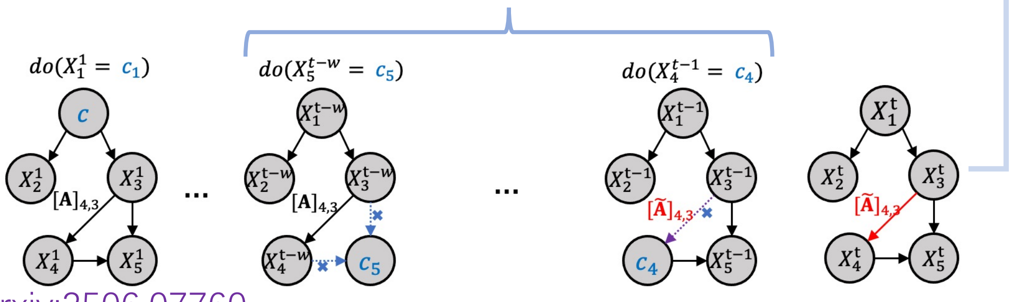
Work 4: Quickest causal change detection by adaptive intervention

- $X^t = \mathbf{A}^t X^t + U^t, \quad U^t \sim N(\boldsymbol{\mu}^t, \boldsymbol{\Sigma}^t),\ \boldsymbol{\Sigma}^t \triangleq \mathrm{diag}(\sigma_1^{t^2}, \dots, \sigma_p^{t^2})$.
- 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 $W_{t,A^\circ}(W_{t,A^*})$ $\quad$!! $T_{b,A^\circ}^{multi}\ (T_{b,A^*}^{max}) = t$

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

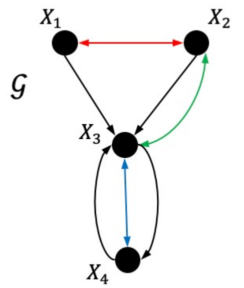
Max-AI (A^*) for short window and single change. **Multi-AI** (A°) for long window and multiple change.



arxiv:2506.07760

Work 5: Design of Experiment for Discovering Directed Mixed Graph

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



- ■ directed edge
- ■ non-adjacent bidirected edge
- ■ single adjacent bidirected edge
- ■ double adjacent bidirected edge

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