Network Kriging

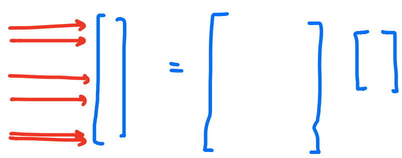
- End-to-End monitoring

    ↳ #paths ≈ $O(N_v^2)$ infeasible

- Let P be the set of all paths

Let $G_{ij} = \begin{cases} 1 & \text{if path } i \text{ traverses } j \\ 0 & \text{o.w.} \end{cases}$

Want to consider $y = Gx$ but only have access to some paths due to complexity.



Rmk: Only need $O(N_e)$ to exactly recover y.

Q: Approximation error and statistical error when sampling less than $O(N_e)$

Path redundancy: Key here. Measure that using SVD of G.

$$v_1 = \arg\max_{x \neq 0} \frac{x^T G^T G x}{x^T x} = \arg\max y(x)^T y(x) = \text{path volume.}$$

Partial Characterization

$B = G^T G$ non-decreasing diag

$\lambda(B) = \lambda_1 \geq \dots \geq \lambda_{n_e}$

$$\boxed{\frac{\lambda_k}{\lambda_1} \leq \frac{b_{kk}}{b_{11}} \dim(G)}$$

- Betweenness centrality controls decay
- Lots of optimal linear prediction stuff.

Path selection

- Minimise $MSPE(a^T y_S)$
- Subset selection problem - NP complete
- Choose k paths such that they span the first k singular directions