

CPS: Small: Recovery Algorithms for Dynamic Infrastructure Networks

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Most modern infrastructures are large-scale networks of interacting components, resulting in cascading disruptions. We develop data-driven methods for the modeling, analysis, and control of infrastructure networks, with the goal of improving resilience.

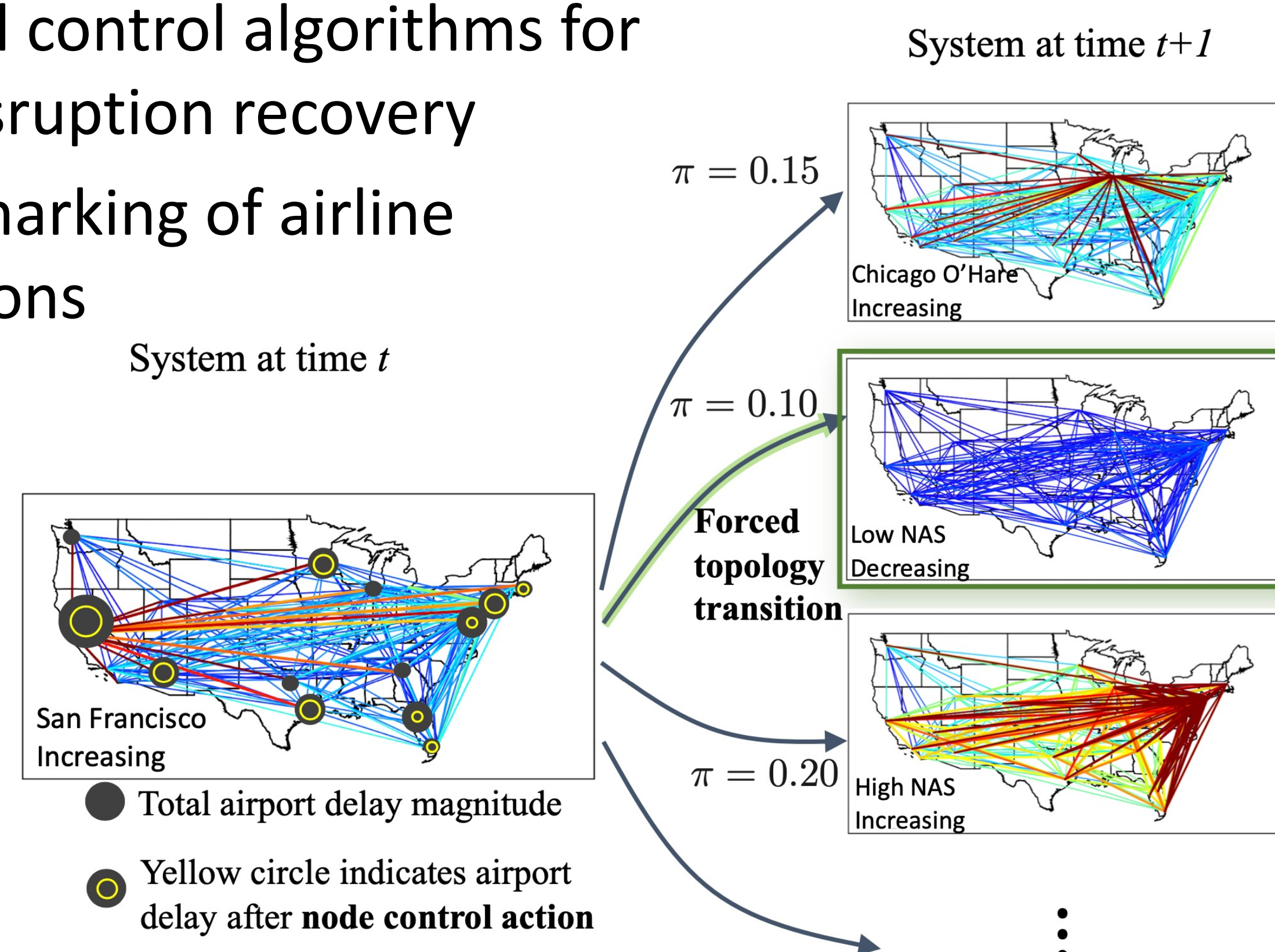
Challenges:

- **Modeling:** Identification and validation of scalable models of infrastructure networks
- **Analysis:** Privacy-aware outlier detection in graph signals to analyze disruptions in large-scale networks
- **Control:** Design of optimal recovery algorithms
- **Incentives:** Empirical analysis of the equity of congestion pricing

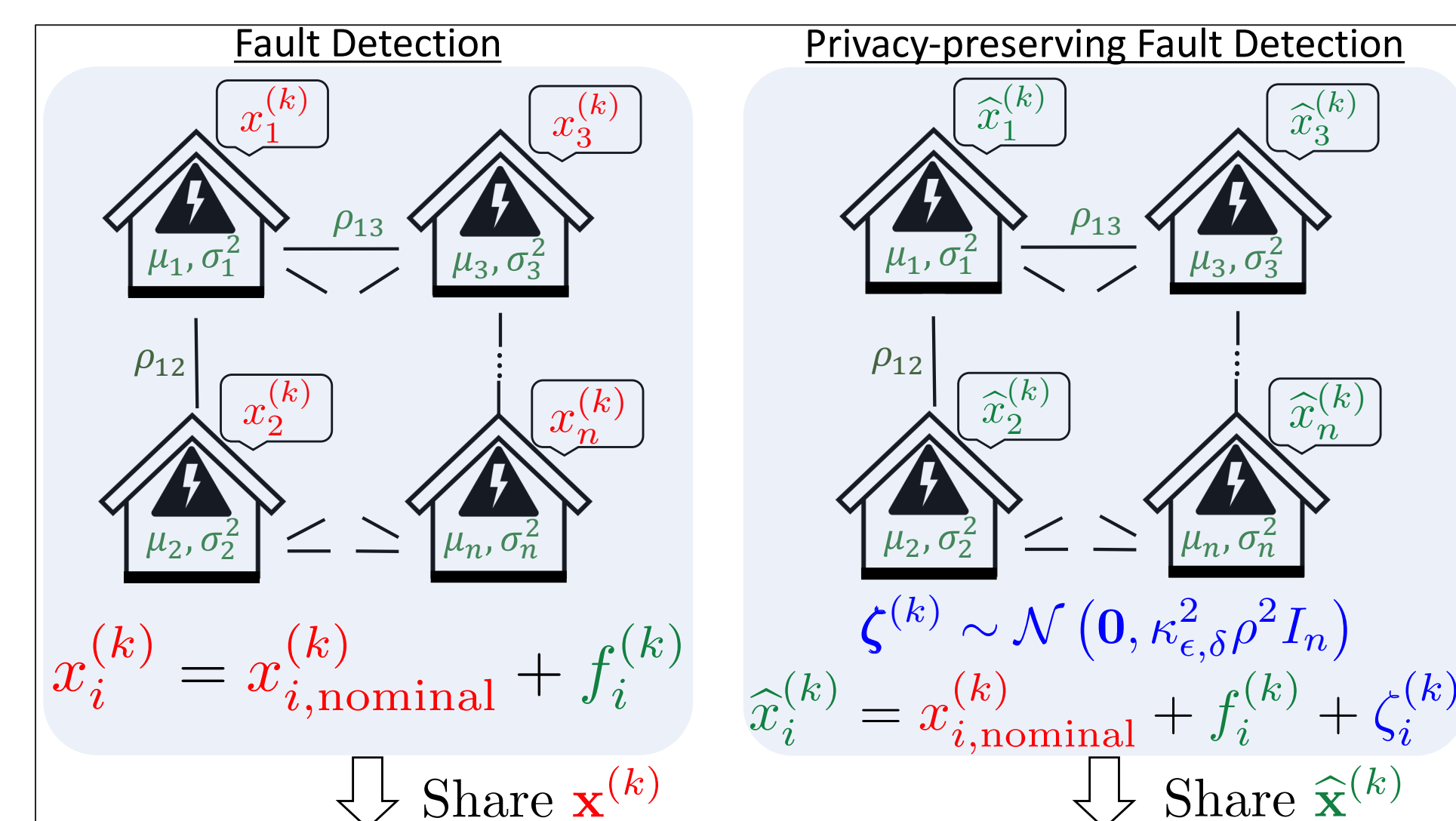
Scientific Impact:

- Models of networked dynamical systems (air transportation networks, smart grids, etc.)
- Optimal control algorithms for recovery after disruptions
- Robust control of queuing networks
- Differentially private anomaly detection of correlated data
- Empirical analysis of use behavior in response to pricing

- Data-driven identification of Markov Jump Linear Systems
- Optimal control algorithms for post-disruption recovery
- Benchmarking of airline operations
- Analysis of the equity of congestion pricing in London



- Differentially private outlier detection for correlated data



Publicly known
Privacy-sensitive
Privacy noise

μ_i, σ_i : Mean, variance for house i
 ρ_{ij} : Correlation between houses i and j
 n : Number of houses
 f : Additive fault
 ϵ, δ, ρ : Privacy parameters
 k : Day

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- M.Z. Li et al. "Approximate Projection-Based Control of Networks," CDC 2020
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