

Structure, Infrastructure, and Interdependency Frontiers

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NIST CENTER FOR RISK-BASED COMMUNITY RESILIENCE PLANNING



Past Challenges

- Structure & Infrastructure Modeling
 - Mainly focused on the physical response of the respective systems
 - Detailed FE modeling vs. simplified approaches
 - Large number of archetypical structures needed for community-level simulations
 - Validation
 - *Multiple hazards + multiple structures/structural types → large computational demand & efforts*

Past Challenges

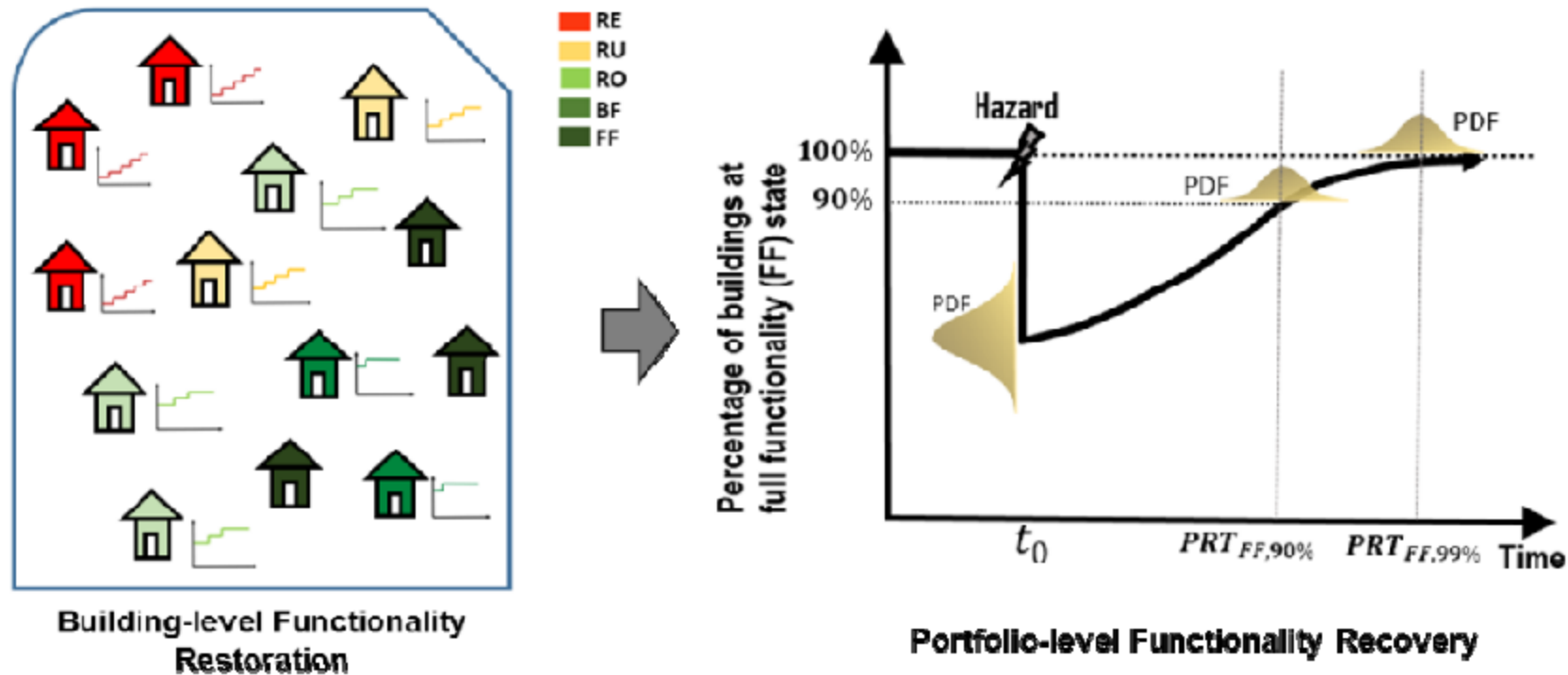
- *Interdependency Frontiers*

- Physical interdependency vs. system interdependency (accounting for socio-economic aspects)
- Validation of recovery over time

Current Strategies

- Computational methods/models accounting for:
 - Damage
 - Interdependencies
 - Functionality & Recovery of systems (schools, healthcare, households, businesses, etc.)
 - Socio-demographic characteristics

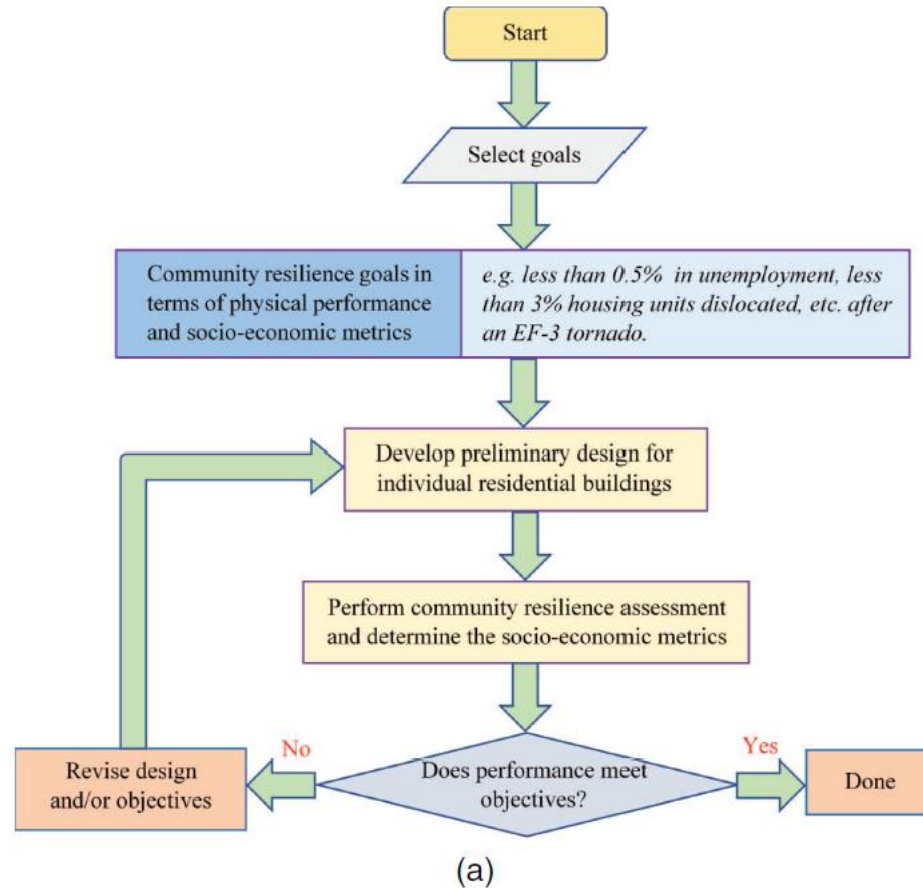
Current Strategies – Highlighted examples



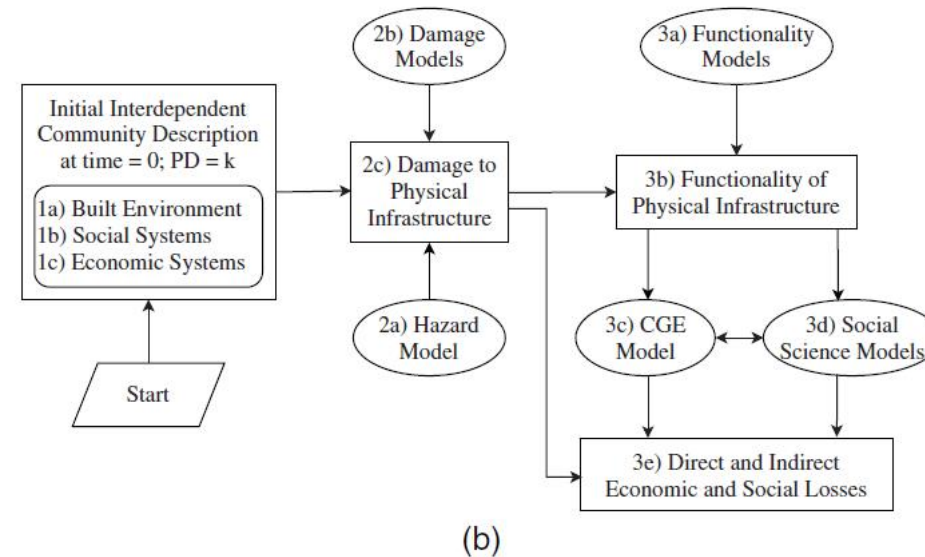
Lin, P., & Wang, N. (2017). Stochastic post-disaster functionality recovery of community building portfolios I: Modeling. *Structural Safety*, 69, 96-105.

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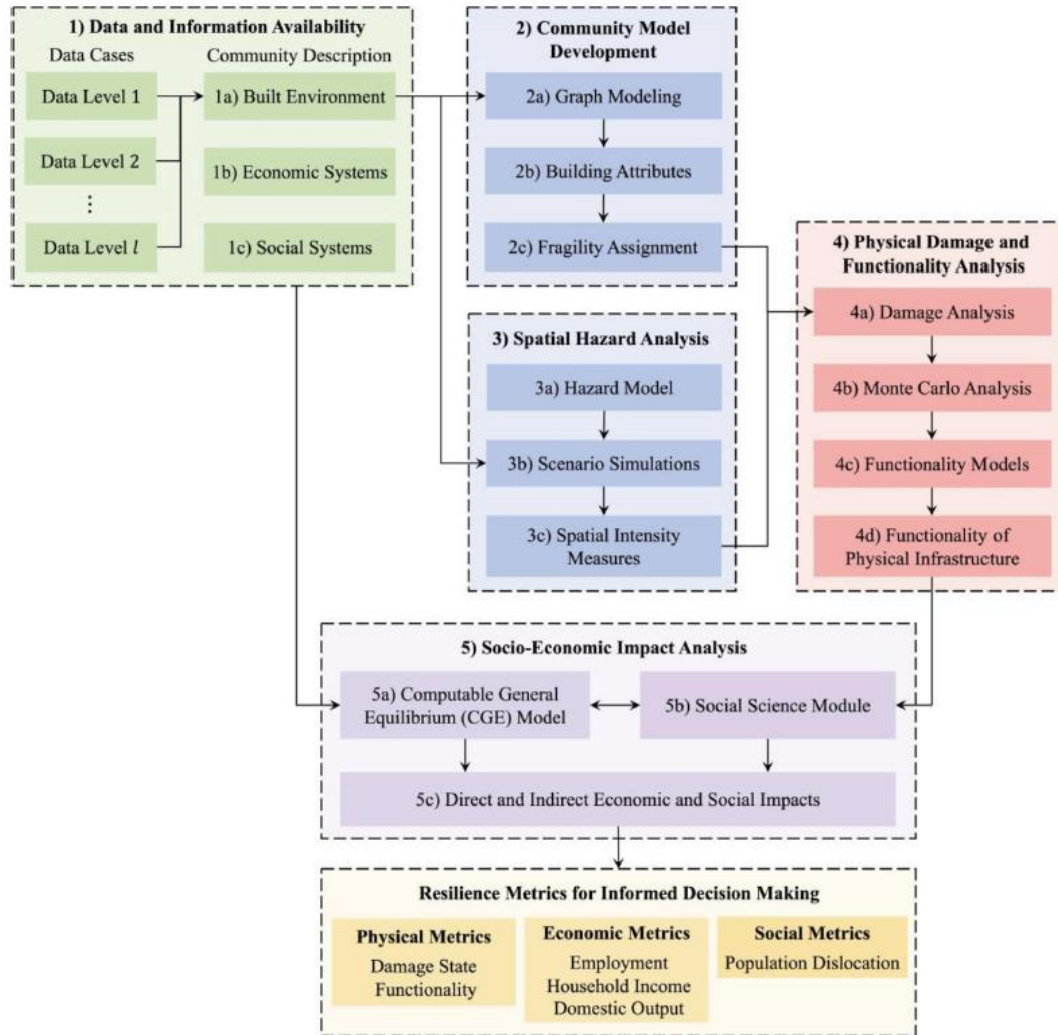
Current Strategies – A few highlighted examples



Wang, W. L., van De Lindt, J. W., Hartman, B., Cutler, H., Kruse, J. L., McAllister, T. P., & Hamideh, S. (2022). Determination of individual building performance targets to achieve community-level social and economic resilience metrics. *Journal of Structural Engineering*, 148(5), 04022045.

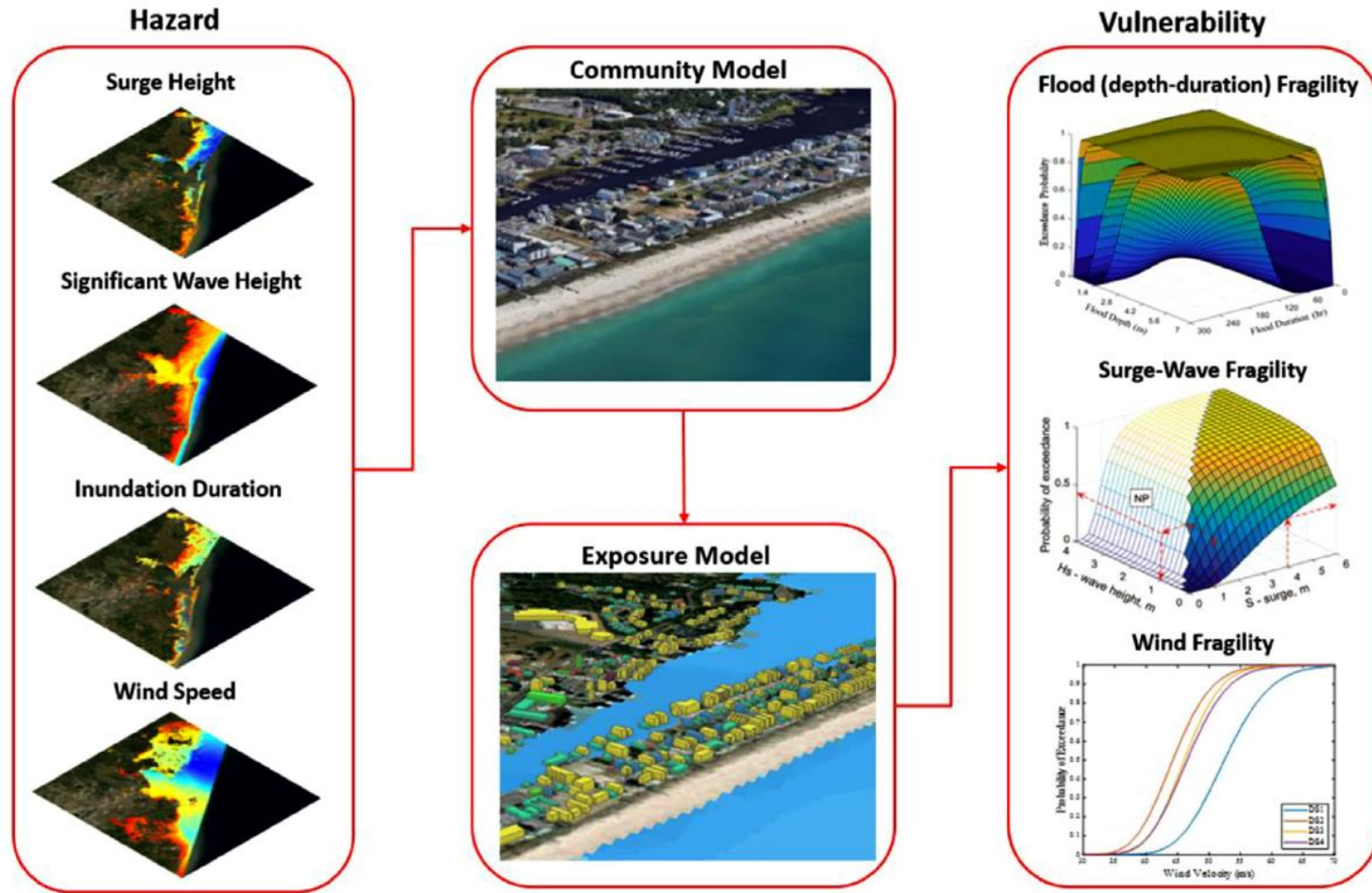


Current Strategies – A few highlighted examples



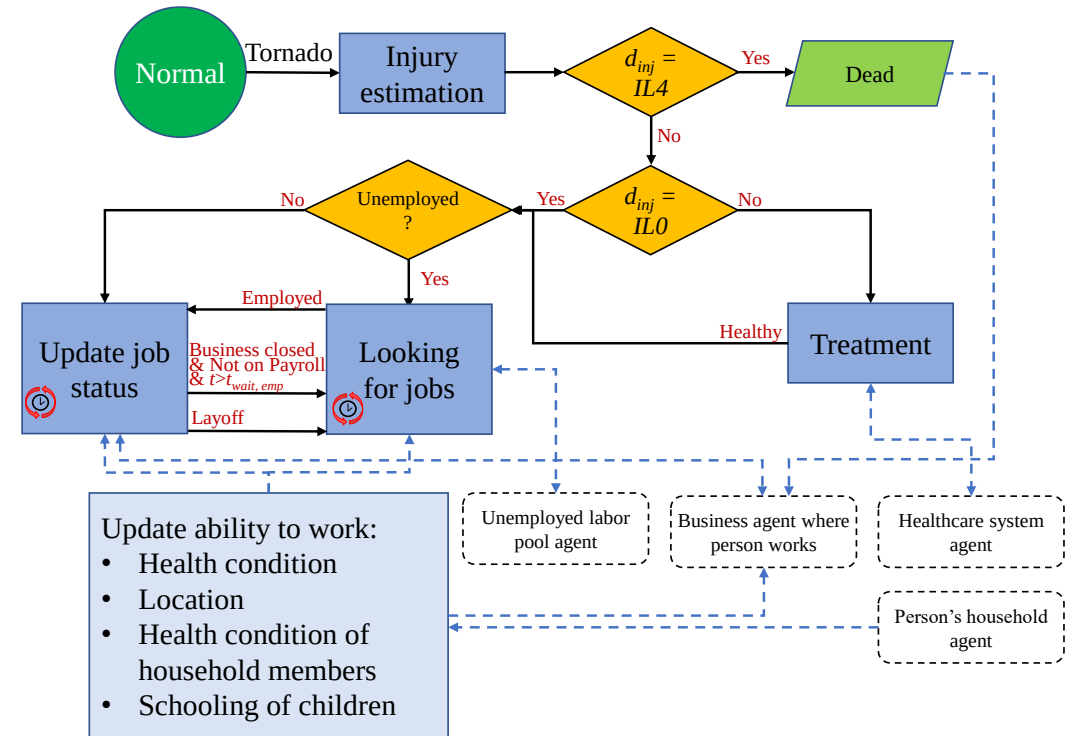
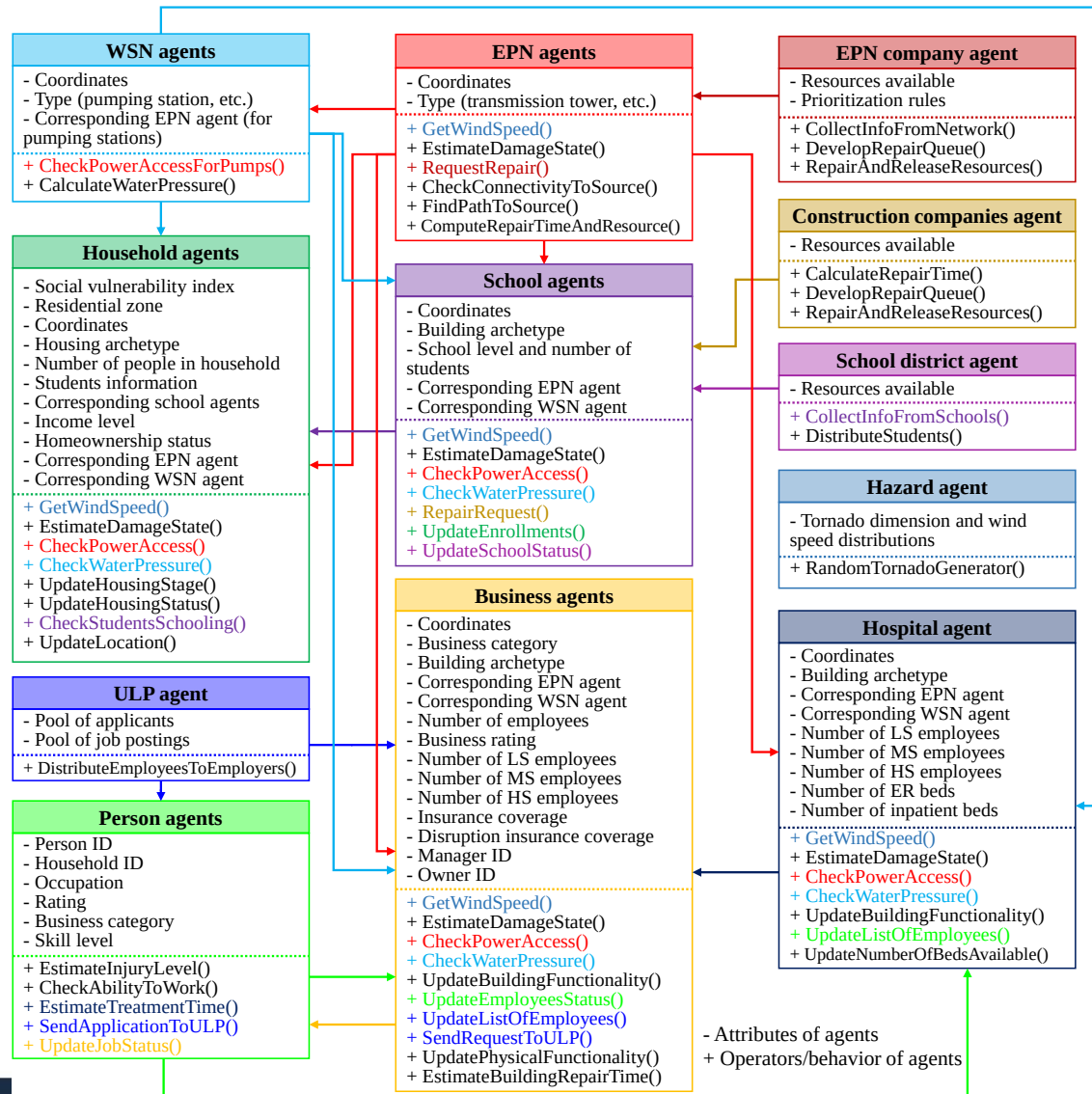
Roohi, M., van de Lindt, J. W., Rosenheim, N., Hu, Y., & Cutler, H. (2020). Implication of building inventory accuracy on physical and socio-economic resilience metrics for informed decision-making in natural hazards. *Structure and infrastructure engineering*, 17(4), 534-554.

Current Strategies – A few highlighted examples



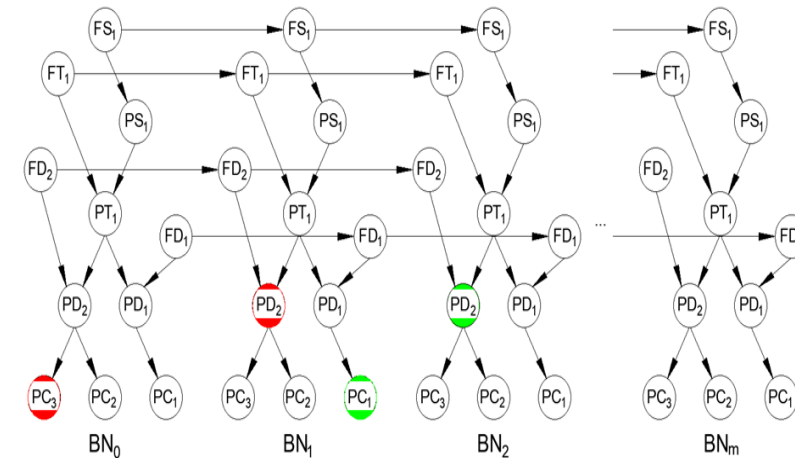
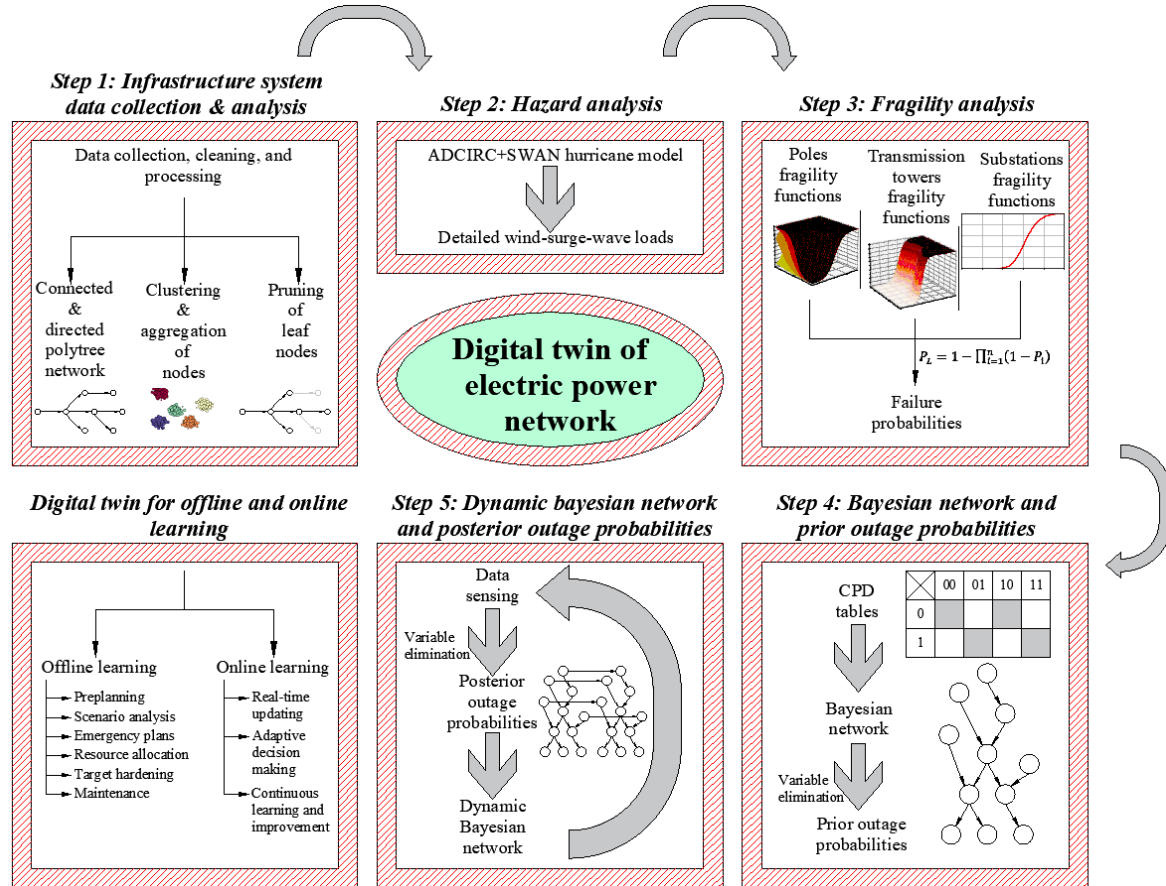
Nofal, O. M., Amini, K., Padgett, J. E., van de Lindt, J. W., Rosenheim, N., Darestani, Y. M., ... & Duenas-Osorio, L. (2023). Multi-hazard socio-physical resilience assessment of hurricane-induced hazards on coastal communities. *Resilient Cities and Structures*, 2(2), 67-81.

Current Strategies – A few highlighted examples



Aghababaei, M. and Koliou, M. 2022 Community resilience assessment via agent-based modeling approach. *Computer-Aided in Civil and Infrastructure Engineering*, DOI:10.1111/mice.12916.

Current Strategies – A few highlighted examples



Braik, A. M., & Koliou, M. (2023). A novel digital twin framework of electric power infrastructure systems subjected to hurricanes. International Journal of Disaster Risk Reduction, 104020.

Opportunities

- Long-lasting collaborations
- Keep working as a team (not siloed!)