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Resilience of Large-Scale Power Distribution: Modeling and Real Data

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Severe weather events are extreme but realistic scenarios of large-scale disruptions to power distribution, the last mile of our energy infrastructure. The impact of severe weather is significant: Each major disruption previously occurred caused power failures to millions of customers in large geographical areas for extended durations. A resilient power grid is called for in the nation, which poses a numerous fundamental questions. For example, how to quantify the resilience? How resilient is large-scale power distribution to severe weather? In this talk, we first discuss technical challenges for quantifying residence that involve heterogeneous factors from power distribution to services. We then show that these factors can be modeled, in a network setting, through spatial-temporal random processes. A dynamic resilience metric is then derived from the model. The model and the metric guide us to learn resilience from real data. We will present a study, using large-scale real data on failures and recoveries, to understand how resilient power distribution is to a severe-weather disruption. Joint work with Yun Wei and Henry Mei (Georgia Tech), in collaboration with utilities and policy makers, and supported by NYSERDA.