PhD
STEPCHANGE
seminar series

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DYNAMIC URBAN WATER PLANNING: ADAPTING TO CHANGING DROUGHTS, TECHNOLOGY INNOVATION, AND POLICY SHIFTS

ABSTRACT

Severe droughts strain municipal water resources and jeopardize urban water security. The 20th century approach to ensuring robustness of an urban water system involves oversizing traditional water infrastructure to buffer hydrological variability. A rapidly changing climate threatens this approach, exposing water planners to risks of either overbuilding costly water infrastructure or underbuilding and incurring supply failures. One emerging strategy is to expand capacity dynamically in response to drought conditions, but current dynamic planning models inadequately capture the impacts of different drought types, the potential of non-traditional water sources, and the effects of technology and policy innovation on optimal planning strategies and costs. We developed DRIPP, a new tool for long-term, dynamic, water supply planning. DRIPP integrates climate, watershed, urban distribution, and technology models to optimize urban water portfolios under a variety of drought types. Our results for the city of Santa Barbara, CA, revealed the sensitivity of optimal portfolios to drought intensity, duration, and frequency, highlighting the need to account for changing drought characteristics in urban water planning.

In addition to addressing hydrological change, we recognize the importance of considering other generally overlooked system changes, such as technology and policy innovation.

We use dynamic control techniques to design robust and cost-optimal strategies for water supply expansion for hundreds of plausible innovation states, e.g., improvements in treatment cost and diversification, deployment times, demand reduction campaigns.

Results for our case study identify high-impact innovation trajectories for the city across technologies and policies – and quantify their potential utility cost reductions.

Event date: June 15th, 2023

Time: 11:30 am

Location: DEIB - building 20 Seminar Room

BIOGRAPHY

Marta Zaniolo received her PhD in Information Technology in the Environmental Intelligence Lab of Politecnico di Milano. Currently a postdoctoral researcher in the Department of Civil and Environmental Engineering (CEE) at Stanford University, she will assume the role of assistant professor in the CEE department at Duke University starting January 2024. Her research focuses on leveraging data science, machine learning, and optimization techniques to tackle current challenges of water resources planning and management in the face of global change.

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