Causal Inference of pipe breaks in water supply networks via statistical analysis and machine learning

Dr Charalampos Konstantinou

Department of Civil and Environmental Engineering, University of Cyprus, University of Cyprus

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https://ucy.zoom.us/meeting/register/tJwvdOqvqTgoGtcsgGrFTPxJZNmEHKH1Pdbm

Summary: Water supply pipes age, deteriorate and break, which puts at risk the continuous provision of safe potable water endangering the public health in cities. Risk management methods are increasingly applied to optimise the capital investment for pipe replacement and rehabilitation, taking into account the probability and hydraulic impact of pipe breaks. As part of this process, however, historic pipe break data and statistical methods should be utilised to gather causal insights for past breaks to inform operational changes and/or capital investment decisions in order to reduce future breaks. Regression models for count data and probabilistic models have been developed to carry out an exploratory causal analysis for historic pipe breaks in an operational water supply network. In each group of models being developed both statistical and machine learning models were used. Their role was proven to be complementary given that statistical models provide the direction and magnitude of the impact of a predictor variable on the response variable whilst machine learning models output mainly a ranking of the features importance, though provide better fits, increasing the confidence on the results. Both statistical and machine learning models agreed on the importance of pressure and pressure related components as a cause for pipe failures. This conclusion highlights the need for monitoring and control of the various pressure components in operational networks.

Charalampos Konstantinou received his first degree in Civil Engineering from NTU of Athens in 2015 focusing in hydraulics and environmental engineering, and his MSc in Environmental Engineering and Business Management in 2016 from Imperial College London. He received his Ph.D in 2020 from the University of Cambridge, where he continued his research as a research associate until August 2021. He is currently a postdoctoral researcher in the Department of Civil and Environmental Engineering. His expertise, scientific contributions and research interests include (a) stochastic processes in hydrology and climate (b) the generation of artificially cemented weak sandstones via microbially induced carbonate precipitation (MICP); (c) the investigation of hydraulic, mechanical and physical properties of cemented granular materials.