

ClimaTRACKS: Forecasting resilience of railway network under propagating uncertainty

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Giuliano Punzo from University of Sheffield, where he is a lecturer and director of the Sheffield Urban Flows Observatory, gave an update on progress on ClimaTRACKS, a transport project which is researching forecasting resilience of railway network under propagating uncertainty. Together with Giuliano, the team is made up of Ji-Eun Byun, University of Glasgow, Qian Fu, University of Birmingham, Tohid Erfani, University College London, Iryna Yevseyeva, De Montfort University and Konstantinos Nikolopoulos, Durham University.

Weather conditions can have a dramatic effect on railway operation, causing issues such as foliage on the lines or overhead line drop. The project seeks to predict how local failure problems on the railway network can impact on passenger flows or a flow of goods on the railway network.

To properly take into account the inevitable effects of uncertainty in railway services, the project focuses on occurrence of uncertainty from weather conditions and asset failures and propagation of uncertainty through interdependent components in a network. To this end, this project is collating relevant datasets, developing a computational model to perform probabilistic analysis on network performance, and making those outcomes available to the public using the DAFNI platform.

The project launched on 1st April 2024 with meetings fortnightly since.

The team has already created a probabilistic map to demonstrate when assets may be taken out of commission due to wind and why, and what is associated with asset commissioning – some assets more likely to fail than others and this adds up to uncertainty.

They are now working on how to propagate this uncertainty and likelihood of asset failure or service failure onto the network, and to model how this could pass from local failure to system wide failure. Ultimately, they plan to provide a metric of the resilience of the system to points-wide failure.

Through the group's experience, in particular from Qian Fu at University of Birmingham, the group was able to start on the data management arrangements to compile the data to feed into the model (and ultimately make the model available on DAFNI). Data has been obtained from the Network Rail data portal and discussions have started with Network Rail to request the release of more informative data that could be shared with the community.

Initially the research is focusing on the data and classification model for local weather and the expected outcome for a single asset.

They have also compiled the network structure for the flow model – mapping local failures to global outcomes. They are coding an event network chain across the physical infrastructure network onto which they will then superimpose the flow.

By the end of the project, the team also hopes to contribute to the Network Rail weather risk assessment framework.

ClimaTracks completed the event network model in August, a full scale toy model in October, and are delivering the full model, with upload on the DAFNI platform by 20th December 2024.

