Finding vulnerabilities and points of failure in public transportation systems

23.04.2018

Using publicly available timetables for public transportation systems of 20 cities around the world, Master’s degree student in complex systems, Arash Badie Modiri has been looking for methods of determining the importance of each route in keeping the city connected.

This is done by ranking transportation routes of each city according to each one of the proposed measures of importance and removing them, one by one in according to their ranks, from a simulation of the public transportation system of the city. The methods that cause more delays and reduce accessibility to a larger part of the city faster could be used to identify how crucial each route is and how much damage the failure in that route could cause.

In his masters' thesis, he points out that a method frequently used since the turn of the millennium to study the vulnerability of public transportation network and many other networks besides, namely static network, failed to provide any measure of removing routes consistently more effective than the baseline of comparison, random failure.

On the other hand, he was able to find that a measure based on a newer model, temporal networks, that were much more effective in causing delays than random failure. He also discovered that nominal capacity of each route could also be used to uncover find more which routes are more critical in connectivity of the system, even though the simulation did not take into account overcrowding of vehicles.

Results of this study can be used to understand the internal structure of public transportation networks as well as providing transportation administrations with new methods of increasing reliability of public transportation systems.

More information:

Arash Badie Modiri
arash.badiemodiri@aalto.fi
tel. +358 46 564 8351

Mikko Kivelä, professor
mikko.kivela@aalto.fi
tel. +358 50 382 4555