Generate computable real-world graphs

Markus Prossegger

Carinthia University of Applied Sciences
m.prossegger@cuas.at

Thanks to several EU funding programs, a great deal of money is flowing into the expansion of broadband communication networks. But builders of fiber-optic-based networks are still hesistant because of the enormous investment costs. One of the main reasons is the high financial outlay for civil engineering work. While the cost of hardware components has fallen during the last decades, the cable routing work is still the cost driver in network construction projects. To reduce the financial risk, extensive simulations and optimizations should be performed. There are various modern network simulation and optimization techniques from the field of operations research. However, the validity of the opimization results is limited by the validity of the underlying graph.

Our study demonstrates an automated process for generating a network graph that bridges the gap between the real-world and the mathematical optimization of a communication network. An undirected graph, weighted with real-world constructions costs, is generated using large amounts of heterogeneous spatial data, technical and legal constraints, and the formalized knowledge of domain experts. In this process, we employ a combination of meta-heuristics with machine learning methods.

The created graph can then be used to solve the minimum Steiner tree problem, which is a typical optimization problem in the field of network moedling. To ensure a valid optimization result, the dimensions of the graph must be as small as possible and at the same time as detailed as possible to maintain its validity in the real world.