Estimation of OD matrices with naive Bayes method

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Abstract

The Origin/Destination (OD) matrix is an essential input for all traffic simulations. This matrix determines how many vehicles travelled from point X to point Y, where X and Y can be either a whole city or some kind of traffic zone. In practice, experts usually use estimations for getting the elements of these matrices, but the cost of these measurements can be very high. For mathematical estimations, we need a large amount of historical information and statistical data about the field of our interest. As example for our concrete case, it is nice to have information over the population, the number of cars or the number of trucks in the area. Sometimes the granularity of the sufficient data can go down to street level. So, the pure mathematical models are usually unusable, and the experts have to create the OD matrices manually with the use of their additional practical experiments. As demonstration of the size of this task, the national level OD matrix of Hungary contains more than 1 000 000 values.

In our proposed solution, we generate an OD matrix and we adjoin a probability to each value, which shows the estimated probability of accuracy for the actual value. If it is less than P_{min} percent, the experts can modify it. We accept this modification as reliable data. We add it to the training set with high weight. Therefore, in the next execution the probability attached to a value will be high in similar situations and the experts don't have to override result of our algorithm. So experts can calibrate the model by this feedback.

We use the additive naive Bayesian method to calculate values of OD matrix [2], the matrix contains also probabilities. The input of the algorithm is statistical data about demography, economy, vehicles and accidents; and the OD matrix of previous years.

Summing up, we have worked out a new method to generate an OD matrix that requires only minimal collaboration with experts. An expert has opportunity to calibrate and override the model. Currently, the method is used as part of complex traffic simulation pilot software.

Keywords: traffic simulation, OD matrix , Bayes estimator

References

[1] B. Raney , A. Voellmy , N. Cetin , M. Vrtic , K. Nagel, Towards a Microscopic Traffic Simulation of All of Switzerland, Proceedings of the International Conference on Computational Science-Part I, April 21-24, 2002, p.371-380.

[2] C. Tebaldi and M. West, Bayesian inference on network traffic using link count data, Journal of the American Statistical Association, vol. 93, no. 442, June 1998, p. 557-576.