

## Making more flexible ATISMART+ model for traffic simulations using a CAS

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Traffic simulations usually require the search of a path to join two different points. Dijkstra's algorithm [1] is one of the most commonly used for this task due to its easiness and quickness. In [2, 3] we developed an accelerated time simulation of car traffic in a smart city using Dijkstra's algorithm to compute the paths.

Dijkstra's algorithm provides a shortest path between two different points but this is not a realistic situation for simulations. For example, in a car traffic situation, the driver may not know the shortest path to follow. This ignorance can be produced, among others, because one of the following two facts: the driver may not know the exact length of the lanes, or, even knowing the exact length, the driver may not know how to find the shortest path. Even more, in many cases, a mixture of both facts occurs.

A more realistic simulation should therefore consider these kind of facts. The algorithm used to compute the path from one point to another in a traffic simulation might consider the possibility of not using the shortest path.

In this talk, we use a new probabilistic extension of Dijkstra's algorithm which covers the above two situations. For this matter, two different modifications in Dijkstra's algorithm have been introduced: using non-exact length in lanes, and the choice of a non-shortest path between two different points. Both modifications are used in a non-deterministic way by means of using probability distributions (classical distributions such as Normal or Poisson distributions or even "ad hoc" ones). A precise, fast, natural and elegant way of working with such probability distributions is the use of a CAS in order to deal with exact and explicit computations.

As an example of use of this extension of Dijkstra's algorithm, we will show the ATISMART+ model. This model provides more realistic accelerated time simulations of car traffics in a smart city and was first introduced in [4] and extended in [5]. This model was developed combining JAVA for the GUI and MAXIMA for the mathematical core of the algorithm.

The studies developed in the above mentioned works, dealt with Poisson, Exponential, Uniform and Normal distributions. In this talk we will introduce, as a novelty, the possibility of using other continuous probability distributions such as: Lognormal, Weibul, Gamma, Beta, Chi-Square, Student's t, Z, Pareto, Logistic, Cauchy or Irwin-Hall, and other discrete distributions such as: Bernouille, Rademacher, Binomial, Geometric, Negative Binomial or Hypergeometric. Even

more, this new version allows to deal with any “ad-hoc” continuous, discrete or mixed user’s distributions. This fact improves the flexibility of ATISMART+ model.

## References

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