Agent Based Individual Traffic Guidance

This thesis investigates the possibilities in applying Operations Research (OR) to autonomous vehicular traffic. The explicit difference to most other research today is that we presume that an agent is present in every vehicle - hence Agent Based Individual Traffic guidance (ABIT). The next evolutionary step for the in-vehicle route planners is the introduction of two-way communication. We presume that the agent is capable of exactly this. Based on this presumption we discuss the possibilities and define a taxonomy and use this to discuss the ABIT system. Based on a set of scenarios we conclude that the system can be divided into two separate constituents. The immediate dispersion, which is used for small areas and quick response, and the individual alleviation, which considers the longer distance decision support. Both of these require intricate models and cost functions which at the beginning of the project were not previously considered. We define a special inseparable cost function and develop a solution complex capable of using this cost function. In relation to calibration and estimation of statistical models used for dynamic route guidance we worked with generating random number sequences. During this work we made significant findings related to random numbers.

Drawing a random number

Random numbers are used for a great variety of applications in almost any field of computer and economic sciences today. Examples ranges from stock market forecasting in economics, through stochastic traffic modelling in operations research to photon and ray tracing in graphics. The construction of a model or a solution method requires certain characteristics of the random numbers used. This is usually a distribution classification, which the sequence of random numbers must fulfill; of these some are very hard to fulfill and others are next to impossible. Today mathematics allows us to transform distributions into others with most of the required characteristics. In essence, a uniform sequence which is transformed into a new sequence with the required distribution. The subject of this article is to consider the well known highly uniform Halton sequence and modifications to it. The intent is to generate highly uniform multidimensional draws, which are highly relevant for todays traffic models. This paper shows among others combined shuffling and scrambling seems needless, that scrambling gives the lowest correlation and that there are detectable differences between random numbers, dependent on their generation.
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When working with traffic planning or guidance it is common practice to view the vehicles as a combined mass. From this models are employed to specify the vehicle supply and demand for each region. As the models are complex and the calculations are equally demanding the regions and the detail of the road network is aggregated. As a result the calculations reveal only what the mass of vehicles are doing and not what a single vehicle is doing. This is the crucial difference to ABIT (Agent Based Individual Traffic guidance). ABIT is based on the fact that information on the destination of each vehicle can be obtained through cellular phone tracking or GPS systems. This information can then be used to provide individual traffic guidance as opposed to the mass information systems of today – dynamic roadsigns and trafficradio. The goal is to achieve better usage of road and time. The main topic of the paper is the possibilities of using ABIT when disruptions occur (accidents, congestion, and roadwork). The discussion will be based on realistic case studies.
Projects:

Disruption Management i transportsektoren
Department of Informatics and Mathematical Modeling
Period: 01/04/2003 → 01/07/2009
Number of participants: 6
Phd Student:
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