

MATES : Multi-Agent based Traffic and Environmental Simulator - Core Technologies and Practical Applications –

†*Shinobu Yoshimura and Hideki Fujii

Department of Systems Innovation, School of Engineering, The University of Tokyo, Japan

*Presenting author: yoshi@sys.t.u-tokyo.ac.jp

†Corresponding author: yoshi@sys.t.u-tokyo.ac.jp

Abstract

There are a variety of serious and modern problems related to city traffics all over the world, i.e. traffic jam and accidents, local as well as global environmental and energy problems, maintenance of mobility in aging societies, and evacuation planning against natural as well as man-made disasters. Especially such problems have been becoming more and more serious in Asian countries. The most critical factor which makes the problems very complex to solve is the interaction among numerous individuals having different preferences and behaviors. These phenomena have been out of scope of quantitative simulation so far.

To evaluate, predict and solve such city traffic-related problems precisely as well as quantitatively, we have been developing a Multi-Agent based Traffic and Environmental Simulator named MATES [1-4]. Here each car driver, pedestrian and others such as tram are modelled as an intelligent agent, and then a city traffic is directly reproduced as a result of the complex interaction among multiple agents having different preferences and behaviors in terms of mobility. In other words, two kinds of complexity in real world's city traffics are precisely modeled here, i.e. (a) intelligent behavior of each individual and (b) the interaction of numerous individuals.

In my talk, after describing the research background, I explain several core technologies of the simulator, i.e. Intelligent Agent modeling, Hierarchical Road network modeling, their interaction, Dynamic Route Search algorithm, OD(origin-destination) matrix inverse analysis, parallel implementation and others. Then I show several practical applications of the simulator. One of them is the simulation of a tram line extension problem just in front of the JR(Japan Railway) Okayama Station in Okayama city, which is a typical prefectural capital city in Japan. Here tens of thousands of agents of cars, pedestrians and trams, hundreds of cross sections are simulated in a wide area of 10 km² of a central district of Okayama city. A time increment is 0.1sec. Nowadays a policy of enhancing public transportation to reduce individual car use is a common and urgent issue in rapidly aging societies. However, this is now in a big controversy among various stakeholders including city governor, officers, police officers, shop owners, and residents. One of the critical issues in the controversy is whether the tram line extension might cause any serious worse effects on car traffics because the tram extension certainly reduces a fraction of traffic signal for cars. Using the developed simulator, we successfully provide the stakeholders a scientific information on the quantitative effects of the tram line extension into car traffics.

Keywords: Multi-agent modeling, Mixed traffic simulation, tram line extension

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