

論文 / 著書情報  
Article / Book Information

題目(和文)	道路渋滞管理のためのルート選択問題に関するエージェント・ベース・モデルの研究
Title(English)	Study on Agent-Based Models for Routing Selection in Road-network Congestion Management
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種別(和文)	論文要旨
Type(English)	Summary

(博士課程)  
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## 論文要旨

THESIS SUMMARY

専攻： 知能システム科学 専攻  
Department of  
学生氏名： 蒋 斌  
Student's Name

申請学位 (専攻分野)： 博士 (工学)  
Academic Degree Requested Doctor of  
指導教員 (主)： 寺野隆雄 教授  
Academic Advisor(main)  
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Academic Advisor(sub)

要旨 (英文 800 語程度)  
Thesis Summary (approx.800 English Words)

In the past decades, road-network congestion especially in urban has become more serious due to an increasing travel demand and limited traffic capacity. Congestion is known to cause travel and waiting costs, pollution emissions and even increase the probability of road hazards, which further restrict our economic prosperity and social progress. Therefore, effective congestion management mechanism as an foundation component of human society has its research and practical significance to benefit the travelers, businesses and environment. Traditional congestion management mostly emphasizes on either building more roads to expand the traffic capacity or reducing travel demand through government intervene measures. However, it is impractical to set up enough roads to completely satisfy the increasing travel demand. And, the effect of government intervention measures is always not obvious with an increasing travel demand. Besides, the recent literature has witnessed a great interest and success in designing intelligent transportation systems (ITS), such as intelligent traffic signal control and vehicle route guidance to solve the road-network congestion problem.

Under such a background, this thesis studies the congestion management issue based on vehicle route guidance of intelligent transportation system. The literature review shows that agent-based framework with bottom-up perspective has been widely used in this field because of its natural and suitable for capturing the dynamic and geographically distributed features of transportation systems. In our study, we aim to propose agent-based models with weighted multi-objective optimization algorithm to implement vehicle route guidance. Especially, our focus is to construct a quantitative index sequence which could achieve the congestion evaluation and management of road-network at the same time. First, a multi-agent system is built, where each agent stands for a vehicle that would adapt its route to a dynamic road-network congestion condition by a two-objective optimization process: the shortest path and the minimal congested degree of the target link. The agent-based approach captures the nonlinear feedback between vehicle routing behaviors and road-network congestion status, thus we can observe the formation and evolution of road-network congestion through agent-based simulations. Next, a series of quantitative indexes is constructed to describe the congested degree of road nodes, and such indexes are used as weights in the two-objective function employed by the agents for routing decision in a changing traffic environment. In this way, our proposed agent models with adaptive weight-based multi-objective optimization algorithm could achieve congestion distribution evaluation and congestion management at the same time. Besides, we define a set of evaluation criteria to measure the effect of our proposed agent models on road-network congestion improvement.

Intensive experiments on a generated road-network topology and a real road map have both shown an applicability and effectiveness of our proposed agent model on reducing congestion. We further examine the agent model effect with adaptive weight-based two-objective optimization algorithm. The simulation results have also confirmed an applicability and effectiveness of the node weights as a new quantitative index sequences which describe the road-network congestion distribution, and shunt vehicles on seriously congested roads based on that index simultaneously. By comparing the distribution of those congested links or nodes on the real road map, we find that most congested locations are the unique road connecting two regions or road junction. The reason is that these locations always connect traffic arteries, thus most agents of the simulated traffic system have to pass such links or nodes to go through the regions and finally reach their destinations.

The contributions of our study in the field of congestion management could be found in the hybrid route guidance strategy which quantifies the influence of congestion avoidance and implements a two-objective function which considers both shortest path and congestion avoidance for the routing optimization; and agent-based models with weighted two-objective algorithm for understanding the formation and reduction of road-network congestion by capturing the nonlinear feedback between agent routing behaviors and road-network congestion conditions; as well as a quantitative index sequence which measures the real-time congestion distribution and also is used as weights of the two-objective function simultaneously for implementing agent routing selection function, it could achieve a good tradeoff between user satisfaction and effective utility of road-network. The proposed model and method will have their significant potentials for actual traffic congestion control. With the help of GPS devices, the proposed model and method will have their theoretical value and practical significance for both vehicle navigation and route guidance used in the field of ITS.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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