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METHOD OF DISTRIBUTION OF TRAFFIC FLOW BASED ON THE TRANSPORT PROBLEM

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Abstract
Abstract: Connected and Intelligent Transportation Systems (C-ITS) are revolutionizing the way we manage and operate transport systems. However, with the increasing integration of digital technologies into transportation infrastructure, security becomes paramount. This article explores the development and application of mathematical models to enhance the security of C-ITS within the transport system. We discuss the key challenges, solutions, and implications of securing C-ITS and propose a roadmap for future research in this domain.

Keywords: Intelligent Transportation Systems, transport systems, transportation infrastructure, security, security of C-ITS, Quantum Key Distribution.

Introduction

Traffic congestion is a significant challenge in urban areas, leading to increased travel times, fuel consumption, and environmental pollution. To alleviate congestion and optimize traffic flow, transportation planners and engineers employ various mathematical models and algorithms. One such method is the application of the transport problem, a classic optimization problem in operations research. In this article, we will explore how the transport problem can be utilized to distribute traffic flow efficiently and minimize congestion.

The Transport Problem: The transport problem involves finding the optimal allocation of goods from a set of supply nodes to a set of demand nodes, considering capacity constraints and minimizing transportation costs. By adapting this problem to traffic flow distribution, we can treat road segments as supply nodes and destinations as demand nodes.

Mathematical Formulation: Let's consider a road network with m road segments and n destinations. We define the following variables:
x_{ij}: The flow of traffic from road segment i to destination j.

d_i: The demand at destination j.
s_i: The supply (capacity) of road segment i.
c_i: The cost of transporting traffic from road segment i to destination j.
The objective is to minimize the total transportation cost, which can be formulated as:
Minimize: $\sum(i=1 \text{ to } m) \sum(j=1 \text{ to } n)\ c_{ij} * x_{ij}$
Subject to:
Capacity Constraint: $\sum(j=1 \text{ to } n)\ x_{ij} \leq s_i$, for all i = 1 to m.
Demand Constraint: $\sum(i=1 \text{ to } m)\ x_{ij} = di$, for all j = 1 to n.
Non-negativity Constraint: $x_{ij} \geq 0$, for all i = 1 to m and j = 1 to n.

Solution Approach: To solve the transport problem and distribute traffic flow efficiently, various algorithms can be employed. One commonly used algorithm is the North-West Corner Method, which starts by allocating traffic flow from the top-left corner (i.e., the first road segment and the first destination) and proceeds in a sequential manner until all supply and demand constraints are satisfied.
Another widely used algorithm is the Vogel's Approximation Method (VAM), which considers the cost differences between the least and second-least cost routes, ensuring a more balanced distribution of traffic flow.

Benefits and Applications: The method of traffic flow distribution based on the transport problem offers several benefits and applications:

- Congestion Reduction: By optimizing traffic flow distribution, the method helps reduce congestion on specific road segments, leading to improved travel times and reduced traffic delays.
- Resource Optimization: Efficient traffic flow distribution ensures better utilization of road network capacity, reducing the need for costly infrastructure expansions.
- Emergency Response Planning: The method can be used to optimize emergency response routes, ensuring faster and more efficient access to critical locations during emergencies.
- Urban Planning and Design: The method can aid in designing efficient road networks and transportation systems in urban areas, considering future traffic demands and minimizing congestion.

The North-West Corner Method can be summarized as follows:

1. Start at the top-left corner of the transportation matrix.
2. Allocate the maximum possible flow from the current supply node to the current demand node, considering the capacity constraint of the supply node and the demand constraint of the demand node.
3. Move to the next supply node (to the right) and repeat step 2 until the capacity constraint of the supply node is reached.
4. Move to the next demand node (down) and repeat step 2 until the demand constraint of the demand node is satisfied.

5. Repeat steps 2-4 until all supply and demand constraints are satisfied.

Another widely used algorithm is the Vogel's Approximation Method (VAM), which considers the cost differences between the least and second-least cost routes, ensuring a more balanced distribution of traffic flow.

Vogel's Approximation Method can be summarized as follows:

1. Calculate the difference between the least and second-least cost for each supply and demand combination.
2. Identify the supply node and demand node with the highest cost difference. Allocate the maximum possible flow from the corresponding supply node to the demand node, considering the capacity and demand constraints.
3. Update the remaining supply and demand quantities.
4. Recalculate the cost differences for the updated supply and demand quantities.
5. Repeat steps 2-4 until all supply and demand constraints are satisfied.

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Conclusion:

The method of traffic flow distribution based on the transport problem offers a mathematical framework to optimize traffic allocation and minimize congestion on road networks. By formulating traffic flow distribution as an optimization problem, transportation planners can employ algorithms such as the North-West Corner Method or Vogel's Approximation Method to find efficient solutions. This approach has significant potential for reducing traffic congestion, improving travel times, and optimizing resource utilization in urban areas. The method of traffic flow distribution based on the transport problem offers a mathematical framework to optimize traffic allocation and minimize congestion on road networks. By formulating traffic flow distribution as an optimization problem, transportation planners can employ algorithms such as the North-West Corner Method or Vogel's Approximation Method to find efficient solutions. This approach has significant potential for reducing traffic congestion, improving travel times, and optimizing resource utilization in urban areas.

References:

1. Барский А.Б. Нейронные сети: распознавание, управление, принятие решений. – М.: Финансы и статистика, 2004. – 176 с.
2. Каллан Роберт. Основные концепции нейронных сетей: Пер. с англ. – М.:Издательский дом «Вильямс», 2001.
3. Комарцова Л.Г., Максимов А.В. Нейрокомпьютеры: Учеб. пособие для вузов. – 2-е изд.,перераб. и доп. – М.: Изд-во МГТУ им. Н.Э. Баумана, 2004. – 400 с. Технические науки — от теории к практике № 11 (47), 2015 г. www.sibac.info
4. Мелихова О.А., Чумичев В.С., Джамбинов С.В., Гайдуков А.Б. Некоторые аспекты криптографического взлома и повышения надежности алгоритмов шифрования// Молодой ученный. – Казань, № 11(91), 2015. –С. 392–394.
5. Мелихова О.А. Приложение матлогики к проблемам моделирования// Известия ЮФУ. Технические науки. – Таганрог: Изд-во ТТИ ЮФУ, 2014. № 7(156). – С. 204–214.
6. Мелихова О.А., Гайдуков А.Б., Джамбинов С.В., Чумичев В.С. Методы поддержки принятия решений на основе нейронных сетей// Актуальные проблемы гуманитарных и естественных наук. – М., № 09 (80). Ч. 1. 2015. – С. 52–59.
7. Мелихова О.А., Григораш А.С., Джамбинов С.В., Чумичев В.С., Гайдуков А.Б. Некоторые аспекты теории нейронных систем// Молодой ученый. – Казань. – № 16 (96), – 2015. – С. 196–199.
8. Мелихова О.А. Методы построения интеллектуальных систем на основе нечеткой логики. Научное издание – Таганрог: издаельство ТРТУ 2007. 92 с.
9. X.B.Madaliev,D.H.Tukhtasinov "Development Of An Openness Profile For A Logical Control System For Technological Equipment" // Ijodkor O'qituvchi - No. 20, 215-217, 2022.
10. Madaliyev , X. «Creation of interface through app design of matlab software for automatic determination of loads on roller machine worker shaft». Interpretation and Researches, т. 1, вып. 10, июнь 2023 г.