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Study on the characteristics of travel time based on the method of wavelet decomposition

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Abstract

The fixed-point detectors using the technology of Automatic Vehicle Identification (AVI) is able to gather samples of vehicles' travel time on the corresponding section of urban main roads. Through the application of wavelet decomposition method, the irregular travel time data of the road section would be denoised into travel-time curves. These curves would be classified and analyzed to reveal the characteristics and the regular pattern of vehicles' travel time on certain urban road section in order to identify its relationship with land use and urban space distribution.

Keywords: Automatic Vehicle Identification；travel time；wavelet decomposition method；travel-time curves ;land use

1. Introduction

Travel time of vehicles on sections of urban main roads is affected by the temporal and spatial characteristics of urban road section and the city's land use condition.

In this paper, the characteristics of the samples of travel time collected on the certain urban freeway section would be studied to identify its relationship with land use and urban space.

Samples of vehicles' travel time data used in this paper were collected through the Automatic Vehicle Identification (AVI) system. Automatic Vehicle Identification (AVI) is one of the most important technologies of the Intelligent transportation system (ITS). The Automatic Vehicle Identification (AVI) System is able to extract

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image data using the surveillance camera and recognize the vehicle license plate from the complex background of the image. All the information of the vehicle license number and the plate color could be identified through the technology of image preprocessing, feature extraction, license plate character recognition and etc..
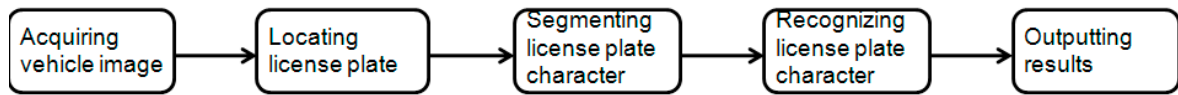

Fig.1 Operating principle of license plate recognition system

AVI readers can likewise be installed for real-time traffic monitoring, incident detection, travel information, performance measure data collection, and electronic toll collection, said by Sherali, Desai and Rakha (2006). Zhou and Mahmassani (2006) also denoted that OD trip-desire information can be obtained from direct-interview surveys or estimated from real-time traffic surveillance data.

As the data collected by the AVI readers is intensive and shows strong disturbance, the irregular travel time data would be denoised through the application of wavelet decomposition method. These curves would be classified and analyzed to reveal the characteristics and the regular pattern of vehicles' travel time on certain road.
We finally note that the travel time of vehicles on urban main roads has a strong spatial pattern, which is impacted by the city's distribution of commercial land and residential land.

2. Research object and data set

2.1. Research object

The object of study selected by this paper is the three main transmeridional main roads in Shenzhen, respectively, North Road, Shennan Avenue and Riverside Avenue. AVI readers are located on sections of these roads. The time period for data collection was 5 working days from Monday to Friday.
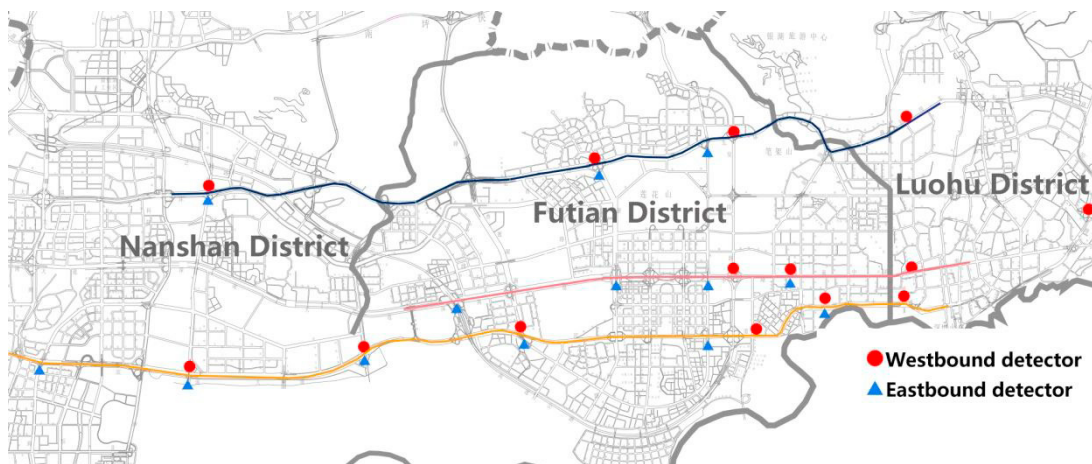

Fig.2 Study objects

The Automatic Vehicle Identification (AVI) system can continuously detect passing vehicles in the 24 hours of day on the installation location of the detector. The mass data gathered by the system has formed into dense number, which means that the system is able to observe the urban traffic and its evolution pattern on a real-time and continuous level. The sample size is adequate considering that the license plate data used in this paper consists of