Incident Detection for the Surface Street Network with the Mesh-wised Traffic Indices on the Macroscopic Fundamental Diagram

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1 Introduction

This paper describes the incident detection method for the surface street network based on the mesh-wised traffic indices which is called 'Trafficscope'. 'Trafficscope' has been proposed[1] for the visual comprehension of regional traffic situations in terms of the fluidity and the singularity of traffic conditions. The fluidity index represents the average traffic smoothness of each mesh based on Macroscopic Fundamental Diagram (MFD)[2, 3]. It may provide the rough sketch of the congestion over the region with quick comprehension. On the other hand, the singularity index highlights the singular meshes in statistic based on the quantity of the information for traffic congestion[4] to express the 'rareness' of the conditions. It may help to learn how extraordinary the traffic conditions are.

Figure 1 show the examples of the Trafficscope information of Tokyo city center. The left picture shows the fluidity index of each mesh. The red color means low fluidity with heavy congestion and the blue color does high fluidity. The right picture shows the singularity index at the same time of the left picture. In this picture, the red color means high singularity and the blue means low. By comparing those two pictures, people will see how the congestion in the south area of Tokyo is extraordinary.

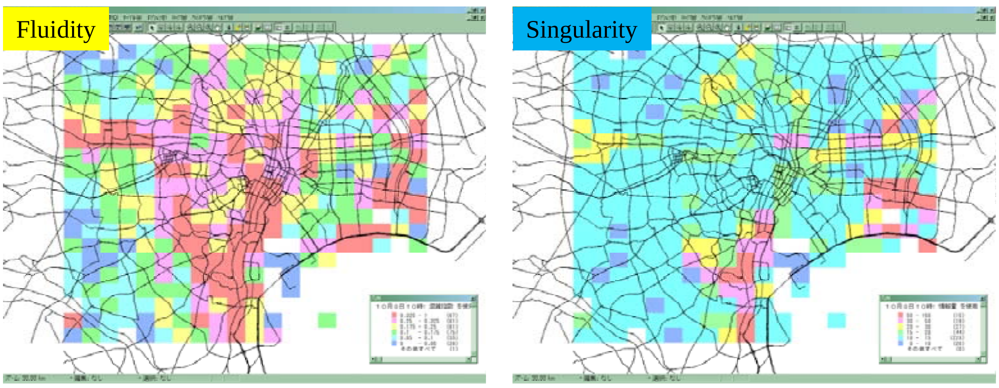

Figure 1. The indices of Trafficscope (left: fluidity, right: singularity)

2 Incident Detection for the Surface Street Network

Through the dozens of case studies with real floating car data in Tokyo, we have so far found the singularity index has high sensitivity to the incident occurrence which will affect the area traffic conditions[5], such as extreme weather, serious traffic accidents, troubles in public transport operations, etc. Different from the highways on which many traffic sensors are installed, there seems to be rate to build the incident detection system for the surface street network in practice. The sensitivity of the singularity index may help to establish the incident detection method on the surface street network.

As an incident becomes serious, the area size affected by the incident will be larger. This implies us we may estimate the seriousness of the incident by counting the meshes which have higher singularities and adjacent each others. For this purpose, the time-space mesh clustering algorithm is introduced to give an identical label to the affected area by some incidents. The algorithm will provide the 'root' information for each mesh cluster to indicate the presumed place where the incident may happen.

Figure 2 shows the Trafficscope information after some time from the big accident occurence. In this picture, the fluidity index of each mesh is represented by the tint from green (smooth) to red (congested) and the high singularity is highlighted by the thick colors. In this case, as the major junction of the Metropolytan Expressways (MEX) was closed by the accident, many vehicles getting off MEX caused seriously heavy congestion. The dotted line in the picture surrounds the labeled area in on singular cluster which may be originated with this accident and the 'x' marks the root of this cluster.

In the full paper, the detail of the algorithm will be explained.

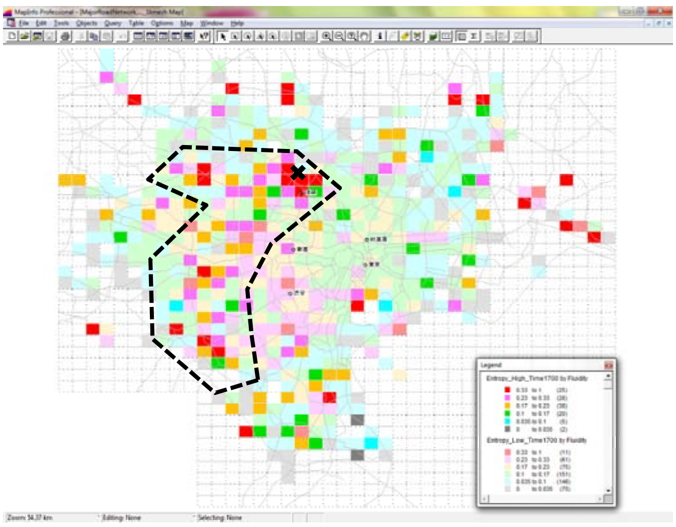

Figure 2. Trafficscope information at the incident scene

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