博 士 論 文(要約)


Traffic Accident Risk Analysis with Spatio-Temporal Data

(時空間データを用いた交通事故リスク分析)


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As people have become much more dependent on transportation systems in recent years, traffic accident has been a serious problem. Globally, traffic accidents lead to not only death and injuries, but also financial costs to both society and the individuals involved. Traffic accidents are caused by a number of factors, including vehicle design, road design, and driver behavior. Analyzing these factors will help us reduce accidents, which is inferred as accident risk analysis.

To analyze distribution and factors of accident risk, we need enough data. However, the collection of accident data is strongly depend on police agencies. Even in Japan, while many provinces make efforts on collecting accident data, some still do not pay attention on it. What's more, to analyze causes and influential factors of accidents, we also need other causes related data. Previously studies are restricted by lacking of these data, especially data related to human movement, like traffic volume data, so that they cannot achieve dynamic analysis, which can show how risk changes.

As sensor technologies have explosively developed in recent years, it is much easier to collect various and huge data. Especially, with the widely usage of GPS devices, it is easy to collect people location data in real-time and allows us to analyze human relative task from a new perspective. Corresponding, machine learning methods have made breakthrough to handle such big data.

Therefore, I aim to make contributions on applying new methods and exploring new application in accident risk analysis. In detail, I have mainly focused on:

(1) Analyzing the distribution and correlation of accident data in Japan to give suggestions of preventing accidents.

(2) Utilizing matrix factorization method to estimate accident distribution and solve accident data missing problem.

(3) Introducing deep learning method into traffic accident analysis, which can improve the performance of traditional analysis method. Also, I explore and discuss the possibility of applying deep learning to predict accident risk with GPS data.