Visualizing Students' Time-Space Trajectories on University Campus using Smartphone-based Survey Data and Topic Model

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Abstract

A typical university campus has several transport problems. For example, many bicycles located in a cluttered way can impede the safety of the campus and worsen the campus landscape. In addition, congestion is often observed at the cafeteria during lunch time. The behavioral data of students, faculty, and staff within the university would be useful when considering solutions to these problems.

A traditional method of collecting behavioral data has been paper-based travel surveys; however, the method is not sufficiently accurate for a detailed planning of the campus. Furthermore, the survey cost and burden are high. Thus, the use of smartphones and Wi-fi trace data for surveys has attracted considerable attention in recent time. A large amount of data can be obtained through such surveys, and an efficient procedure is needed to analyze the collected data.

Existing studies have attempted to extract behavioral patterns from GPS-based data; some studies have applied topic modeling to this problem. However, the application of this method to small-scale areas (e.g., a university campus) has been limited. In this study, we apply topic modeling to the data collected via a smartphone-based GPS survey at Kumamoto University Campus, Japan in January 2016 and visualize students' time-space trajectories.

Topic models were originally used to analyze text data, and this study considered the document and words in the original topic model as trip chain and mesh, respectively. We successfully retrieved behavioral patterns by topic models, and these patterns can be explained using individual attributes, demonstrating the usefulness of this approach. In addition, visualizing time-space trajectories provided more detailed analysis.

A university campus usually has many Wi-fi access points and examination of Wi-fi trace data is possible. Although we made use of data obtained from the smartphone-app-based survey, the method can be also applied to Wi-fi trace data. Our proposed method will enable us to infer individual attributes of tracking data in the future.