Constructing Activity-Mobility Patterns of Students Based on UB Card Transactions

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Abstract

This research constructs activity-mobility patterns of students based on their UB card transaction. The research has two different stages. The first stage consists of the development of algorithms that construct students’ continuous paths in space-time dimension using a set of UB card transaction data points as an input. The base algorithm will construct activity-mobility patterns with no prior knowledge. The modified algorithm will construct activity-mobility patterns with prior knowledge of students’ prior pattern as they have similar patterns for certain days of the week. With our second stage, a survey will be conducted to provide detailed information of the students’ daily routine from home to school and back. When comparing the survey data with the algorithm results, we will be able to analyze the performance of our algorithms. Our anticipated results will be that our algorithms created can find a more efficient critical path movement throughout the campus than the real life collected data.

Background

- Activity-mobility patterns have been widely used to represent the movement of traveling entities in time and space.
- In previous studies, researchers generated various mobility patterns using a broad range of positioning technologies such as Global System Mobile, Global Positioning System, traffic sensors and smart phone data.
- A UB Card is a student's official ID at the University at Buffalo and is used across campus for various reason including Stampedes (on-campus bus system), facilities access, dining and shopping.
- In this research, we propose to use UB cards as a convenient source of data in order to define a UB campus-wide model for students' activity-mobility patterns generation in time-space dimension.

Methodology

Proposed Algorithm

1. Constructing activity-mobility patterns only based on students’ UB card transaction record.

2. Develop an algorithm with no prior knowledge to frame a modified patterns of students’ daily activities.

Algorithm

- Gathering the student transaction data set $R$, $R = (T_i, L, T_Y)$, UBcard transaction record Model
- $i$ = Number of UBcard transaction record point
- $T_i$ = Time of UBcard transaction in record $R_i$
- $L$ = location of UBcard transaction in record $R_i$
- $T_Y$ = UBcard usage type in record $R_i$
- Creating $N_{h,i}$ and $N_{t,i}$ conditionally based on $T_i$, $L_i$ and $T_Y$ of the record $R_i$
- $N_{h,i} = (T_h, L, T_Y)$, this is the head node which generated associating with $R_i$
- $[T_{h,i} - T_i] = Head$ time of $R_i$
- $N_{t,i} = (T_t, L, T_Y)$, this is the tail node which generated associating with $R_i$
- $[T_{t,i} - T_i] = Tail$ time of $R_i$
- $L_i = location$ of $UBcard$ transaction in record $R_i$ ($N_i$)

• Estimating unconnected region by establishing brand new nodes $E_{i, h} = (T_{h,i}, L_i, T_{i+1})$ and selecting the optimized option to finish the simulated path.

Data Collection

1. Collecting information of students’ daily activities from survey.

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Table 1: Survey of students’ daily activity information

2. Obtaining reported activity-mobility pattern.

Expected Results

According to the error analysis between reported and constructed patterns, the activities with UB card transaction records, such as stampede bus, dining and facility access will be well captured. Other activities like attending classes, studying in the library and using personal transportation (walking or driving) will not be captured in constructed pattern.

Impact

The potential impact from this research could help generate the most efficient pathways for movement in a given area. For instance, this research could represent the most efficient way for a safety protocol like an Ebola outbreak. This critical path movement can develop a strategy to minimize the spread of this disease by showing which location to cut off minimized containment.

References


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