論 文 の 内 容 の 要 旨

論文題目　Citywide Human Mobility Modeling at a Rare Event
（希少事象における都市規模の群衆移動モデリング）

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There are two broad categories of citywide human mobility, routine, composed of daily or periodic travel, and rare, which occurs during events such as the Olympic Games or natural disasters. State-of-the-art studies have shown that routine mobility patterns can be modeled stochastically, while rare human mobility modeling, essential to a variety of urban computing scenarios, such as emergency management and traffic regulation, is a much more challenging and understudied problem.

Rare event human mobility modeling comprises three important stages: 1) Profiling depicts the influence of a past rare event to the citywide human mobility with each aspect; 2) Predicting forecasts the short-term human mobility giving an on-line citywide human mobility stream; 3) Simulating aims to simulate the citywide human mobility of an imaginary rare event. For a temporal perspective, citywide human mobility is modeled for the rare event in the past (profiling), present (predicting) and future (simulating).

In profiling stage, CitySpectrum is proposed to extract basic patterns underlain in the citywide human mobility and interpret the influence of rare events as the fluctuation of these basic patterns. CityMomentum discards the historical data and leverages the most recent human mobility to make on-line short-term prediction. This models is further extended by a more sophisticated online deep ensemble learning that exploits both historical and the most recent data to make more accurate human mobility predictions. CityCoupling aims to simulate citywide human mobility at the rare event that happened in another city (e.g. simulating the citywide human mobility if Osaka was also stroked by the 311 earthquake as Tokyo).

The proposed methods are applied on a large mobile phone GPS dataset in Japan. Both qualitative and quantitative analysis are conducted to show an advantageous performance as well as a great potential of applying these methods in real-world scenarios.