

Detecting Sudden Rises in Traffic Demand Based on Route Search Request Logs

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1. Introduction

People often specify a time in the future as a departure or arrival time when they use online route search service (Figure 1). In this study, by using request logs of route search service, we attempted to detect sudden rises in traffic demand which have been difficult in a conventional method with statistical or forecasting models.



The screenshot shows the PC-NAVITIME route search interface. At the top, there are four navigation icons: a train for '乗換案内' (Transfer information), a car for '車ルート' (Car route), a green cube for 'トータルナビ' (Total navigation), and a bicycle for '自転車ルート' (Bicycle route). Below these is a search form with two input fields: '出発駅' (Departure station) containing '表参道' and '到着駅' (Arrival station) containing '新宿'. A double-headed arrow icon is between the fields. Below the fields are date and time selectors: '2013年6月' (Month), '3日' (Day), '11' (Hour), and '56' (Minute). There are radio buttons for '出発' (Departure) and '到着' (Arrival), with '出発' selected. Below the date and time are radio buttons for '表示順序' (Display order): '時間' (Time), '運賃' (Fare), and '乗換回数' (Transfer count), with '時間' selected. A large orange button labeled '検索' (Search) is centered at the bottom. A link '▶ 詳細条件・経由駅を設定' (Set detailed conditions and route) is at the bottom right.

Figure 1. Screen for entering route search requests (PC-NAVITIME).

2. Data

In this study, we examined the possibility of detecting sudden rises in traffic demand which happened from March 18 to April 14, 2014, using the request

logs between stations which were recorded from February 1 to March 17, 2014 with several route search services provided by NAVITIME JAPAN Co., Ltd.

3. Methods

It appears that the more route search requests were run in advance, the earlier forecasting a sudden rise in traffic demand becomes available.

First, we got the statistical increasing trend in the number of advance search requests (Figure 2). An advance search request is defined as a route search request which were run prior to specified departure or arrival time.

Second, we forecasted the growth of the number of the future route search requests which would be run prior to the specified time.

Third, we detected sudden rises. In this study, we defined a sudden rise as a case which per-hour retrieval frequencies by specified station and time-specification method (i.e. a specification of either departure or arrival time) become at twice the basic frequencies in an ordinary day and at least 50 times.

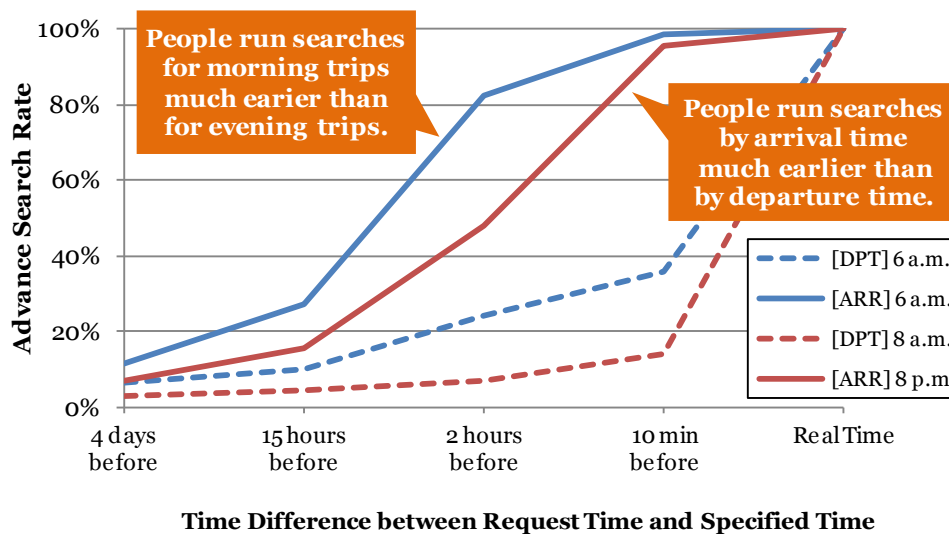


Figure 2. Increasing trend in the number of advance search requests.

4. Results

During the target period, total 12,268 sudden rises happened. We detected 267 of them at 4 days before the specified time. The major part of them is happened for concerts, sporting events and, because of the season, graduation and entrance ceremonies of schools and the government (Table 1).

Cause Event	Number Detected	Stations for Example
Concert	62	Seibu-Kyūjō-mae, Suidōbashi, Korakuen, Saitama-Shintoshin, Shin-Yokohama
Sporting Event	17	Ukimafunado, Hasune and Keisei-Sakura (for marathon), Urawa-misono
Other Event	12	Kokusai-tenjijō-seimon, Yokosuka-chūō (for U.S. Fleet Activities)
Holiday Resort	28	Kudanshita (for cherry-blossom viewing), Takaosanguchi, Tokyo DisneySea Station
Government & Business District	36	Nihon-ōdōri, Tochōmae, Kasumigaseki, Nishi-shinjuku
School Event	47	Kudanshita, Hiyoshi, Chuo-Daigaku · Meisei-Daigaku,
Time Schedule Revision	15	Wakōshi, Shinjuku-sanchome, Kita-sando, Motomachi-Chūkagai
Airport	2	Haneda Airport, Haneda Airport Terminal 1
Unknown	48	
Total	267	

Table 1. Sudden rises detected at 4 days before the specified time.

The following example is about a concert.

Figure 3 is a heat map, which shows top requested stations as origins or destinations with the route search services between 4 and 5 p.m. on April 13, 2014. Momoiro Clover Z, a Japanese idol group, held a concert on the day at Seibu Dome. Seibu-Kyūjō-mae, the nearest station of there, was the 7th most requested station at that time.

Figure 4 shows a time-based distribution of the number of route search requests of which the destination was Seibu-Kyūjō-mae and arrival date was April 13, 2014. A number of search requests are concentrated before the curtain time of the concert and the opening time of the merchandise booth. At April 9, or 4 days before the concert, the retrieval frequency of the hour before its curtain time had already become at 8 times the cumulated num-

ber of the route search requests in an ordinary day. This indicated that we can detect sudden rises in traffic demand by using request logs of route search service.

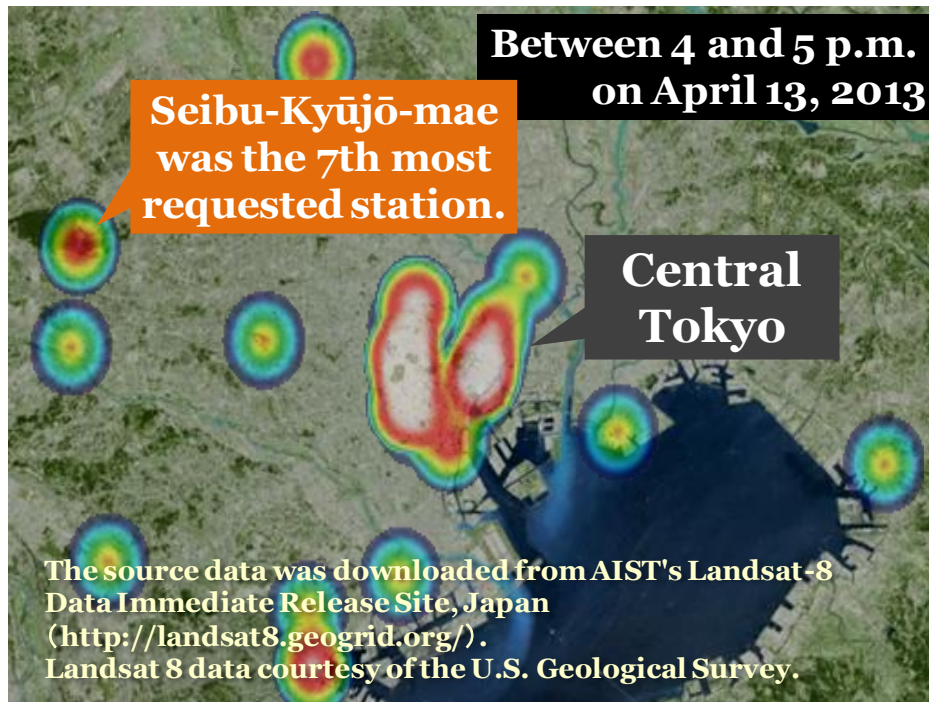


Figure 3. Heat map of top requested stations. (Between 4 and 5 p.m. on April 13)

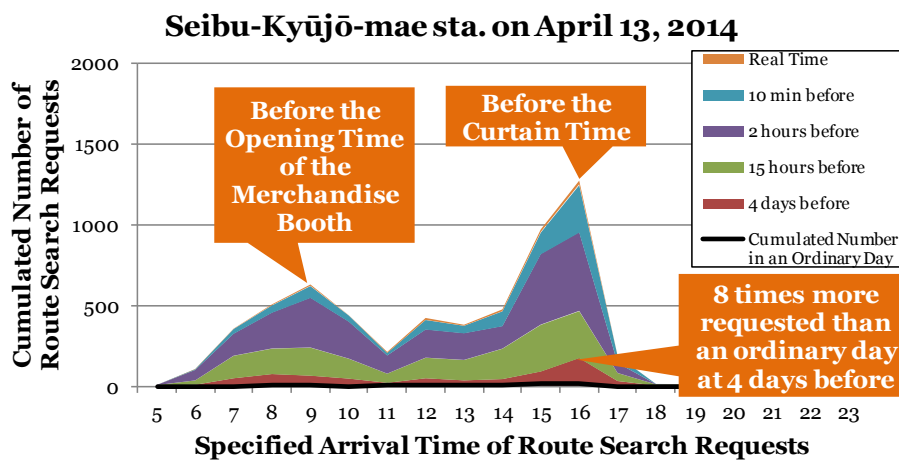


Figure 4. Time-based distribution chart of the number of route search requests.

5. Discussion

We think that detecting sudden rises in traffic demand will improve public transportation services and retail marketing approaches. Especially during events such as 2020 Tokyo Olympics and Paralympics, for which forecasting traffic demand is quite difficult, our study would contribute to suppress the traffic disruption and maximize its economic effects.

References

Ishimura R, Ota K & Tomii N (2013) Detecting Sudden Rise in Demand of Transportation Needs in the Near Future Based on Immediate and Historic Data of Route Search Service (in Japanese). The 47th Research Meeting on Civil Engineering Planning, 2013