MSS | Regional Revitalization | Tourism Statistics

Collaboration Projects

"Mobile Spatial Statistics" Supporting Development of Society and Industry
—Population Estimation Technology Using Mobile Network Statistical Data and its Application—

Using Mobile Spatial Statistics for Regional Revitalization

*Tourism is regarded as an important element of regional revitalization, but no methods have been established for ascertaining the actual number of visitors to events and festivals, which is a fundamental statistic of tourism. We therefore performed a proof-of-concept experiment targeting the Mihara Shinmei Festival, and we studied visitor numbers using MSS and Premiere Panel™*1. By working with Premiere Panel, we also estimated the number of people that could not be ascertained from MSS alone. In this article, we describe the results of testing the validity of this concept by comparing the results of this study with the results of a field survey.*

Research Laboratories
Tomohiro Nagata
Sadanori Aoyagi
Hiroshi Kawakami

1. Introduction

With Japan's recent shifts towards an aging population and a growing concentration of population in urban areas, the impoverishment of regional economies is becoming a noticeable issue, and tourism has been touted as an important element of regional revitalization. For the proper proposal and evaluation of tourism policies, it is essential to ascertain the number of visitors that attend events and festivals in the area.

In this article, as an example of the application of Mobile Spatial Statistics (MSS) to regional revitalization, we describe on the results of a study into visitor numbers at the Mihara Shinmei Festival held in Mihara city, Hiroshima prefecture.

2. Regional Revitalization through Tourism

2.1 Role of Tourism

Efforts are currently being made to devolve authority to local governments, and with the aim of improving local economies, various measures are being implemented to stimulate local communities.

One of the most important measures being considered is regional revitalization through tourism. Tourism can be expected to being economic benefits not only to the travel and accommodation industries, but also to a wide range of other industries including catering and souvenirs. It is estimated that

*1 **Premiere Panel**: A service that uses mobile terminals to perform questionnaires for NTT DOCOMO's Premium Club members for research and promotion purposes. A trademark or registered trademark of NTT DOCOMO, Inc.

tourism benefited Japan to the tune of ¥51.4 trillion (5.3% of GDP) in the 2008 business year [1].

2.2 Tourism Surveys and Their Role

Most tourists come from outside the local area, and their numbers vary widely depending on the scheduling of events. It is thus impossible to ascertain tourist numbers from statistics such as the census that only count full-time residents. Each municipality therefore studies the number of tourists that arrive, and the hourly changes in this number.

These tourist surveys allow each municipality to ascertain the degree of congestion and the like, and to study the measures they implement in relation to events. For example, based on the survey results relating to the previous year's event, it is possible to study the timetable of entertainments within the event, and its security and traffic control measures.

Conventional survey methods include counting up the number of tickets sold, or having surveyors manually count the number of people entering the event. However, these survey methods can only be applied to certain events, and it appears that there are currently many events at which it would be difficult to perform surveys of this sort. Even when it is possible to perform a survey, the survey methods are not unified between different regions and events. In this situation, it is difficult to make accurate comparisons with other events.

The authors have therefore performed a proof-of-concept test at the Mihara Shinmei Festival in Mihara city, Hiroshima prefecture, by assuming that MSS can be used to provide an easy and nationally unified way of measuring the number of visitors to an event.

3. Proof-of-concept Test at Shinmei Festival

3.1 Mihara Shinmei Festival

The Mihara Shinmei Festival is held around the north exit of JR Mihara station over three days ending on the second Sunday of February each year, and features a display of daruma (good-luck dolls), potted plants and street vendors lining the roadside for over a kilometer. The 2012 festival took place on the 10th (Friday), 11th (Saturday) and 12th (Sunday) of February [2]. Since the Mihara Shinmei festival is held on the streets, it has the following features:

- The venue covers an extensive area
- The venue has many entrances and exits
- People are can enter and leave the venue freely

In the conventional methods mentioned above, there would be many survey points where entrance gates and staff would have to be positioned, which is likely to result in the survey being very expensive and complicated to perform. On the other hand, MSS uses the existing communication infrastructure, which means it has the advantage of there being no need for any preparations at the scene of the event so that the survey can be performed easily.

3.2 Overview of Proof-of-concept Test

MSS works by aggregating the location data of mobile terminals in grid[*2] units and using this information to estimate the population in these grid units, so in this proof-of-concept test we performed an analysis of multiple grids around the Shinmei festival venue. **Figure 1** shows the area covered by this analysis.

In this analysis, we studied the changes in the number of visitors to the Mihara Shinmei festival at hourly intervals while the event was in progress.

The number of visitors was estimated by obtaining the difference between the population of the Mihara Shinmei festival on the day in question and the population on a non-festival day. Specifically, the population on a non-festival day was taken as the population on the same day of the week and in the same one-hour period one month before the start of the Mihara Shinmei festival.

However, it is only possible to estimate the MSS for some of the visitors to the event. For example, MSS are useful for estimating the numbers of people aged 15–79, but not for people aged 14 or less, or 80 or more. We therefore used Premiere Panel to ascertain the

*2 **Grid**: A geographical block in the shape of a net that covers the whole country based on lines of latitude and longitude.

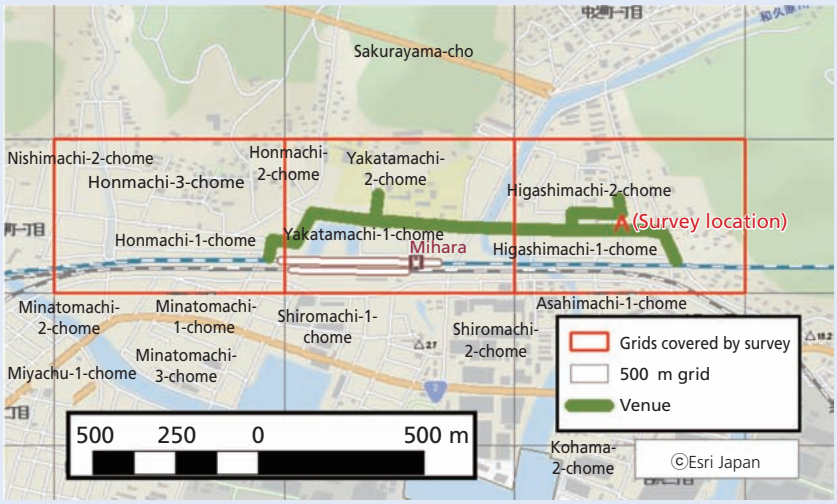


Figure 1 Area covered by our analysis (around the Shinmei festival venue)

ratios of visitors aged 14 or less/80 or more, and we multiplied these ratios by the number of people in the 15–79 age group obtained by MSS to complement the values that could not be ascertained directly by MSS, allowing us to ascertain the total number of visitors to the event.

4. Survey Results

4.1 Survey of Changes in Visitor Numbers

Figure 2 shows the estimated visitor numbers obtained from this proof-of-concept trial at hourly intervals over the duration of the festival, together with a breakdown of the results by gender and age group.

Fig. 2(a) shows how the number of visitors changes over the course of each day. On Friday there was only a gentle increase in the number of visitors, but on Saturday and Sunday the visitor numbers increased greatly from the opening time of 9 am, and reached a peak at 1 pm. There was also a slight decrease at around 2 pm on the first day, but this can be attributed to a period of rainfall that may have caused some people to temporarily postpone their visits.

Fig. 2(b) shows how the ratio of male and female visitors varies. Overall, it can be seen that there were more females than males. Fig. 2(c) shows a breakdown of the visitor numbers by age group. On all three days, there tended to be a higher proportion of middle-aged and senior visitors in the early morning, with the proportion of younger visitors increasing with the passage of time through to the evening.

4.2 Verification of the Estimated Visitor Numbers

To verify the validity of the MSS, we compared these results with the results of two surveys:

- Turnout figures published by the Mihara Shinmei Festival Supporters Association
- On-site pedestrian traffic survey

The Mihara Shinmei festival is organized by a festival supporters association, which publishes figures on the visitor turnout during the period of the event [3]. The Mihara Shinmei Festival Supporters Association surveys the number of visitors to the entire festival venue at hourly intervals based on the number of people in part of the venue, and the turnout figures are calculated by adding up the number of visitors in each one-hour period. These turnout figures are therefore equivalent to the total number of visitors during the event period in the MSS.

The turnout published by the Mihara Shinmei Festival Supporters Association was 337,000, and the total number of visitors according to MSS was 349,000. Since these numbers are quite similar, it can be seen that the absolute value of the visitor numbers estimated by MSS is valid.

Next, we performed a manual survey of pedestrian traffic at the event venue, and we compared the survey results with the changes in the number of visitors. The pedestrian traffic analysis results are shown in Fig.3. Although the visitor numbers and pedestrian traffic numbers are different quantities, it is reasoned that they are both proportional

to the degree of congestion at the venue and should therefore exhibit the same tendencies to increase and decrease over time.

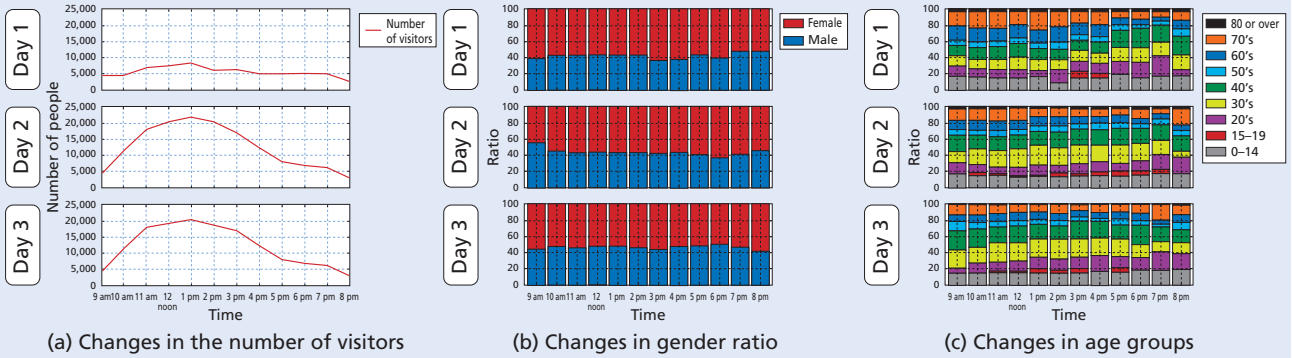
At point A in Fig.1, every time a visitor passed by from west to east inside the venue, we recorded the time of this occurrence together with an instant assessment of the visitor's gender and age group, and we counted up the total number of people passing by in one hour. Similarly, we also calculated the gender and age group ratios for each one-hour period.

Figure 3(a) shows the changes in the number of people passing by. The results compare favorably with Fig.2(a), with the number of passers-by being smaller on the first day than on the second and third days, and reaching a peak at around 12 noon on the second and third days. Since both sets of results exhibit similar increasing and decreasing trends, it can be seen that the trends in visitor numbers estimated by MSS are valid.

Also, the changes of the gender ratio shown in Fig.3(b) are in agreement with the results of Fig.2(b) and indicate a consistent trend whereby there are slightly more female visitors throughout the duration of the event. Furthermore, the breakdown in visitor numbers by age group shown in Fig.3(c) matches the results of Fig.2(c) where the initial values on each day showed a high proportion of older people and fewer young people, with a tendency for there to be fewer older people and more young people as time passes.

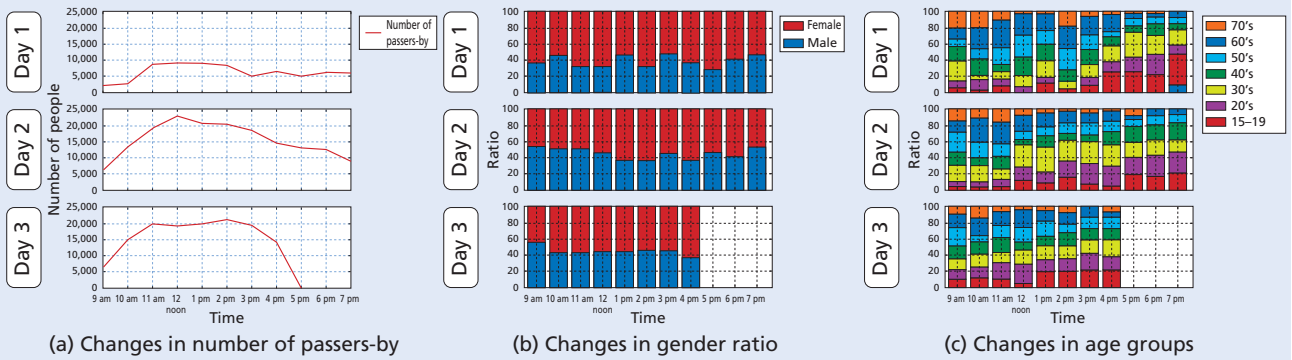
5. Conclusion

In this article, we have discussed the background of how MSS can be applied to the field of regional revital-



(a) Changes in the number of visitors (b) Changes in gender ratio (c) Changes in age groups

Figure 2 Results of visitor number analysis



(a) Changes in number of passers-by (b) Changes in gender ratio (c) Changes in age groups

Figure 3 Results of analyzing the number of passers-by

ization, and we have described the results of a proof-of-concept field trial at the Mihara Shinmei festival.

There are said to be approximately 10,000 events held throughout Japan every year. MSS are able to objectively evaluate statistics such as these event attendance figures with the same methods and criteria. However, since MSS are by their nature aggregated over the areas covered by mobile terminal base stations, they are poor when it comes to estimating visitor numbers at events held in small areas such as inside buildings. It is therefore considered that other survey methods may be more appropriate for certain types of event.

In the future, we will perform proof-of-concept tests at large-scale events in order to obtain further verification of the utility of this approach. Also, in tourism, it is not just the number of visitors that is important but also the amount of money they spend and how long they stay before leaving. We hope to use MSS and Premiere Panel to establish methods for estimating these additional quantities, which would be beneficial for drafting and verifying the effects of regional revitalization policies.

REFERENCES

[1] Bureau of Tourism, Ministry of Land, Infrastructure and Transport: "Survey of the economic benefits of the travel and tourism industries," Mar. 2009. http://www.mlit.go.jp/common/000059567.pdf

[2] Mihara city: "The Shinmei Festival." http://www.city.mihara.hiroshima.jp/kurashi/event/sinmei/index.html

[3] Mihara Daruma Festival Supporters Association: "Turnout figures." http://www.mhr-cci.or.jp/shinmei/hitode.html