A Qualitative Regional Transition Analysis in the mobile E-commerce

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The mobile e-commerce catches the attention from the industries as the users with a micro browser in mobile handsets increase in a drastic manner. It is observed that users in the mobile Internet are so-called "easy come, and easy go" users. Even with a large number of real active users, the user behavior characteristics are largely unexplored. This is a challenge for the user behavior study because the marketing technologies in the mobile Internet are in the very early stage despite of the emergent importance in the industry. The author presents the challenges in the mobile e-commerce marketing. Then the author discusses the regional characteristics in the mobile e-commerce. The author proposes a qualitative regional transition analysis to cope with the regional e-commerce marketing. A case study is performed to capture the general regional transition pattern in the past observation.

1. Introduction

As the Internet access using a micro browser in a mobile handset becomes common, the mobile e-commerce catches the attention from the industries. The number of the Internet users using micro browsers can outnumber one in the wired Internet. The features in micro browsers have been accumulated as color, scripting languages, multimedia interaction languages, and so on to incorporate the demands from mobile e-commerce. One of the unique features of the mobile e-commerce is the close relationship to the local context. In the exploratory study in the early days of mobile e-commerce, the author found that the user distribution over different regions might have significant divergence. This leads to the critical industrial needs to develop methodologies to identify such a regional characteristics for each mobile e-commerce service.

The widely accepted usage of information appliances has now little doubt, as described in[2]. However, the acceptance of the services in these appliances will be highly likely different from those of PC Internet. It is a critical issue that how we can capture the each diverse user behavior patterns in this newly emerging computer communication domains. Mobile Internet can cover a wide spectrum of Internet usage. However, in this paper, we call the Internet users who access the Internet using microbrowsers on a cellular phone handset as mobile Internet users. It is not so accurate, however, it is natural to focus on the handset-based users considering the significance of cellular phone based users in the Internet users who have mobile characteristics. This paper explores the issues in mobile e-commerce analysis. An methodology based on economic geographic approach is proposed. The case studies are presented to outline the preliminary results from this methodology to capture the characteristics of real world mobile e-commerce.

2. Challenges in Mobile Internet Users

2.1 Research Issues

Only five years ago, the mobile Internet use was just a dream. People did not agree that a small display on a mobile handset can help people actively access to the Internet. In addition, people could not see that most people will endure the input pains using just ten keys on a handset. With the last 1-mile has been bridged with the emerging wireless technologies, the mobile e-commerce is one of the growing service domains in the Internet. In Japan, the number of the people accessing the Internet from mobile handsets almost equals to that of the PC Internet access. There are about 70 million active mobile handset based Internet users in Japan at the end of March 2003. The widely accepted use of Compact NetFront™, a HTML subset-based Internet aligned solution for a micro-browser on a cellular phone handset is one of the keys of mobile Internet growth in Japan.

The mobile Internet is a significant portion of

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the Internet in Japan. It naturally leads to the questions like followings:

- Are the mobile Internet users similar to the PC Internet users?
- If the mobile Internet users are different, in what aspects they are different from the PC Internet users?

Any attempts to capture the mobile Internet users encounter the challenge that the mobile Internet users' behavior is so dynamic and volatile.

2.2 Purpose of the Study

This study aims at developing a methodology to identify the regional characteristics of the mobile e-commerce. It focuses on the long-term transition characteristics to support the long-term mobile e-commerce marketing efforts. Especially, the methodology should provide a general approach to a wide range of applications with a wide range of comparison granularities to cope with the emerging new Internet services and their analyses.

2.3 Preliminary Findings of mobile Internet Specific User Behavior

Our preliminary observation was made on several i-mode services in Japan. I-mode is the most popular Internet access service from mobile handsets using Compact HTML, a subset of HTML. Its share in Japanese market is approximately 60%. From the initial observation, the user share in metropolitan areas was significant. Tokyo, Kanagawa, Saitama, Chiba, an area within 50 km from the center of Tokyo occupied about 40% of the users. Is it the common nature of the mobile Internet? Or it depends on the diffusion stages, e.g. the early adopters are metropolitan residents, but gradually the effect of early adoption will vanish? In addition, a new question arises that it is just a metropolitan and non-metropolitan or any area-specific characteristics are observable. From the early observation, we think the mobile Internet users are typical metropolitan users at least in the early stage. The metropolitan area occupancy ratio in two services is measured in a preliminary study, as presented in **Fig. 1**.

This study is motivated from the initial observations in which major mobile Internet services have a high ratio of metropolitan users. Tokyo, the biggest metropolitan area belongs to the Kanto region. The difference between

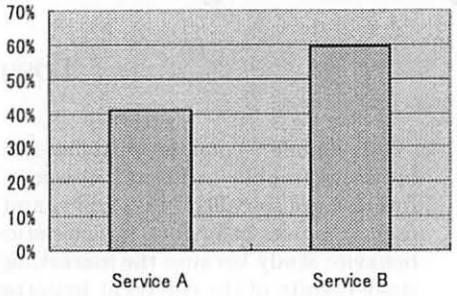

Fig. 1 Ratio of 3 major metropolitan areas

the north Kanto area distant to Tokyo and the south Kanto area adjacent to Tokyo is clear. It leads to the economic geographic analysis based on the region and relative metropolitan nature in that region. The emerging mobile technologies started to capture a new user segment that was not familiar with PCs. Japan has multiple regions and each region has a region-central area. They form a structured clustering of the regions. Based on the preliminary study, this paper tries to capture and compare the user distribution density in region base. Kanto, the Tokyo-surrounding area is treated differently. Tokyo, South-Kanto(adjacent to Tokyo), North-Kanto are treated in a separate manner. In each other region, the prefecture that has the region-central city is separately analyzed to identify the difference. It means that this economic geographic analysis is based on the following assumption:

- Japan has a three-layer geographic structure to adopt an advance service
- The first layer is Tokyo
- The second layer consists of Tokyo-adjacent area and each region's central area
- The third layer consists of each region except the second layer regions

From this assumption, the analysis is done using the prefecture groups shown below:

- Kanto Metropolitan: Tokyo
- South Kanto: Kanagawa, Saitama, Chiba
- North Kanto: Ibaragi, Gumma, Tochigi
- Tokai: Shizuoka, Gifu
- Tokai Metropolitan: Aichi
- Koshin'etsu: Yamanashi, Nagano, Niigata, Toyama, Ishikawa, Fukui
- Kansai Metropolitan: Osaka

- Kansai: Kyoto, Nara, Shiga, Mie, Wakayama, Hyogo
- Chugoku Metropolitan: Hiroshima
- Chugoku: Okayama, Tottori, Shimane, Yamaguchi
- Shikoku: Kagawa, Ehime, Kochi, Tokushima
- Kyushu Metropolitan: Fukuoka
- Kyushu: Saga, Oita, Kumamoto, Miyazaki, Nagasaki, Kagoshima, Okinawa
- Tohoku Metropolitan: Miyagi
- Tohoku: Aomori, Akita, Iwate, Yamagata, Fukushima
- Hokkaido: Hokkaido

3. A Qualitative Regional Transition Analysis

3.1 Regional Transition Patterns

In the preliminary study[4], the author described how the user ratio per population differed from service to service. It indicated that the mobile Internet service has the regional transition patterns. The mobile Internet has a unique feature that it has always-on nature and is attached to the users for 24 hours and 365 days. In addition, the mobile carrier-provided unique user identifier makes the user-specific tracking easy. The mobile Internet is truly personal communication, which reflects the personal user-specific behaviors. In the preliminary study, the author assumed the trickledown effect from the metropolitan areas to the rural areas. The quantitative analysis is difficult due to the constraints and the dynamism in the mobile Internet. It is hard to track and fetch the detailed information from the real users due to the user interface constraint. It is difficult to explain the test or questionnaire procedures on the mobile handset display. Therefore, the author focuses on the qualitative analysis to identify the regional characteristics of the mobile e-commerce.

3.2 A proposed method

The author proposes a qualitative regional transition analysis to identify the regional characteristics in the mobile e-commerce. Idea is that using the independence test to categorize the region. The method is as follows:

- Get the population or household census data
- Get the user subscription or diffusion data
- Get the average subscription or diffusion data
- Perform the independence test for each region
- Categorize the region as independent, statistically significantly positive, statistically significantly negative

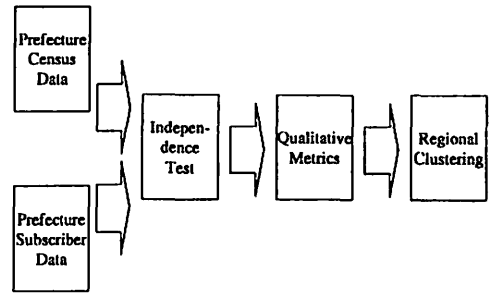

Fig. 2 Qualitative Region Analysis Flow

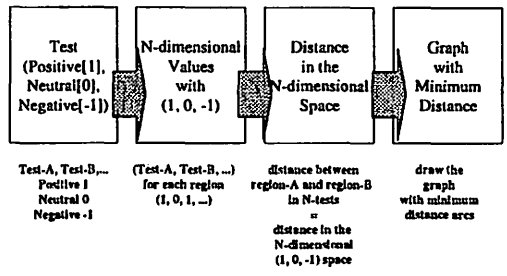

Fig. 3 A Qualitative Region Analysis Method

The data for the nation-wide IT census data are available at[3] and[1]. For the independence test, the χ^2 test is performed in the each region.

The test is done for the following criteria:

- PC and Internet diffusion in the household
- Mobile communication diffusion
- Mobile Internet service usage
- Non-mobile service usage

The flow of the qualitative region analysis is outlined in **Fig. 2**.

The method to draw a qualitative regional relation graph is depicted in **Fig. 3**.

It constructs the regional use pattern graph from the multiple positive-neutral-negative tests using the distances in the N-dimensional space. The edge denotes the minimum hamming distance relation to each node. When

there is a node with distance one to the node, it constructs the edge with the real line. When there are no nodes with hamming distance one, the nodes with the minimum hamming distance constructs the edge with the dotted line.

4. Case Study Results

The result based on the four mobile Internet services in 2001 is shown in **Fig. 4**. There are four services, two are from the mobile carrier official directory listed services, and the other two are independent sites available in the Internet. The four services include a business information service, a consumer information service, an online catalogue request service, and a web mail service. The two information services have the daily information updates. The online catalogue request service provide the outline of the catalogues, and the catalogue requested is delivered by the postal services, therefore, the online part is just the postal address entry for the request. The web mail service can be accessed from the PC Internet. Only the business information service requires the monthly subscription fee. In order to compare the similar data in non-mobile devices, the result based on the PC-based Internet game service and the game console based Internet service is shown in **Fig. 5**. The PC-based Internet game service log is taken from the data in 1999. The service was a role-playing game type one with a monthly charges. The game console based Internet service log is based on the log in 2001. The service provided diary, news and bulletin boards service from game console. This service was accessible from PC, too. They were services for game users.

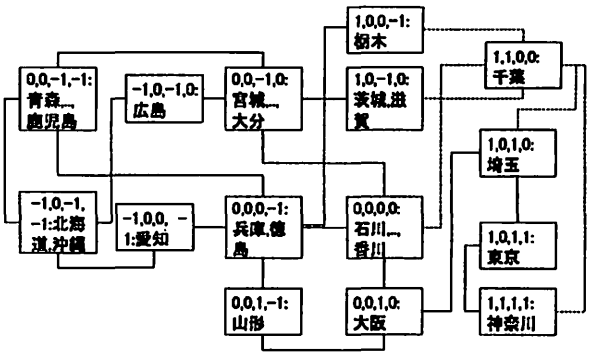

Fig. 4 Regional Mobile Internet Service Use Patterns

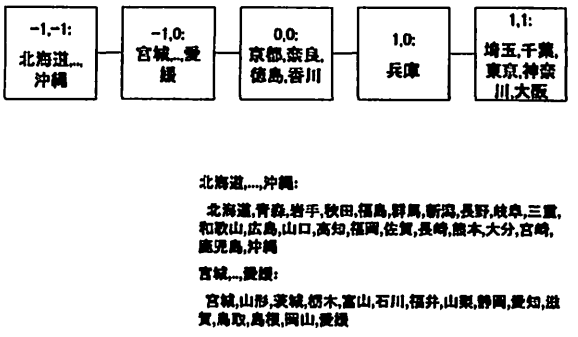

Fig. 5 Regional Internet Use Patterns of PC Game Internet and Game Console Internet

5. Discussion

5.1 Comparison to the general PC and mobile use statistics

In order to compare the mobile Internet service use patterns, the author investigates the Internet use, PC use in household, and mobile phone user transition. The author uses the prefecture-based Internet use patterns in September 2000 and September 2001. The author uses the prefecture-based per household PC use in October 1994 and October 1999. The author uses the prefecture-based mobile phone subscription user data in March 1996, in March 1998, in March 2000, and in March 2002. The case study result in all the 8 categories is shown in **Fig. 6**. The regions in the right side are metropolitan areas. It should be noted that the large number of developing regions are contained in the one node denoted "Hokkaido...Okinawa" in the left side.

In order to focus the mobile behavior, the author tries to split the use pattern transition into two factors. The PC-related one and the mobile phone based one. The PC-related data based result is shown in **Fig. 7**. They are based on the independence test of per-household census data. It should be noted that the large number of developing regions are contained in the single node in the upper-left corner denoted by "Hokkaido...Okinawa". The lower-right corner node denoted by "Saitama...Nara" contains the

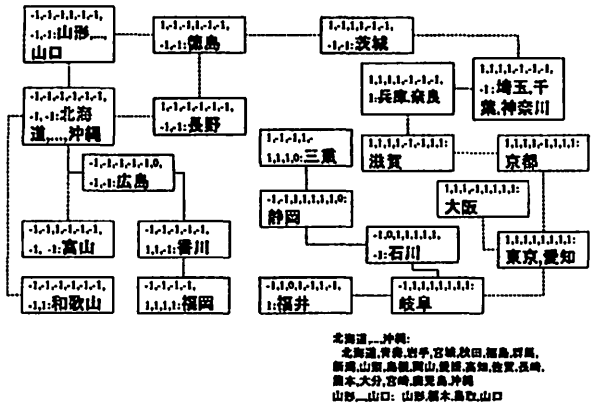

Fig. 6 Regional Use Pattern Transition of Internet, PC and Mobile phone

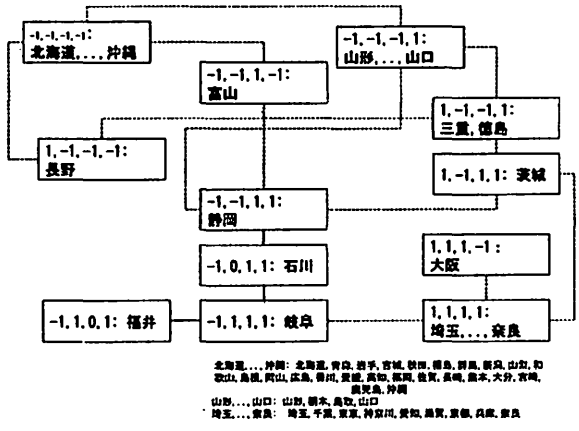

Fig. 7 Regional Transition Patterns of Internet and PC Use

metropolitan regions.

The mobile phone use subscription transition pattern based result is shown in **Fig. 8**.

Similar to the previous graphs, the large number of developing regions are contained in node in the upper-left corner denoted by "Hokkaido...Okinawa". The lower-right corner node "Tokyo...Fukuoka" contains the metropolitan regions. The detailed structure of the graphs and the detailed description of the each node are not identical, however, the general trend is similar in those graphs.

5.2 Trickledown diffusion and Region-specific patterns

In order to discuss the regional use pattern topology, there are two issues to be covered. The first one is whether there is trickledown-

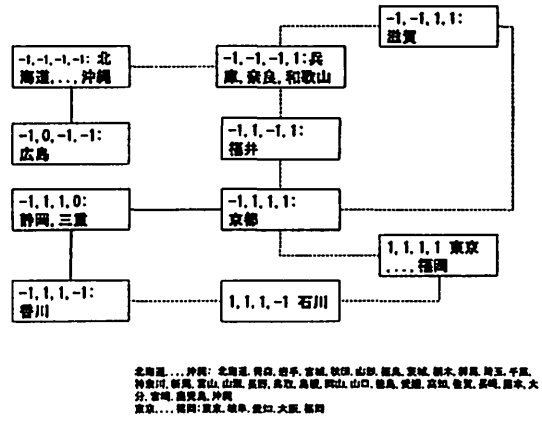

Fig. 8 Regional Transition Patterns of Mobile Phone

based diffusion in the regional topology. The second one is whether mobile Internet has the distinguished patterns compared to the other Internet or mobile phone use patterns. In the first aspect, the trickle down model is not applicable to the most of the patterns. When we assumed the trickle-down model in regional areas, the prefectures to be centered in the region include Tokyo, Osaka, Aichi, Miyagi, Ishikawa, Kagawa, Hiroshima, and Fukuoka. In the result shown above, the distinguished difference in Miyagi, Ishikawa, Kagawa, Hiroshima, and Fukuoka in prefecture level is not found. In the second aspect, it is apparent that the active use patterns are visible in Tokyo, Kanagawa, Saitama, and Chiba, in the southern Kanto area in either PC Internet or mobile Internet domain. The Internet use is correlated to the income, and young generation ratio. It should be noted that Fukuoka is use intensive in the mobile phone. It is only the exception noted in the regional use pattern topology. The south Kanto, Tokai, and major prefectures of Kinki are the use intensive prefectures. It is interesting that the behavior observed in these figures does not indicate any mobile Internet specific features. In the mobile Internet, the users expose content-specific behavior patterns in some cases. The regional factor could be explored in the content-by-content base, however, the general tendency does not pose the distinguished feature between the PC Internet and the mobile Internet. In the general prefecture level, the use patterns are driven by the accumulation of the technology literacy that is related

to the commerce activeness. The detailed studies in a multiple commerce services available in all the regions may expose more region-specific or content-specific characteristics. In order to explore such characteristics, the date from universal mobile commerce services or universal bulletin boards services are for further studies. The method is scalable and applicable to a wide range of services in a wide range of region granularities.

5.3 Graph characteristics

Another finding from the figures are the number of the nodes depicted in the figures. In each figures, there could be at most 3^n where n denotes the number of variables. In Fig. 5, there are five nodes where n is 2. In Fig. 4, there are 15 nodes, where n is 4. In Fig. 6, there are 21 nodes, where n is 8. In Fig. 7, there are 12 nodes, where n is 4. In Fig. 8, there are 10 nodes, where n is 4. It should be noted that Fig. 7 and Fig. 8 is a decomposition of Fig. 6, therefore, they are not independent. From these figures, the variety of the node number is significantly smaller than the possible maximum number. It shows the existence of the clustering factor in these figures. From the findings in this case studies, there is a significant difference between the Tokyo, Kanagawa, Chiba and Saitama area and other regions regardless of the services in mobile communications or Internet. In this stage, the mobile commerce is better to follow the usual communication diffusion patterns in Japan. It should be noted that the mobile Internet data were taken from the year 2001 data where the mobile Internet was still in the early stage. Recent emergence of the IMT-2000 high speed mobile Internet may expose the different user transition patterns. However, it should be noted the digital divide between the Tokyo metropolitan area and the other regions are quite fundamental over a long span of time. The significance of this divide cannot be underestimated in any mobile e-commerce domains.

6. Conclusion

As it has becomes apparent that the number of the mobile e-commerce users could outnumber the non-mobile e-commerce one, it is crucial to capture the mobile e-commerce behaviors. Due to the limited user interface on the mobile handsets, it is difficult to identify the user opinions and preferences on the site during the service. It is common that users run away when required a lot of marketing-related input. The author proposes a qualitative regional use pattern graph approach to illustrate the differences in the regional use patterns. The results in the PC, Internet, mobile phone and mobile Internet services in the prefecture level are shown to visually demonstrate the method. From the results, the author discusses the regional use pattern in Japan. In the findings, the regional use patterns are similar in the PC Internet and the mobile Internet. The detailed studies in a multiple commerce services available in all the regions may expose more region-specific or content-specific characteristics. From the findings in the case study, there is a significant digital divide between the Tokyo metropolitan areas and other regions even though the mobile Internet has activated the new user clusters. The qualitative region transition analysis is applicable to a variety of services when the positive or negative test is performed. In the era of the mobile broadband Internet, the timely service penetration analysis is critical for the mobile e-commerce. This study shows the simple general method applicable to such a growing marketing demand. The proposed method can be applicable to a wide range of profile sets other than regions.

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