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Social network analysis of word of mouth on the internet

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Abstract:

The purpose of this research is to analyze the diffusion of movie reviews on the web. We analyze the network of Yahoo! Japan Movie Users using the social network analysis and compare with the Rogers' diffusion model. As Rogers suggested, we can see large influence between the neighbor categories. However, the data also suggested that there are also some influences of innovators. The fact that innovators have a large influence was not considered in Rogers' model.

Keyword: diffusion model, social network analysis, word-of mouth

Today, a wide variety of evaluations of commodities and services are available on the Web, such as those on personal blogs and online stores like Amazon.com. Many people refer to such web pages for the user' comments on experience products before they make decisions whether they should buy them or not. The motion picture industry is an example of a typical experience product market characterized by product-quality information asymmetry between firms and consumers (Eliashberg and Sawhney 1994; Nelson 1974). In distinguishing between sellers of high and low quality product before consumption, consumers in such market look for credible information that firms can provide using signals, such as advertising expenditure (DiOrio 2001), warranties (Boulding and Kirmani 1993), and brand names (Wernerfelt 1988).

Consumers find judgments from both professional critics and amateur comments. Professional critics commonly provide reviews and ratings (Boulding and Kirmani 1993; Kirmani and Rao 2000). Although amateur consumers can obtain useful information from critics, they sometimes have different feelings with professionals because their experiences and preferences are different

(Chakravarty, Liu, and Mazumdar 2008; Holbrook 1999; Wanderer 1970). Therefore consumers often search for amateurs' opinion which are alike with theirs).

Liu (2006) collected the word of mouth of mouth site of Yahoo! Movie, and analyzed the relationship between the content (positive/negative evaluation) of the word of mouth and the amount of sales. As a result, there was no relationship between the content and the amount of sales; however, the amount of word of mouth did have an influence on the sales.

When consumers refer to other consumers' opinions, they will not equally consider every reviewer's opinion. As they can read other reviewers' histories, they can find judgments from their favorite reviewers' opinions. But in previous studies, it had not been considered how the reviewers evaluate each other mutually. Hence, in this research, I took the relationship among reviewers into consideration. It is effective for movie marketing to investigate the effects of word of mouth from the social network perspective. So, I focused on the reviewers' linkage using social network analysis. In this research, I analyzed the network in the site of Yahoo! Japan movie.

When consumers refer to the reviews, of course, they can see only reviews which were written before they see movies. Hence, the timing of reviews is also important. Rogers (2003) researched when the consumer adopted the innovation. He classified consumers into five categories. The people who belong to these categories follow normal curve. According to Rogers, first 2.5 % people who adopt a new innovation are called innovators. And the next 13.5% people are called early adopters, following the next 34% as early majorities, next 34% are late majorities, last 16% are laggards. Early adopters are also called opinion leaders. Opinion leaders tell about the innovation to the people around them. This is called word of mouth. The people around early adopters, opinion leaders, become early majorities. And the people around early majorities become late majorities. Their characters are skeptical, and dare not adopt innovation immediately. Laggards are stubborn, and are hardly influenced by other people. For example, most Japanese people carry mobile phones but laggards don't want to buy until when they forced to.

In this study, I analyzed the relationship between the buying movies) and the network structure of the consumer in the site of Yahoo! Japan movie, using the social network analysis and compare with the Rogers' diffusion model. behavior (watching of

The network in the site of Yahoo! Japan movie

About the site

In this study, I took the data from this web site called Yahoo! Japan Movie. There is an American version of this web site. Users write movie reviews and they grade them. But Japanese version has

an additional function called 'fan list'. With this function, users can put their favorite users as fans. For example, if I want to see a certain movie, I'll watch the movie's page of this site. I can read the movie reviews there. And if I find a good comment, I'll go to his or her page to see his or her other reviews. And if he or she and I share favorite movies, I'll put him or her as my favorite user. Then I become his or her fan. In this way, users construct networks, and I called it 'fan network'. Fan network is a directed graph.

The whole fan network can be seen as figure 1 (Number of nodes; 2406 Density; 0.002 Clustering coefficient; 0.074 Average distance; 3.73). This whole network is too complex to be analyzed. So I focus on fan networks of some movies. The left line is an aggregate of isolated points, which have no fan, and they are not anybody's fan.

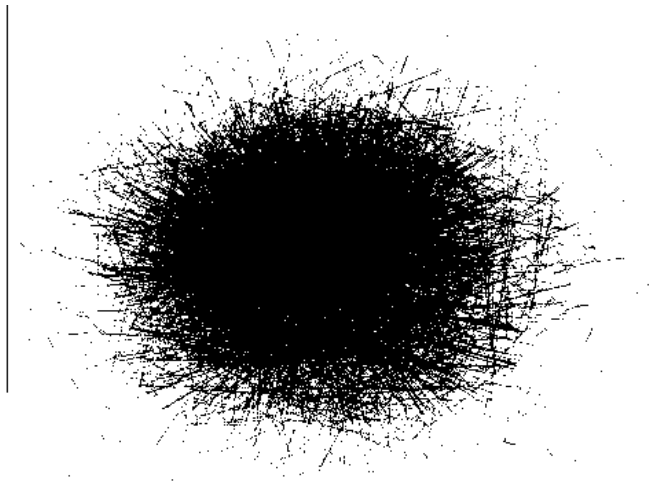


Figure 1 whole fan network

Method

The first movie I focused on is called 'Love and Honor' in English, 'Bushi no ichibun' in Japanese. This is a Japanese movie. This movie was released on 2006/12/1 in Japan, and the DVD was released on 2007/6/1. So I took the data from 2006/12/1 to 2007/5/31. Its box-office revenue was about 410 billion yen, about 4.1 billion dollars.

I will apply Rogers' diffusion theory to this movie. First, I took out the people who wrote a review of this movie, and examined the relationship among them. On this site, the number of people who wrote reviews during this time is 915, and there are 1150 ties between them. Then I mapped the fan network of this movie. Figure 2 shows the network of this movie.

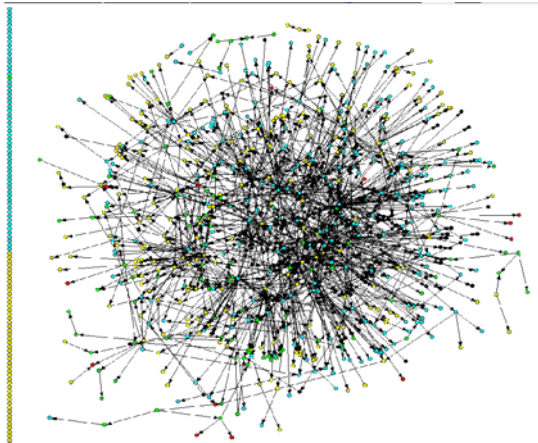


Figure 2 Fan network of 'Love and Honor'

I apply the diffusion theory to this network. I classified them in to five categories according to the time they wrote reviews. The first 2.5 % users are innovators. They are 23 people, and plotted as figure 3. They wrote reviews on the first day the movie released. As you see, there are no ties between them.



Figure 3 Innovators of this movie

The next 13.5% users are early adopters. They wrote reviews by 2006/12/4. Figure 4 shows early adopters including innovators. As you see, the ties between users emerged. The total number of innovators and early adopters is 146, and there are 64 ties between them.

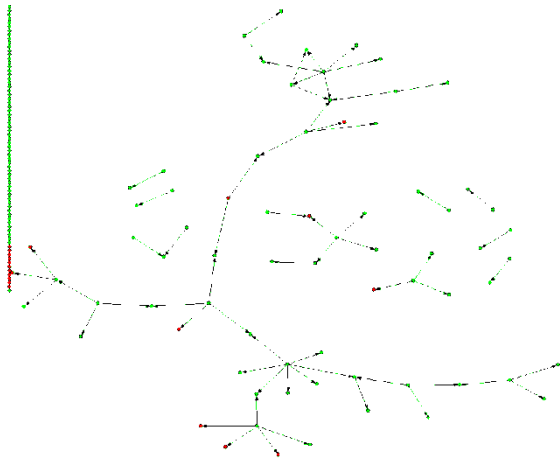


Figure 4 Early adopters

The next 34% users are early majorities. They wrote reviews by 2006/12/22. As you can see in figure 5, the number of ties increased. The total number of innovators, early adopters and early majorities is 458, and there are 288 ties between them.

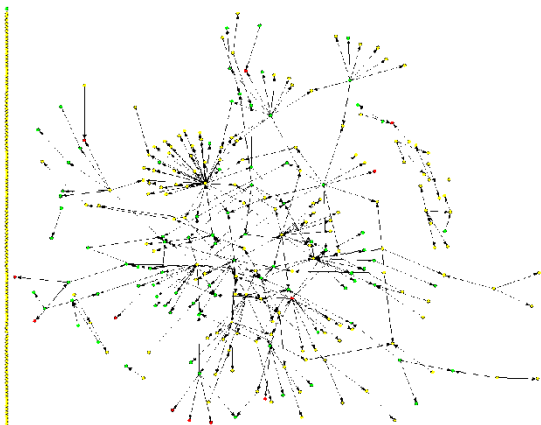


Figure5 Early majorities

I repeat the procedure to late majorities and laggards. The next 34% users are late majorities. They wrote reviews by 2007/1/21. There are many more ties. The total number of innovators, early adopters, early majorities and late majorities is 769, and there are 778 ties between them. And the last 16% users are laggards. They wrote reviews by 2007/5/31.

Then, after plotting all the five categories, there is the whole fan network of this movie (figure2). The total number is 915, and there are 1150 ties between them. Table1 shows the summary of network variables at each time.

Table1 Comparison at time series

	density	Clustering coefficient	Average distance
Innovator	0	0	∞
Early adopter	0.0024	0	4.418
Early majority	0.0031	0.027	4.821
Late majority	0.0027	0.062	4.458
Laggard	0.0028	0.056	4.251

Next, I examined how users in each category influenced each other. Table 2 shows the summary. For example, each innovator and each early adopter has 0.52 ties between them on average. And each early adopter and early majority has 0.8 ties between them, and so on.

Table2 Influence between categories on 'Love and Honor'

	Innovator	Early adopter	Early majority	Late majority	Laggard
Innovator	0	0.52	0.52	0	0
Early adopter		0.4	0.8	0.4	0.27
Early majority			0.37	0.72	0.26
Late majority				0.78	0.55
Laggard					0.51

The point to observe here is the influence between early adopters and early majorities, and early majorities and late majorities. Based on Rogers' model, early adopters have the greatest influence on early majorities, and early majorities have on late majorities. And this phenomenon can be seen in these figures. Those are the largest percentages in this table, that is, early adopters have the great influence on early majorities and early majorities have on late majorities. I interpret that the data

support Rogers' theory.

However, the data point to another possibility. Coming back to table 2, there is another point to observe. Please take a look at the innovators' figure. They show that innovators have a big influence on early adopters and early majorities. I should note that these numbers are nonnegligible. Rogers said that innovators are enthusiasts, they have not so much influence on others, but they have some influence on others in this network.

Then, I repeat this procedure to other movies; 'Pirates of Caribbean ~At World's End' and 'Red cliff Part I'. 'Pirates of Caribbean ~ At World's End' was released on 2007/5/25 in Japan, and the DVD was released on 2007/12/5. So I took data from 2007/5/25 to 2007/12/4. Its box-office revenue was about 1050 billion yen, about 10.5billion dollars. Table 3 shows the summary of the influence between categories on this movie.

Table 3 Influence between categories on 'Pirates of Caribbean ~ At World's End'

	Innovator	Early adopter	Early majority	Late majority	Laggard
Innovator	0.02	0.51	0.73	0.65	0.11
Early adopter		0.16	0.57	0.22	0.22
Early majority			0.12	0.54	0.29
Late majority				0.18	0.39
Laggard					0.42

'Red cliff Part I' was released 2008/11/1 in Japan, and the DVD was released on 2009/3/1. So I took data from 2008/11/1 to 2009/2/28. Its box-office revenue was about 500 billion yen, about 5billion dollars. Table 4 shows the summary of the influence between categories on this movie.

Table4 Influence between categories on 'Red cliff Part I'

	Innovator	Early adopter	Early majority	Late majority	Laggard
Innovator	0.02	0.51	1.15	0.71	0.1
Early adopter		0.15	0.57	0.27	0.18
Early majority			0.24	0.45	0.21
Late majority				0.1	0.29
Laggard					0.32

In Table 3 and Table 4, I can find the same phenomenon as Table 1. I can see large influences between early adopters and early majorities, and early majorities and late majorities; and I can also find large influence between innovators and other categories.

Conclusion and discussion

As Rogers' suggested, I can see large influence between the neighbor categories. However, our data also suggested that there are also some influences of innovators. The innovator's influence was not considered in Rogers' model. This is a new finding of this study.

Based on these findings, I would like to propose two implications. The first point is concerned with modeling of diffusion of innovations. Rogers' model is an aggregate model; he paid little attention to each consumer. This is because when Rogers propose this model, they did not have access to detailed data such as who bought, what, when, and where. But Social Network Analysis enables us to sophisticate the model of diffusion. Social Network Analysis and of course the development of computers allow us to analyze the network of consumers and how they influence each other.

The second point is concerned with marketing activities. Opinion leaders are often focused in marketing, but I had better pay attention not only to opinion leaders but also to innovators, that is maniacs.

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