### Analysis Chinese Social Media of Weibo using the Mathematical Model of Hit Phenomena

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#### Abstract

Using this A mathematical model for the hit phenomenon, the calculated daily purchase of entertainment-related contents can be compared with the observed daily number of postings on Twitter and blogs in online social networks. Therefore, the mathematical modeling of hit phenomena presents as a powerful theoretical tool for investigating the collective motions of thought in human societies. In this paper we've been doing up to now the analysis of the products of modern entertainment. We want to show that this method was capable of adaptation in the entertainment of chinese. While online social networks such as Twitter have been studied, the popular Chinese microblogging network SinaWeibo has had relatively lower exposure. But Weibo users has very high amount of Chinese. We want to find a common point from keywords in the universality and seasonal content and the relationship of SNS of China and Japan in this study. And will prefer to consider the characteristics of the SNS in China.

Keywords: Hit phenomena, stochastic process, Sina, weibo, chinese, drama

#### 1. Introduction

The popularization of social network systems (SNS) like blogs, Twitter, Facebook, Google+, and other similar services online social networks around the world, interactions between accounts can be stocked as digital data. Though the SNS society is not the same as real society, we can assume that communication in the SNS society is very similar to that in real society. Thus, we can use the huge stock of digital data of human communication as observation data of real society [1-4]. Recently, we present a mathematical theory for hit phenomena where effect of advertisement and propagation of reputation and rumors due to human communications are included as the statistics physics of human dynamics [5]. This theory has also been applied to the analysis of the local events in Japan successfully [6]. Our model has been also applied to "general election" of a Japanese pop girls gourd AKB48 [7], music concert [8, 9] and even to a Kabuki player of 19th century [10]. Figure 1 shows the daily number of events (concerts), the number of tickets sold and word-of-mouth (WOM) data for the band Coldplay in 2012. We measured the number of artist-related Twitter and blog items using Topsy [11]. We also used the value-tour box office costs, obtained through Box office attendance data. Returning to the Coldplay data of Figure 1, the number of WOM appeared to be influenced by the event on a daily basis. The first high peak of WOM behaved as a threshold beyond which the number of sold tickets markedly increased. Thus, the number of tickets sold per day was roughly correlated with daily WOM data. By contrast, in the box office business, motion picture attendance and WOM are perfectly correlated [1]. Thus, not only the experts but also the general public can provide valuable quantitative data for art evaluation.



# Figure 1. Number of tickets sold, word-of-mouth (WOM) data and the number of Concerts, TV, and News items for Coldplay, the British rock band that attracted the largest audience share in 2012 [8, 9]

We want to show that this method was capable of adaptation in the entertainment of chinese. While online social networks such as Twitter have been studied, the popular Chinese microblogging network SinaWeibo has had relatively lower exposure [13-15]. But weibo users has very high amount of Chinese. We want to find a common point from keywords in the universality and seasonal content and the relationship of SNS of China and Japan in this study. And will prefer to consider the characteristics of the SNS in China [15].

#### 2. Theory

Recently, one of the authors (Akira Ishii) and his co-workers proposed a mathematical model for hit phenomena in which human thought dynamics are stochastic processes influenced by media advertisements, communications with friends, and rumors in the society [5]. In this model, direct and indirect communications are two- and three-body interactions, respectively. Thus, phenomena such as hit movies are described as the purchase intention of person i in terms of two-body and three-body interactions.

The intention to targets of an individual i is given as 1

$$\frac{dI_i(t)}{dt} = -aI_i(t) + \mathop{a}\limits_{j} d_{ij}I_j(t) + \mathop{a}\limits_{j} \mathop{a}\limits_{k} h_{ijk}d_{jk}I_j(t)I_k(t) + f_i(t)$$
(1)

where  $d_{ij}$ ,  $h_{ijk}$ , are the coefficients of direct and indirect communication, respectively, and  $f_i(t)$  describes the random effect acting on individual *i*,. The above equation applies to every consumer, so that  $i = 1, ..., N_p$ , where  $N_p$  is the number of individuals in the society. Taking the effect of direct communication, indirect communication, and the decline of audience into account, the above equation quantifies the hit phenomenon. The random effect  $f_i(t)$  embodies the advertisement and publicity affects each individual. Stochastic process theory yields the following equation for the ensemble-averaged intention to target.

$$\frac{d\langle I(t)\rangle}{dt} = -a\langle I(t)\rangle + D\langle I(t)\rangle + P\langle I(t)\rangle^2 + \langle f(t)\rangle$$
(2)

(4)

where  

$$Nd = D$$
  
 $N^2p = P$  (3)

Eq. (2) is applicable entertainment intention to targets in Weibo. In, Eq. (2) is applied only to motion picture data, but it can be equally applied to other current markets [6-8]. In applying Eq.(2) to China entertainment data, the random effect embodies the monthly number of events and news of the China entertainment. The results are shown in Figure 10. Public intention to attend a WOM in weibo matches the observations of weibo data. The parameters in our calculation are adjusted to minimize the reliable factor by Monte Carlo methods, where is the difference between the calculated curve and the corresponding observed weibo's data. The number of integrated customers or incoming people to the event in china can be calculated using the intention as follows,

$$P(t) = \int_0^t I_i C_{\xi}(\xi) d\xi$$

Since the intention to targets of the individual customer increase due to both the advertisement and the communication with other persons, we construct a mathematical model for hit phenomena as the following equation this paper.

#### 3. Example in weibo -Seasonal Keyword-

We obtained the data trend of reviews by keyword of September 5 to October 4, 2013 corresponding to "fall" from weibo and Twitter first.







Figure 4. We obtained the data of "fall" from Weibo [16]

We also obtained the data trend of reviews by keyword of September 8 to October 8, 2013 corresponding to "Typhoon" from weibo and Twitter.







Figure 6. We obtained the data of "Typhoon" from Topsy

From Figures 3, 4, 5, 6 plot the results for seasonal keyword. Figures 3, 4 shows the peak Twitter weibo also be the highest on the 18th September the same. That can be considered that showed a peak of trends similar and that the change in temperature from the point indicated a similar peak at the same time, reports the arrival of autumn is performed at the timing during the day approximately the same entanglement. We can be seen that the response along the social conditions of society weibo also as Twitter from this result and the results of previous research is affected by the reviews online.

#### 4. Example in weibo –Drama trends-

We also obtained the data trend of reviews by keyword of September 8 to October 8, 2013 corresponding to "Hanzawa Naoki" from weibo and Twitter. Hanzawa Naoki (半沢直樹) was a 2013 Japanese television series by Japanese broadcaster TBS. It follows the story of Hanzawa Naoki, a banker working for the largest bank in Japan. The show received consistently high ratings: the final episode reached 42.2% in the Kanto area, the highest figure for a drama in the Heisei Era in Japan [17].

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Figure 7. The number of Twitter data in Japan and Weibo in China for HanzawaNaoki



Figure 8. The number of Twitter data in Japan \* 10 and Weibo in China for HanzawaNaoki

From Figures 7, 8, We obtained the data of the topic of Hanzawa Naoki up to the first half of October from 6 July 2013 drama of Hanzawa Naoki has been aired from weibo and Twitter. topic of Hanzawa Naoki at weibo on regardless Hanzawa Naoki also had not been aired on TV real-time, Up towards the topic of time series of Hanzawa Naoki in Japan did not change substantially. On the contrary topics in China showed a number much higher than Japan. To obtain the results of the numerical amount of reviews Hanzawa Naoki of Japan and China almost unchanged from Figure 8, when recalculated to 10 times all the result of Japan. In other words, weibo could also determined that the SNS that is worth analyzing the hit phenomenon of the topic or events in content as well as Twitter. So we analyzed in the mathematical model actually in the next chapter.

International Journal of Multimedia and Ubiquitous Engineering Vol.9, No.3 (2014)

### 5. Results







# Figure 10. The calculation and the observed data for Coldplay, the British rock band. The line means the observed number of daily posting of WOM(Weibo in China)(Blue) and Calculate(Gleen)

Using Eq. (4) with the daily number of topic of the HanzawaNaoki as the influence of the advertisement effect  $\langle P(t) \rangle$ , we obtain the following result in Figure 10. We found in Figure 10 that our calculation of the intention to entertainment for HanzawaNaoki in China (Weibo) shows very well agreement with the real observed WOM.

## Table 1. Table of parameters for the HanzawaNaoki in China (Weibo). Cadv is the strength of the advertisement; a is the decline factor of the advertisement; Dnn is the direct communication factor; Pnn is the indirect communication factor

alpha	= 1.0164907212982395(1/day)
Cadv	$= 456.44525764451686 \qquad (1/day)$
before	= 8.5000956915583216(1/day)
a	= 16.599992885216235  (1/day)
NpDnn	= 3.6169479690495835 (1/day)
Np2Pnn	= 1.3726399229117414(1/day)

We have been able to use exactly the same mathematical model to analyze and predict hit phenomena in the past and present as well as in Weibo in China. We expect that in future, the potential of China media for the study of society will be unlocked, leading to a new point of departure for research in the field of Chinese society and How they think about Japan. As described above, indicated by weibo on a high amount of reviews despite not been aired Hanzawa Naoki in China. Possibility of illegal upload of video drama online on the This is due to a fact that we can not miss. It is the result thought-provoking problems with the current state of content protection of Japan. However, it tends to exhibit a high amount of reviews, even across borders is an interesting result is content such as drama, which is also evaluated in the audience rating in the amount of reviews in Japan. We also believe that it will be the collaboration of scholars in the humanities and sciences, in conducting research and discovering new knowledge that will enable us to assess our curiosity and creativity as human beings, both past and present.

We made it possible to analyze the characteristics of the upstream side of the topic overseas and acceptance of Japanese culture in this research methods. We think this research results that's effective material for strategize views and for overseas export of Japanese culture. It also shows the possibility of SNS is also effective as a tool for sensing how piracy go abroad of Japanese content as up to the topic of this paper is do they swell. We hope to be if you can contribute to the construction and development of culture by the analysis results of the mathematical model of the hit phenomenon.

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