POLISH JOURNAL OF MANAGEMENT STUDIES
Kwiatkowska J, Gutowska J

2012
vol. 5

MEMETICS ON THE FACEBOOK

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Abstract: The aim of this article is a verification of mems propagation in social networks. A mem is a valuable piece of information which has a viral characteristics and it constitutes at present the basis for actions in social media. The verification of the hypothesis established by the authors of this article has been conducted on the basis of computer simulation realised in the NetLogo environment.

Key words: social networks, memetics, propagation of information, simulation, multi-agent programming

JEL Codes: Z10

Introduction

Facebook is a social Internet platform that has been founded in February 4, 2004 and nowadays it joins together more than 700 millions users[10]. It connects people, it enables to exchange messages an photos, it provides access to entertainment as well as the newest information. What is more, it is the best environment for actions in social media, where a mem, that is valuable piece of information which has a viral characteristics, constitutes a basic element.

Mem is a term proposed by Richard Dawkins in his book titled The Selfish Gene and it defines the unit of cultural information[11]. Mem might be subjected to replication, mutation or recombination, what leads to the propagation of information, for example. A theory which describes cultural evolution where a mem constitutes a basic unit of selection is known as memetics.

The aim of this article is a verification of the way of mem propagation in social networks as well as a simulation of the viral content spreading.

According to the above mentioned assumptions, the authors of this article elaborated a model of the mem propagation in the social networks of users who have accounts in the Facebook utility. The model has been implemented in the Netlogo environment.

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[10] http://www.pcworld.pl/news/373457/Facebook.liczba.polskich.uzytkownikow.rosnie.html

[11] http://pl.wikipedia.org/wiki/Memetyka

Implementation of the model

Assumptions concerning this project:

- a mem propagates as a result of the interpersonal communication between specific nodes,
- mem propagation process is constant and deterministic,
- a mem us is open for genera use (its content is understandable for all members of the network),
- speed of the mem propagation is dependent on time of the day when the information is exposed,
- a set of nodes represents a group of friends of the one user in the Facebook network,
- edges between the nodes represent bounds of familiarity between given users.

Research hypotheses

H1: Social network in the Facebook portal possess classless structure
H2: Mem in the Facebook portal propagates according to the assumptions of the Duncan Watts theory
H3: There are three groups of actors present in the process of mem spreading: susceptible to influence (ignorants), spreaders and the one who kill the rumour.
Those who are susceptible to influence are not conscious of mem presence, spreaders are passing information all the time and individuals who are killing the rumour, that is hamper its propagation.

Duncan Watts's theory assumes that there are local or global cascades of influence which indicate the existence of information epidemics. If a huge group of usual people is activated (a cascade is triggered by a critical mass) then there is a probability that these people will propagate information to ones who are susceptible to influence (they will infect other individuals) (the outbreak of an epidemic is present). Watts proved his theory conducting numerous simulation, what caused reduction of the importance of a theory that assumed presence of the leaders of opinions [8].

NetLogo

The simulation has been conducted in the NetLogo, which is a multi-agent programming language, with the help of which it is possible to model complex phenomena. Interfering in behaviours of single agents, the analysis of interactions that occurs between these agents might be conducted. Agents represent passive abstractions, that is certain kind of data structures, which are subjected to manipulation while simulation takes place. The important advantage of NetLogo is

the possibility to use this environment while working with people who did not obtain education in computer science or in programming. It is defined as a low threshold for new users [1]. It is the environment, that while using it by universities, it might meet educational as well as research needs – students might realize author's projects in order to search for the new, creative and outstanding solutions. Models that are implemented in NetLogo are simple and readable for their authors as well as for their recipients. The availability is the next very significant advantage on the NetLogo – it is a freeware simulation environment.

NetLogo is the effect of the cooperation of the two scientists: Uri Wilensky and Seth Tisue, who started to write this language in 1999. In fact, NetLogo is a language that has been implemented in Java. Its the newest version: 4.1.3, has been published in April 3, 2011. To tell the truth, NetLogo constitutes a derivative (dialect) of two languages: Lisp and Logo. It inherited from one of them a single agent (turtle), and from the another – concurrency and multiple agents.

Programming in NetLogo consists in managing the group of agents called turtles, which are moving on the grid composed of the patches (it is another type of agents, which is programmable as well). In order to individualize a project, the author of the simulation might give a turtle proper shape, for example turtle might look like a car, animal or appliance. Patches might represent roads, green areas, traffic lights and many others. Using NetLogo, the following issues among many others might be realized: artificial life, cellular automata, self-organization, path-finding, optimization, genetic algorithms, population dynamics.

NetLogo environment is composed of three tabs: Interface, Information and Procedures.

Interface tab is a place designed for watching and running the model. Procedure tab is intended for creating and storing the programme code.

Model

Every information popularised on the Facebook might be seen by the users if it is:

- made accessible,
- liked,
- commented.

The agents of the model are all of the social network individuals who are joined by the edges. There is possibility, as well, to reflect a real Facebook social network. Popularisation as well as visibility of the information that is made accessible by the central agent at first and whose network has been implemented, is simulated as well. The agents popularise mem among themselves. The number of individuals who popularise the mem depends on the number of logged-in people, time of the day, mem time to live and probability of mem propagation. At the end of the simulation all the results are presented, that is a number of agents who popularised a mem or the number of agents who just have seen a mem. The calculations which help to assess the impact of so called hubs in the information spreading have been conducted as well.
The implemented model has been presented in figure 1.

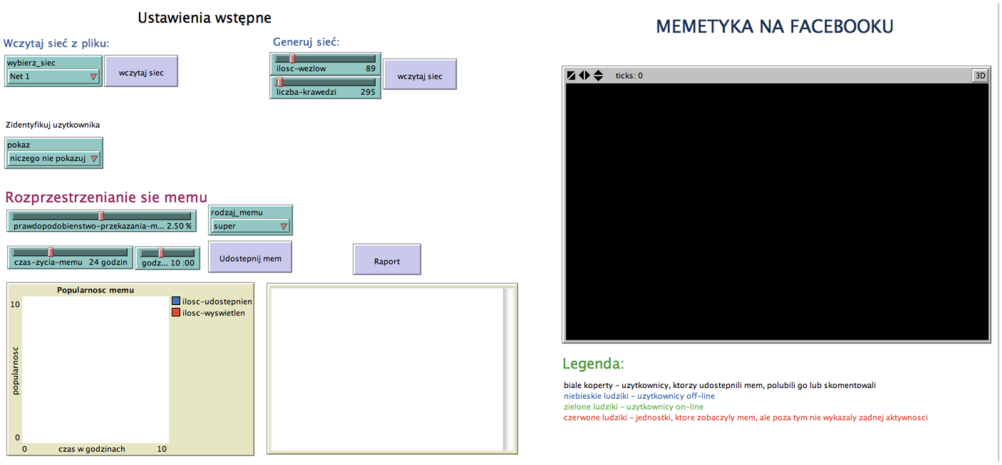

Figure 1 Implemented mode (Netlogo environment)

Simulation time

Discrete time in this simulation is based on hours. When hours and probability of log-in are connected it turns out that morning hours are more effective while popularising content. Popularising mem on the Facebook means, that there is a risk that this piece of information will be covered by another piece information at the moment. That is the reason why the probability of mem propagation in every hour decreases.

Specific steps of the simulation

- Setting up the resource data - loading network from Facebook or its generation. In this step we will obtain data concerning number of agents, connections

between them and some characteristics as agents' id, for example. The next operation is setting time of the day when simulation takes place. It has been assumed, that this research includes only users form Poland. Another important variables are: probability of information propagation (that is expected popularity), mem time to live or its character (super, medium, weak).

- Data loading - a structure of loaded from files social networks is real. The data have been downloaded from the Facebook portal using NodeXL add-in for MS Excel. Afterwards, these data have been exported to the .net file (PAJEK), what enabled to obtain the set of the node numbers that are connected. The files prepared in this way have been edited manually (the redundant parameters have been removed) and saved as .txt files.

- Beginning of the simulation - the mem is made accessible on the board of the central agent. This procedure is the most complicated and it comprises of three submodels:

- Simulation of the agents activity on the Facebook, that means a reflection of the number of logged-in users on the Facebook. This factor defines a number of people who will see and popularise a mem.

- Mem propagation - a key procedure of the process that performs in every round of the simulation. What is more, it has been assumed that displaying and popularisingthe mem on the Facebook is the most common in the first minutes after the start. During the next rounds of the simulation the mem is being propagated to the consecutive agents.

- Visualisation of the agents shape and colour

The appearance of the agents is being updated after every procedure of the agents activity and after mem propagation. The simulation lasts so long, as the mem time to live is expected (it is counted in hours) what means, that the mechanism repeats till the death of the mem. Simultaneously, in the loop to consecutive procedures take place. The first mechanism that takes place in every hour is the change of the user status form on-line to off-line. In every simulation round, users randomly change their status according to the time zone. In the first round, a central individual whose profile has been implemented in the simulation, popularises a mem. During the following rounds, when users changed their statues to the on-line one, those who have seen the mem decide if they want to to popularise it (propagate it to their friends), according to the probability of mem propagation and the time of the day. The simulation ends when the mem tim to live is still valid.

Collecting the results of simulation - during the simulation, all the individuals who propagated the mem or have seen the information but did not spread it, are counted. These data are being plotted while simulation takes place.

The most important procedures

The main procedure of the mem popularisation

go

go is a submodel, which is the most important part of the simulation. What happens in this procedure (the first hour of the simulation):

- the number of logged-in users has been changed (mechanism-online procedure)
- an central agent makes mem accessible and visible on his board
- the random number of individuals decides to popularise mem or not

The decision of the individual depends on the mem propagation probability that is set in the simulation panel and it depends on the type of the mem. The scientists who is conducting a simulation sets the percentage of users who are on-line and who probably popularise a mem. Next, the mem propagation is realised by the following procedure:

```
 let decyzja prawdopodobienstwo-przekazania-memu * count turtles with [online = 1] / 100

ifelse rodzaj_memu = "super"
   [set prawdopodobienstwo-przekazania-memu
     prawdopodobienstwo-przekazania-memu * array:item tablica-prawdopodobienstwa-rozkladu-wykladniczego i ]
[ifelse rodzaj_memu = "medium"
  [set prawdopodobienstwo-przekazania-memu
    prawdopodobienstwo-przekazania-memu * array:item tablica-prawdopodobienstw-rozkladu-normalnego i]
[(set prawdopodobienstwo-przekazania-memu prawdopodobienstwo-przekazania-memu - 0.01) ]]
```

- the number of users who have seen and popularised a mem has been plotted
- the hours of the simulation is increased
- mem propagation probability changes as follow:
  - it decreases according to the normal distribution (super mem)
  - it decreases according to the exponential distribution (medium mem)
  - it decreases linearly (weak mem)

Simulation of the agents activity on the Facebook

mechanism-online

To make the model easier, we can assume that the activity of the users depends on the number of the logged-in users According to the Virtue company,

Facebook users are the most active at 11am, 3pm and 6pm[12]. Using this data, the number of online users in the simulation has been implemented. What is more, every user spends on Facebook every day 1,5 hour on average[13].

Mem propagation

przekazuje-mem

The agent who made a mem popular causes as well, that random percentage of his logged-in friends see it. If theses friends propagate the mem further, the message is spreading.

Visualisation of agent shape and colour

aktualizacja-postaci

In on simulation, an agent status might be changed few times (it depends if this user is online or not, if it propagates a mem, etc.)

Summary

On the basis of the conducted simulations, all the hypotheses established by the authors have been verified. Nevertheless, the following problems have been identified:

Problems emerged while social networks analysis:

- network dynamics - networks change constantly,
- borders of the networks are not strict - sometimes it is difficult to define who belongs to the given network or not,
- networks are incomplete - there are always nodes or connections that are not visible for the researcher [11].

Factors that influence on mem propagation:

- language barriers (in case that a mem is a text information),
- sex of the individual who propagate a mem[11],
- social class [11].

[12] http://mashable.com/2010/10/28/facebook-activity-study
[13] http://spoleczenstwo.newsweek.pl/facebook-w-szesc-dni--czyli-jak-zostac-facebogiem,53514,3,1.html

The elements that might be applied in the future model have been identified as well:

- introduction of the sex variable for every node and verification if propagation depends on this variable (for example mems that concerns technical issues) [22],

- variable that is connected with the emotional value of the mem (negative or positive mem).

References

[1] Fronczak A., Fronczak P., *Świat sieci złożonych. Od fizyki do Internetu*, Wydawnictwo Naukowe PWN, Warszawa 2009
[2] Freedman D.H., *Why economic models are always wrong*, Scientific American, 26 października 2011r.. Artykuł dostępny on-line pod adresem: http://www.scientificamerican.com/article.cfm?id=finance-why-economic-models-are-always-wrong
[3] Kottonau J., Pahl-Wpstl Claudia, *Simulating political attitudes and voting behavior,* Journal of Artificial Societies and Social Simulation vol. 7, no. 4. Artykuł dostępny on-line pod adresem http://jasss.soc.surrey.ac.uk/7/4/6.html
[4] Janas M., *Facebook Open Graph, „lubię to" - kto zyska, kto str?,* 28 kwietnia 2010r.. Artykuł aci dostępny on-line pod adresem: http://www.sprawnymarketing.pl/artykuly/facebook-open-graph-lubie-to/
[5] *Śledzenie kliknięć w „Lubię to!" i naturalnych udostępnień na Facebooku i w Google Analytics.* Artykuł dostępny on-line pod adresem: http://www.conversion.pl/blog/sledzenie-klikniec-w-lubie-to-i-naturalnych-udostepnien-na-facebooku-i-w-google-analytics/
[6] *Definicja mema:* http://nonsensopedia.wikia.com/wiki/Mem
[7] *Jak zmiany statusu na Facebooku odzwierciedlają wiadomości o tsunami w Japonii,* 15 marca 2011r.. Artykuł dostępny on-line pod adresem: http://wiadomosci.gazeta.pl/wiadomosci/1,114873,9254167,Jak_zmiany_statusu_na_Facebooku_odzwierciedlaja_wiadomosci.html
[8] Mazurkiewicz B., *Word-of-mouth Marketing. Rozprzestrzenianie się informacji w sieciach społecznych*, 1 maja 2010r. Artykuł dostępny on-line pod adresem: http://marketing101.pl/word-of-mouth-marketing-wyklad-2-rozprzestrzenianie-sie-informacji-w-sieciach-spolecznych/
[9] *What will sell of Facebook? Insights from word-of-mouth research.* Artykuł dostępny on-line pod adresem: http://socialcommercetoday.com/what-will-sell-on-facebook-insights-from-word-of-mouth-research/
[10] Rabajante J.F., Yuichi T.O., *A model of information propagation in social networks.* Artykuł dostępny on-line pod adresem: http://www.scribd.com/doc/44971529/A-Model-of-Information-Propagation-in-Social-Networks
[11] Magnani M., Montesi D., Rossi L., *Information propagation analysis in a social network site.* Artykuł dostępny on-line pod adresem: http://uniurb.academia.edu/LucaRossi/Papers/326444/Information_propagation_analysis_in_a_social_network_site

[12] Karlik L., *Algorytmy śledzące rozprzestrzenianie się idei.* Artykuł dostępny on-line pod adresem: http://technologie.gazeta.pl/internet/1,104530,8567788,Algorytmy_sledzace_rozprzestrzenianie_sie_idei.html
[13] Zhao L. et al., *Rumor spreading model with consideration of forgetting mechanism*: A case of online blogging, LiveJournal, Phisica A 390 (2011) 2619-2625, Elsevier
[14] Malarz K. et al., *Gossip in random networks*, Acta Physica Polonica B, vol 37 (2006), no 11
[15] Kacperski K, *Opinion formation model with strong leader and external impact: a mean field approach,* Elsevier, 16 luty 1999
[16] Tufekci Z., Grooming, Gossip, *Facebook and MySpace. What can we learn about these sites from those who won't assimilate?*, Information, Communication & Society Vol. 11, No.4, czerwiec 2008, str. 544-564. Artykuł dostępny on-line pod adresem: http://userpages.umbc.edu/~zeynep/papers/ZeynepSocialGroomingandFacebook.pdf
[17] *Do you help spread gossip on Facebook* - Pherhaps donate to the NSPCC instead. Artykuł dostępny on-line pod adresem: http://www.youcouldsave.co.uk/do-you-help-spread-gossip-on-facebook-perhaps-donate-to-the-nspcc-instead/
[18] Rosencrance L., *Social networks spreading more than gossip*, 16 września 2010r., Artykuł dostępny on-line pod adresem:http://www.businessnewsdaily.com/215-social-networks-spreading-more-than-gossip.html
[19] Chierichetti F. et al*., Rumour spreading and graph conductance*, 12 października 2009r.. Artykuł dostępny on-line pod adresem: https://2375626096509007062-a-chierichetti-name-s-sites.googlegroups.com/a/chierichetti.name/flavio/papers/gossip_conductance.pdf?attachauth=ANoY7crr1x_6TMc5QQ7Upb7xCxcm8jpT7eU9NoQzHZSONAaJwu46k5PIjdKT5lWGK2OVtREyVWCj-SrnFRdftHkfxl0oFZUYx6_bEi696NdJZGhfXumDcGO7ggETFgYXWrRiXqD8OfGky2lPHHRONH4gjx7BIykvjpSPQc--uwQYmFdpcROoXvYWKNMRn-CllrIF6Po9Jed_EKRovDifi4SHiPC7Ic5WSg%3D%3D&attredirects=0
[20] Herrick J., *How to stop rumors*, Artykuł dostępny on-line pod adresem: http://www.wikihow.com/Stop-Rumors
[21] Lind P.G. et al., Spreading gossip in social networks. Artykuł dostępny on-line pod adresem: http://arxiv.org/pdf/0705.3224v1
[22] Allsop D.T. et al., *Word-of-mouth research: Principles and Applications*, Journal of Advertising Research, December 2010, Artykuł dostępny on-line pod adresem: http://versatilesolutionsbb.com/web_documents/word_of_mouth_research_jar_dec-07.pdf
[23] Berger J., Milkman K.L., *Social transmission and viral culture,* Artykuł dostępny on-line pod adresem: http://opim.wharton.upenn.edu/~kmilkman/Virality_Feb_2010.pdf
[24] Buttle F.A., *Word of mouth: understanding and managing referral marketing,* Journal od Strategic Marketing 6 241-254 (1998), Artykuł dostępny on-line pod adresem: http://buttleassociates.com/doc/WOMJSM.pdf
[25] Gutowska U., *Algorytmiczne aspekty sieci społecznościowej.* Praca dostępna on-line pod adresem http://www.ii.uj.edu.pl/~gutowska/praca.pdf

MEMETYKA NA FACEBOOK'U

Abstrakt: Celem niniejszego artykułu jest weryfikacja sposobu rozprzestrzeniania się memów w sieciach społecznych. Mem należy uznać za wartościową treść o charakterze wirusowym, która stanowi obecnie podstawę działań w social media. Weryfikacji hipotez przyjętych przez autorki artykułu na podstawie symulacji komputerowej, która została przeprowadzona w środowisku Netlogo.

模因對Facebook的

摘要：本文的目的是驗證社會網絡的MEMS傳播。一個mem是一個有價值的信息件，其中有一個病毒的特性和目前它構成了社會媒體的行動的基礎。這篇文章的作者建立的假說驗證已進行了計算機仿真的基礎上實現的NetLogo環境。