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A novel approach for influence maximization in social networking

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Abstract- The social networking sites today are becoming important platforms for effective viral marketing practice. They are now becoming a huge dissemination and marketing platform, allowing information and ideas to influence a large population in a short period of time. In this paper, a modified improved and novel technique based on Greedy algorithm is implemented. Two methods, namely modified Greedy algorithm and modified weighted Greedy algorithm, for influence maximization in social networking are proposed. The result of proposed implementation are validated and compared with the existing algorithms.

Keywords- Influence maximization, social networking, greedy algorithm

I. INTRODUCTION

With the fast development and steady growth of online social networks, many of online users are using social networks like Facebook, Twitter, Google+, Sina, Microblog, Renren, Myspace, LinkedIn, Friendster etc. [1]. These have become most commonly used propagation method for viral signal. These have become very successful as these are very effective tools in connecting people and bringing the offline people together. People trust the words in their close circles more than any other means [1]. Online social networks provide good way to address the problem, as they are connecting a huge number of people and they collect a huge amount of information about the social network structures and communication dynamics. The social networks are large-scale, have large connection structures, and are also very dynamic in nature.

Influence maximization has major importance in terms of marketing. Consider an example: A small company develops a mobile application let's say an online shopping application. Now, this company wants traffic on this application. But it has limited budget so it can only select small number of initial users and motivates them to use application by providing them special offers (like heavy discounts or by giving them gifts). The company desires that the initial users would start influencing their friends on social networking sites to use the application and their friends would influence their friends' friends and so on, and thus through the word-of-mouth effect a large population in the social network would adopt the application. The problem is who to select as seed users such that influence is on large population. This problem is referred as influence maximization. This problem is of great interest of companies because they can promote their product through this problem.

The aim is to find a set of most influential nodes in a social network so that their cumulative influence in the network is maximized. Literature provides a systematic method of influence maximization as a discrete optimization problem. Influence maximization has important application in viral marketing through social networks, where companies try to promote their products and services through the word-of-mouth propagations among friends in the social networks.

Some recent research has revealed that this may result in misleading conclusions about the outcomes of dynamic processes [5]. It has been seen that the social spreading phenomenon is very dependent on the timing of contacts. The research can turn towards temporal networks merges events for a particular period - time frame [6]. This approach may be considered as a trade-off between working with the static network and event log. It facilitates benefiting from all the achievements of graph theory.

To fully utilize these social networks as marketing and information dissemination platforms, a lot of challenges are to be met. It can be observed that research on social networks needs attention [2]. Another issue focuses on influence diffusion which can be used for marketing strategies, such as word-of-mouth and viral marketing.

A social network can be represented as a graph, and the diffusion models explaining that the information spread process have been widely studied [2]. The major issue, as considered by researchers in this field, is how to maximize the spread of information through a social network. For example, to promote a new product, one can give few people free samples of the product. Those people will recommend the product to their friends and will try to spread information to the network.

The major problem is to select as the initial users so that they influence the largest number of people in the network, i.e., the

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problem of finding influential individuals in a social network is called influence maximization problem. It would be of interest to many companies as well as individuals that want to promote their products, services, and innovative ideas through word-of-mouth effect.

II LITERATURE REVIEW

Goyal *et al.* (2011) [1] studied the influence maximization from a data-based perspective. By introducing a new model, that directly propagated available propagation traces to learn how influence flows in the network and uses this to estimate expected influence spread. **Goyal *et al.* (2011) [2]** proved that Greedy algorithm guarantees the best possible approximation factor in PTIME. **Kempe *et al.* (2015) [3]** studied the ideas and influence propagation through a social network in a number of domains, involving technological and medical advancements. **Zhang *et al.* (2013) [4]** proposed an opinion-based cascading model for solution of maximization problem on the new model to take individual opinion into consideration along with capturing the changes of opinion. **Zhuang *et al.* (2015) [5]** studied the problem of maximizing influence diffusion in a dynamic social network. **Heidari *et al.* (2015) [6]** discussed relative merits and demerits of various techniques for influence maximization problems of finding most influential nodes in a social network. **Michalski *et al.* (2014) [7]** analyzed difference in the results of the model for spread of influence depending on the strategy of building the social network. **Pandit *et al.* (2012) [8]** proposed an algorithm that outperforms the existing state-of the-art, and its success does not depend on any kind of tuning parameter. **Zhou *et al.* (2014) [9]** proposed a method for estimating the nodes' influence based on the network structure in influence maximization.

III EXISTING TECHNIQUES FOR INFLUENCE MAXIMIZATION IN SOCIAL NETWORKING

Greedy Algorithm: Greedy algorithm is used to maximize the influence of social networking. In Greedy algorithm, the node which has maximum children is picked so that influence can be maximized through larger number of children.

Weighted Greedy Algorithm: Greedy algorithm is used to maximize the influence of social networking. In case of weighed greedy algorithm, weights are attached to each edge which tells how much influence those two nodes can have on each other. In case of weighted greedy algorithm, node which have maximum sum of weights of children is picked.

IV PROPOSED TECHNIQUES FOR INFLUENCE MAXIMIZATION IN SOCIAL NETWORKING

Modified Greedy algorithm: This proposed algorithm is a modification of Greedy algorithm so as to maximize the influence and cover maximum nodes with seed nodes. In this proposed algorithm, nodes with maximum unique nodes are chosen instead of choosing node with maximum children. The algorithm for modified greedy algorithm for maximizing the influence is as given below.

1. Read adjacency matrix
2. Initialise total seeds.
3. Set/input number of seeds
4. Set/input condition of cover nodes
5. Loop over total seeds (Loop1)
6. Initialize iseeds
7. Get children of iseed in array ar.
8. Set covered nodes from array
9. Loop over cover nodes (loop2)
10. Find cover children
11. Close the loop (loop2)
12. Final covered children matrix
13. Set the length of array
14. Loop over the length of array (loop3)
15. Set variable for finding the adjacency matrix
16. Prepare the adjacency matrix for covered children
17. Set the counter for covered nodes
18. Close the loop (loop3)
19. Calculate the index of maximum value
20. Calculate the covered nodes and seeds from the array
21. Close the loop (loop1)

Modified weighted Greedy algorithm modified: This proposed algorithm is a modification of Greedy algorithm so as to maximize the influence and cover maximum nodes with seed nodes. In this proposed algorithm, nodes with maximum unique nodes are chosen instead of choosing node with maximum children. The algorithm for modified greedy algorithm for maximizing the influence is as given below.

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1. Read adjacency matrix
2. Initialise total seeds.
3. Set/input number of seeds
4. Set/input condition of cover nodes
5. Initialize weights
6. Loop over total seeds (Loop1)
7. Initialize iseeds
8. Get children of iseed in array ar.
9. Loop over the length of array (loop2)
10. Find weight of iseed
11. Find aggregate weight of seeds in loop
12. Close the loop (loop2)
13. Set covered nodes from array
14. Loop over cover nodes (loop3)
15. Find cover children
16. Close the loop (loop3)
17. Final covered children matrix
18. Set the length of array
19. Loop over the length of array (loop4)
20. Set variable for finding the adjacency matrix
21. Prepare the adjacency matrix for covered children
22. Set the counter for covered nodes
23. Close the loop (loop4)
24. Calculate the index of maximum value and aggregate weight
25. Calculate the covered nodes and seeds from the array
26. Close the loop (loop1)

V RESULTS AND DISCUSSIONS

A. Results of existing and proposed non-weighted techniques

The proposed modified Greedy algorithm and existing Greedy algorithm was implemented on a graph of 25 nodes. Figure 1 shows adjacency list of 25 nodes prepared using MATLAB 2012a.

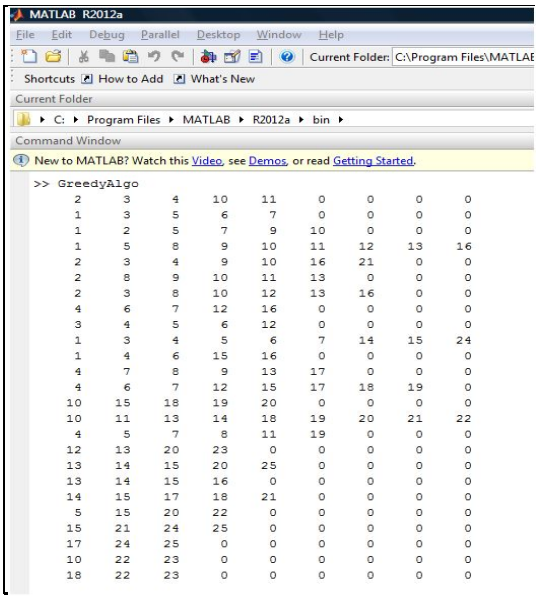

Figure 1: Adjacency List of 25 nodes

Table 1 show the result of implementation for the nodes covered for 4 and 5 seed nodes for Greedy algorithm and modified Greedy algorithm.

Table 1: Results of non-weighted greedy and modified greedy

For 4 seed nodes		For 5 seed nodes	
Nodes covered under Greedy Algorithm	Nodes covered under modified Greedy Algorithm	Nodes covered under Greedy Algorithm	Nodes covered under modified Greedy Algorithm
16	19	22	23

Figure 2 (a, b) shows the graph of nodes covered for 4 and 5 seed nodes using modified greedy algorithm, total seed nodes will be higher than existing Greedy algorithm. So the proposed modified greedy algorithm will perform better for influence maximization in social networking

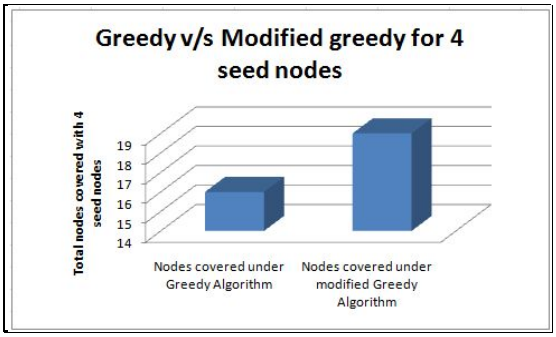

Figure 2(a): Total nodes covered for 4 seed nodes in non weighted greedy and modified greedy algorithm.

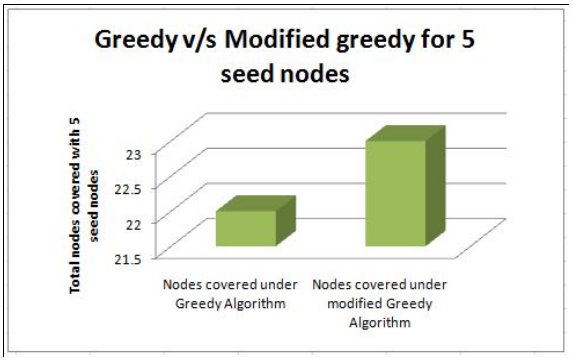

Figure 2(a): Total nodes covered for 5 seed nodes in non weighted greedy and modified greedy algorithm.

B. *Results of implementation on existing and proposed weighted techniques*

The proposed modified Weighted Greedy algorithm and existing Weighted Greedy algorithm was implemented on a graph of 25 nodes. During present implementation, a graph of 25 nodes was taken and an adjacency list of these 25 nodes was prepared. The weights of each edge of the adjacency list are.

Table 2 shows the nodes covered for 4 and 5 seed nodes for weighted Greedy algorithm and weighted modified Greedy algorithm.

Table 2: Results of weighted greedy and modified greedy

Weights & nodes covered for 4 seed nodes			
Weighted Greedy Algorithm		Modified Weighted Greedy Algorithm	
Nodes covered	Weight of nodes	Nodes covered	Weight of nodes
16	27.4	19	46.5
Weights & nodes covered for 5 seed nodes			
Weighted Greedy Algorithm		Modified Weighted Greedy Algorithm	
Nodes covered	Weight of nodes	Nodes covered	Weight of nodes
22	41	23	51.3

Figure 3 (a, b) shows the graph of nodes covered for 4 and 5 seed nodes using weighted modified greedy algorithm, total seed nodes will be higher than existing Greedy algorithm. So the proposed modified greedy algorithm will perform better for influence maximization in social networking

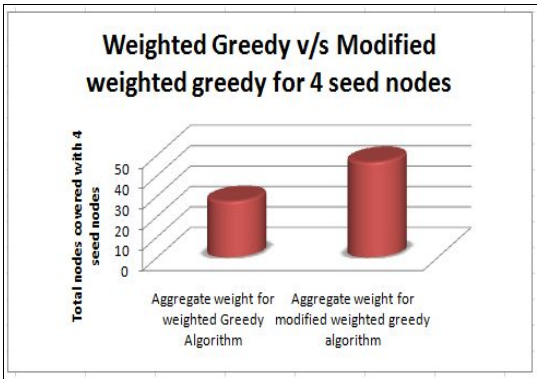

Figure 3(a): Aggregate weight for 4 seed nodes in weighted greedy and weighted modified greedy algorithm.

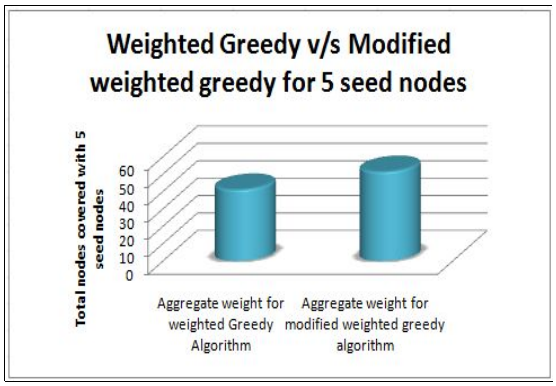

Figure 3(b): Aggregate weight for 5 seed nodes in weighted greedy and weighted modified greedy algorithm.

VI CONCLUSION AND FUTURE SCOPE

In present implementation, new methods were proposed by modifying existing Greedy and weighted Greedy methods for maximization of influence on social networking. These proposed methods were tested and validated by comparing the results with existing method for same input parameters. I concluded that the proposed methods viz. modified Greedy method and modified weighted Greedy method work well and better than existing methods viz. Greedy method and weighted Greedy method respectively for maximization of influence on social networking.

Although the proposed methods viz. modified Greedy method and modified weighted Greedy method are better than existing methods viz. Greedy method and weighted Greedy method respectively for maximization of influence on social networking yet there are still chances of improvement. These algorithms can further be studied and more modifications can be done for better results and cover maximum nodes.

7.REFERENCES

[1]. A. Goyal, F. Bonchi, L.V.S. Lakshmanan, “A data based approach to social influence maximization", The VLDB Endowment, Vol. 5, No. 1, pp. 73-84, 2011.

[2]. A. Goyal, W. Lu, L.V.S. Lakshmanan, “CELF++: Optimizing the Greedy Algorithm for Influence Maximization in Social Networks”, proceedings of WWW, pp1-2.

[3]. D. Kempe, J. Kleinberg, E. Tardos, “Maximizing the Spread of Influence through a Social Network”, Theory of Computing, Vol. 11, Issue 4, pp. 105–147, 2015.

[4]. H. Zhang, T. N. Dinh, M. T. Thai, “Maximizing the spread of positive influence in online social networks", IEEE - International Conference on Distributed Computing Systems, pp. 317-326, 2013

[5]. H. Zhuang, Y. Sun, J. Tang, J. Zhang, X. Sunz, “Influence Maximization in Dynamic Social Networks”, Project under Natural Science Foundation of China, 2015.

[6]. M. Heidari, M. Asadpour, H. Faili, “SMG: Fast scalable greedy algorithm for influence maximization in social networks”, Elsevier Physica-A, Vol. 420, pp.124–133, 2015.

[7]. R. Michalski, T. Kajdanowicz, P. Brodka, P. Kazienko, “Seed Selection for Spread of Influence in Social Networks: Temporal vs. Static Approach", New Generation Computing, Springer, Vol. 32, pp. 213-235, 2014.

[8]. S. Pandit, Y. Yang, N. V. Chawla, “Maximizing information spread through influence structures in social networks", IEEE - International Conference on Data Mining Workshops, pp. 258-265, 2012.

[9]. S. Zhou, K. Yue, Q. Fang, Y. Zhu, W. Liu, “An efficient algorithm for influence maximization under linear threshold model", IEEE - Chinese Control and Decision Conference, pp. 5352-5357, 2014.