

Comparative study of Existing Models for Online Social Network

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Article History: Received: 11 January 2021; Accepted: 27 February 2021; Published online: 5 April 2021

Abstract: Today, Online Social Networks becomes the first choice for businesses to broadcast their campaigns for branding, publicity, strategies, advertising, marketing, social influence and so many other areas. Social Network is a platform for communicating with social actors and Social Media is used by companies for broadcasting information. Online Social Network used by businesses for number of purposes but the primary concern is build new social connections that helps to target most audiences for successful campaign purposes. In OSNs sites the social objects are represented by nodes and the term edge used for connection between nodes under the graph theory. Today Social Network sites have becomes most exploded as compared to traditional sites because of impact of so many influence models over traditional models. Some of popular websites of OSN such as MySpace, Facebook, Flickr, YouTube, Google Video, Orkut, LinkedIn, Live Journal and BlogSpot have great impact on customer when targeting the sales marketing funnel for businesses. Adjacent users sometimes called engaged users tend to have more trust level as compared to random pairs users on the social media sites. Already have so much research that helps to calculate the trust factor using influence modeling. So influence models play a vital role to predict the behavior of the customer that helps to fulfill the goal of the business. The key contribution of this work is study of online social networking models.

Keywords: Online Social Network (OSN), Social Media, OSN Models, Social Networking.

1. Introduction

Social Influence Structure also called Social Network Analysis means considers the scenario how Facebook, Twitter algorithms try to predict products on the basis of your behavior or sometimes analyzing the additional parameters such as engagement, location, interest, reviews and so on[1][2]. Social Influence Structure means consider the deep study of the nodes, edges, protocols, social media, social network, relationship, influence parameters on basis user build the account, connect with friends, engage through social media so that target the new traffic for successful targeting the customer acquisition process[3][4].

Social network analysis helps to study how individuals distribute their behavior influence between different social groups over time [5]. Social Network analysis used to enable data segmentation such as page-views, unique page-views, average time on page, entrance rate, bounce rate, exit rate on the basis of user behavior that evaluated using analytics tools. So Social Network Analysis means computational analysis of matrices that associated with data collection methods on social media. Nodes connected in SNA either directed graph or undirected graph. In directed graph direct relationship between nodes so Twitter Social Graph is the example of directed relationship [6].

Social network categorized on the basis of strong relationship and weak relationship in which strong ones tie-up are most strongly clustered as compared to weak edges relationships while weak edges tie-up known for longer-distance relationship[7][8]. In fact for lifting the viral marketing campaigns on the basis of advocacy feature of marketing funnel number of research efforts have been proposed in past studies[9][10][11].

Directed vs. Undirected graphs

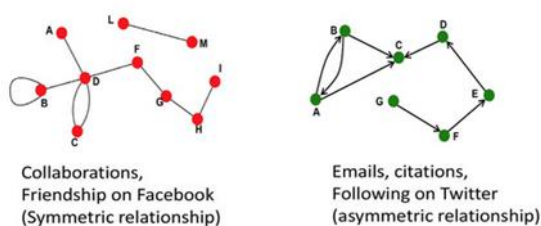


Figure 1.1. Directed vs. Undirected graphs

There is another type of relationship called undirected relationship in which consider facebook social graph is undirected relationship [12][13]. Populations in SNA represented by graph theory in which nodes and edges used for social groups. Entity or actor in the graph is called node and relationship between nodes represented by

edges[14]. A Social Network can be defined as a Graph $G=(V,E)$, where V is the set of vertices which represents the nodes in the network and E is set of edges with which all the nodes in the network are connected. For the real world nodes represent the individuals in the network and edge represents the social relationship between the individuals[15][16][17].

2. Influence models in online social networks

Behavior analysis using advocacy approach in digital marketing sales funnel becomes challenging job for the researchers[18]. Influence models play very important role for deciding either how people can influence each other on the basis of action strategy policies they have implemented on social network sites and E-commerce sites. But implementing predictive analytics and prescriptive analytics on influence models becomes powerful strategy to increase the revenue and predict customer behavior retention policy[19][20].

Many approaches presented the influence models theory address the problem of how to measure the influence probability metric. But still very limited work on strength, limitations and advocacy phase of sales funnel in which customer have to put reviews about the service.

Author proposed the study of different influence models along with their algorithms that helps to measure social influence [21]. Authors considered the viral marketing scenario in which focused on influence maximization problem and applications of influence models [22]. Authors also discussed how to implement optimized influence maximization in social network. Our survey approach firstly examines the literature of maximum OSN models and then divides the influence models on the basis of static influence, dynamic influence, diffusion influence and behavior influence categories[23][24].

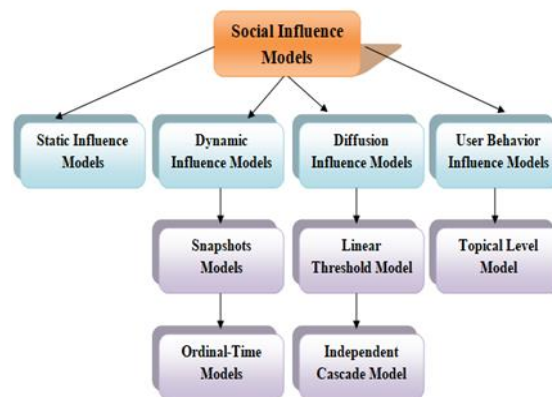


Figure2.1 Social Influence Models

2.1 Static Influence Models

Static Influence Models are the simplest approach having fix network size considered on OSN. In this modeling approach probability on the basis of influence parameter remains static and also independent of time factor. Bernoulli distribution is the main theory used by one instance of Static Influence Models. In Bernoulli distribution we decide what the distribution of influence on OSNs is.

2.2 Dynamic Influence Models

Today in digital marketing scenario companies have many campaign choices such as facebook campaign, twitter campaign, linkedin campaign, adword campaign that will dynamically affect the purchase behavior of customer. So Dynamic Influence Models have great impact on customer loyalty program. Using these campaigns user influence can change time to time. User influence and loyalty for targeting any product or join any community strongly dependent on what reviews, post and engagement activity performed by its neighbors. Here we survey two influence models of social network under dynamic influence feature. The first model is “Snapshot model” and second model is “Ordinal-time model” that based on time sequence of social network.

a) Snapshot model:

In today competition market scenario Company needs to share their brand story for growing their business followers so that people get engaged and converted into customers [41]. Cosley D et. al [42] used approach in which at two different times two Social network snapshots considered for representing the snapshot model. For the first snapshot author considered k -exposed set in which record of all individuals and $p_s(k)$ become adopters for the second snapshot at another time variation .To predict whether the behavior adopted or not, imagine all k – exposed nodes.

b) Ordinal-time model

This model based on time sequence of social network. Ordinal-time model creates the new link over the social network or new behavior adopted by the new individual depends on the moment-by-moment measurement parameter. The nonadopter decision either influence adopted or not depends on the basis of if nonadopter follow k th neighbor that is already adopter using the time sequence approach. Authors proposed number of neighbors in community vs. probability graph through curves on the basis of different campaign on Wikipedia.

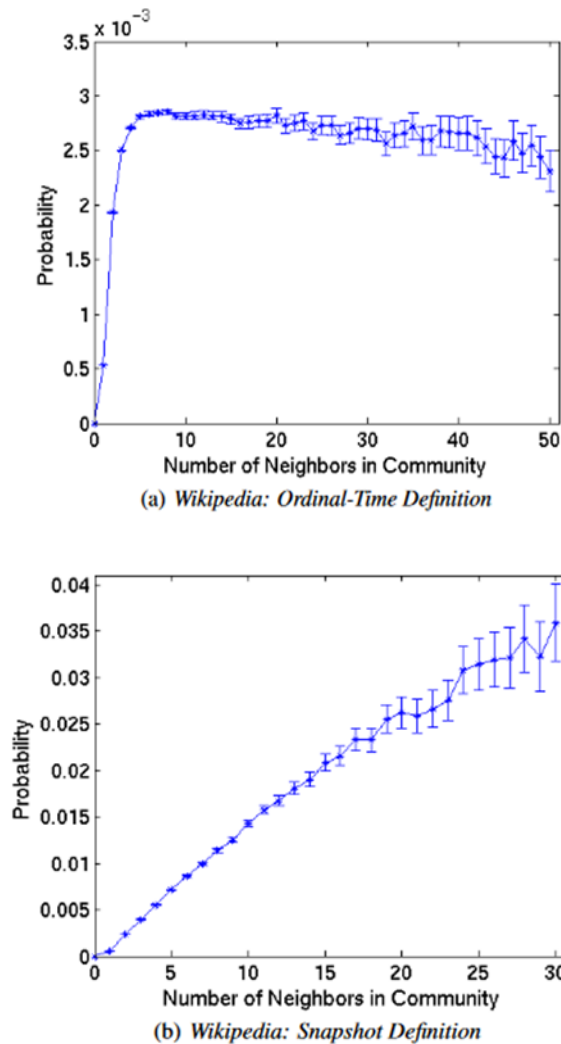


Figure 2.2 Ordinal vs. Snapshot

2.3 Diffusion Influence Models

Diffusion as its name suggests process in which information, post and audience behavior spread over the network. For example new product influence after completing brand awareness campaign only target the small scale audience in which limited few “early adopters”. As more audience adopted the product obviously influence on their friends and neighbors so that creates a cascade. Sometimes diffusion influence models also create the influence maximization problem due to fake posts, fake reviews and fake engagement [30].

Authors [30] discussed the influence maximization problem and also proposed a framework that tries to sort influence maximization problem. The framework based on probabilistic modeling of interaction in which empirical study conducted in the context of viral marketing that considers nodes as customers.

a) Linear threshold model

This approach facilitates each user in the network carry a threshold. User adoption of product depends on if other user in the group already adopted the product. Users with higher threshold don’t need to worry about when adopt a product and user having lower threshold will need to tend either to follow someone or not. Author discussed fundamental algorithm problems related to viral marketing strategies and also proposed algorithms that based on natural greedy strategies that become 63% of optimal for businesses decisions. Authors also discussed how the optimized solution based on degree centrality and distance centrality notions of social analysis [30].

b) Independent Cascade Model

As we discussed in linear threshold model decision influence depends upon the propagation of like information or viral news infection so situations when the node have chance to get infected because in contact with an infected node. News rumors also one of the current scenarios of linear threshold model. But in independent cascade model consider we have some network and initial set of active nodes. In this model firstly focus on two first customer on social media those already bought some product. The rule is on every step an active node u can activate the connected neighbor v with a probability $p_{u,v}$ (single chance) and in this probability model the probability depends on the edge but the key here that every node activate its neighbor through a single chance only.

2.4 User Behavior Influence Models

Author [30] discussed parameters that helps to distinguish social influence on the basis of topic as well also try to quantify strength of model by proposing new model. Authors proposed the Topical Affinity Propagation (TAP) that designed with efficient distributed learning algorithms under Map-Reduce framework. Author also discussed the problem of maximization and after try to solve the problem using Expectation Maximization (EM) algorithm. Author considered the independent cascaded model for implementing the proposed algorithm. Using Expectation Maximization (EM) algorithm the influence probability also increased in each iteration.

3. Comparative analysis of OSN models

In recent years, OSN sites have become an emerging mainstream medium, creating a dramatic social and economic impact in the world. OSNs play a vital role in delivering resources for a number of purposes, with three traditional main positions among other locations. Second, the OSNs are used to maintain and improve current social ties and to construct a new social environment across the globe. Second, OSNs are abused to share their knowledge with their social neighbors, either privately or publicly, as professionals, and to express their opinions in public. Third, it is used to classify novel and interesting content via the filtering and recommendation process.

Many scholars are focusing on the discovery and resolution of various dimensions of social networks. In order to address the issues, the available literature is updated in order to locate differences between the current bodies of information. It is important to compile the information gathered in the past. The study of the social network allows researchers to discover the mechanisms used in social systems and to find the pattern of interaction between individuals that have emerged from research topics such as sociology, epidemiology, the recommendation framework, and criminology.

Khan and Lee [24] suggested a new paradigm of evolution of scale-free social networks (SNs) depend on homophily merged with preferential extensions. A generic SN synthesized dataset containing SN nodal elements, like demographic elements, spatial data or consumer profits, is obtained. Homophilia is one of the main factors in the development of SN interactive relationships. User elements and similarities are used to integrate SN maps. Li et al. [25] provided a systematic study of knowledge dissemination studies in SN. It splits the models of data diffusion into 2 classifications: explaining and predictive designs.

The idea of a DA to calculate the impact of online social network actors such as Twitter was proposed by Goritz et al. [26]. The article compares the influence of the IPA with that of other artists by implementing ERGMs depend on Twitter info in weather modify negotiations. The results show that IPAs have the same authority as state artists in Twitter's world weather climate CN.

Zhang et al. [27] have introduced a novel 2-stage gossip distribution or rebuttal model with a time effect for OSNs. The dynamic mechanism for the propagation and refutation of rumors with a time impact is thoroughly examined. This is followed by a 2-stage design and related mean-area formulas in both homogeneous and heterogeneous systems. The Monte Carlo simulations are performed to explain the dynamics of gossip transmission or rebuttal in both the WSN and the BAN.

Alnajran et al. [28] proposed a NHDP approach to improving the efficacy of SM in the Twitter tweet context. The components of the suggested pre-processing technique are debated or analyzed as part of SemEval-2014's joint job in an annotated data collection. A test with the cosine angle was performed to assess the effect of our approach on the base line (C-Method). The results show that the system has correlations and error rates above the baseline.

Hufbauer et al. [29] proposed a design for creating SN that nearly comparison real network OSN devices (e.g. Facebook and Twitter) including group frameworks. The model is scalable, stable and novel. An automatic variable tuner that could meet the performance of the design to an OSN geology is also proposed. The design could then be utilized as a data factory to create integrated test beds for topology. The model is calibrated to fit 2 huge real-world OSN systems tests, the BAM and the LFR standard utilized as a baseline.

Tang et al. [30] proposed hop-based methods that could be simply scaled to millions of nodes and billions of boundaries. Xia et al. [25] suggested the SNURank algorithm, a mining algorithm for opinion leaders in the social network. It can be used to measure the power of the user and to pick opinion leaders by defining the degree of attention depend on the customer's attention behavior analysis or the ideas of the PageRank algorithm.

Ullah and Lee [31] have suggested the implicit group detection clustering method, based on a trust modeling that weighs the interest of users in a specific OSN. Trust modeling is measured by the user's benefit in grouping users into separate categories of better rates and authenticity resemblances within clusters. The structure plan clustering method operates by listing the nodes by the weighted degree instead and choosing the original community centers which are not in another's neighbors. The deterministic trust platform is developed to forecast the sense of faith among customers and superiors.

A research on the effect of EC on tax and accounting practice was released by Branda et al. [32]. The goal of this investigation is to research the effect of tax and e-commerce accounting operations in the context of the faster growth of Internet transactions. The need for this study is dictated by the current context in which social networks are increasingly being used as forums for the promotion of electronic business. The paper also aims to highlight the need to develop an international system of income/profit taxation as it does not currently exist. To endorse this

strategy, two scenarios of electronic and conventional trading in which e-commerce prospects are illustrated and the major problem of identifying the source of income is demonstrated.

Cao et al. [33] have developed a multi-stage rural e-commerce reverse logistics network platform under the B2C model, taking into account both cost savings and customer satisfaction. The GA 2-phase heuristic nesting method is applied to validate the feasibility of a method with a research study of 3C particles in Anhui Province. The findings demonstrate that the user satisfaction of the scheme in the nearby region is maximized and that the scheme has capability, efficiency, large quality and high risk owing to the low of the extra factor of the scheme and the standardization of resource input.

Liu et al. [34] proposed a credit risk gambling mechanism depend on game postulate and rational net concept of Petri. Second, a theoretical simulation solution known the LGPN is suggested by incorporating the Logical Petri nets into the game theory. The utility functions that explain the relationship among clients in various marketing strategies are retrieved in order to define the benefits that each company acquired all through competition procedures using the least square approach; the next is the Petri Net Logical Game Method for evaluating the interplay among different organizations in the Enterprise Competition Subsystem. An reachable marking graph for Logical Game Petri net system is introduced for behaviour analysis. Findings outcomes present that when companies selects a BM of true administration with a likelihood of 58.95 per cent or more, firms will achieve relatively stable and high expected value.

Liu et al. [35] aimed to resolve the last-mile distribution of RECL for the survival of a third-party logistics business. Evaluating the effectiveness of the RECL (longer travel chain and low consumption volume), the path optimal solution is created to achieve the last mile of RECL in addition to increasing the income of the government-funded logistics business. To fix the method, the ACO was enhanced to fit the last mile distribution of RECL by altering the heuristic specifics, the pheromone upgrade legislation, and the answer installation. The outcomes demonstrated that the proposed ACO could offer a feasible route plan for the last mile of arrival of the RECL.

Wu et al. [36] addressed the implementation of C2B e-commerce in three areas: C2B connotation and definition confusion, C2B network and application bottleneck, and C2B application strategy and prospect. While C2B technology is still in its infancy, consumer-driven e-commerce must be the future of e-commerce. The author claims that more third-party e-commerce sites would be moved from B2C applications to C2B applications.

George et al. [37] examines the context of the customer's objective to buy goods from the C2C EC policy by evaluating 2 mediating parameters: consumer confidence in traders and user trust in suppliers of C2C EC platforms. The survey is made up of 435 respondents from consumers of e-commerce in Indonesia. Results have shown that the credibility of sellers, the quality of information and the quality of service offered by sellers have a positive effect on customers' trust in vendors. Meanwhile, IQ, SQ or policy credibility have a positive impact on the confidence of the users in the C2C e-commerce platform.

Yang et al. [38] developed and introduced BPGS by smart contracts. The blockchain-based PGS (BPGS) for this business model was suggested. Big data. The blockchain is a decentralized framework that can accelerate product checks verification. Moreover, for the BPGS suggested, 51% of attacks cannot be reached without simultaneously compromise between 51% of the traders and e-commerce firms.

In addition to the cost assessment model, Joshi et al [39] focused on different concerns issues linked to previous EC for C2C. Using blockchain in this situation helps to move the model to a distributed one, so that customers can share better without exchanging personal information and products at the right price. The intention was to improve the price assessment of utilize goods, to offer end-users with information security or trust by utilizing various aspects of block chain technology.

Jude et al. [40] examined the e-readiness of small to medium-sized enterprises (SMEs) in Windhoek, Namibia, by introducing an e-Commerce Business to Consumer (B2C) business model as part of their marketing strategy. As SMEs aim an significant part in the NE, their participation in e-commerce is crucial. Quantitative data was obtained by the use of survey questions to determine their e-readiness and analyzed using the Social Sciences Statistical Kit (SPSS). Findings have shown that small and medium-sized businesses in Namibia are able to embrace B2C e-commerce.

Table 1. Comparative Analysis of OSN Models

Year	Title	Model	Remarks
2018	OSN Evolution Model Based on Homophily and Preferential Attachment.	SN Evolution Model	Graph shows a similar description of real-life SN maps with user elements.

2020	International Public Administrations on Twitter: A Comparison of Digital Authority in GCP.	Exponential Random Graph Model (ERGM)	IPA is allocated as much program me as the state artists on Twitter in world weather CN .
2018	Modeling rumor propagation and refutation with time effect in OSN.	Watts–Strogatz and Barabási–Albert	Identifying rumor has improved specifically in order to reduce the negative effects of rumor effectively.
2018	A Heuristic Based Pre-processing Methodology for Short Text Similarity Measures in Microblogs.	Heuristic Modelling	Cosine angle is used to evaluate the effect on the baseline (C-Method), in means of correlations or error levels.
2020	A Proximity-Based Generative Model for Online Social Network Topologies.	Barabasi-Albert and Lancichinetti-Fortunato-Radicchi	This model can be used to generate datasets for training or research.
2017	Influence Maximization Meets Efficiency and Effectiveness: A Hop-Based Method.	Influence Maximization	The OSN datasets show productivity and effectiveness.
2016	Mining Algorithm of Opinion Leaders Based on Analysis of User Attention Behavior.	Page Rank Algorithm, SNURank algorithm	The influence value of user can be determined by the degree of attention. It is more reliable to identify the opinion leaders in social networks.
2017	Community clustering based on trust modeling weighted by user interests in OSN.	Probabilistic Modeling	Community Clustering Approach evaluates the framework effectively by having a weighted subgraph for the community and less for the another groups.

4. Summary

OSN is the most popular virtual community, allowing users to discover, enlarge, and exploit their network. Many social network users share their information and opinions through a variety of OSN sites, like Facebook, Twitter, MySpace, or LinkedIn. Social Network has the potential to link diverse individuals and communities globally. The increasing scale of the social network makes it easier for social users to take the perceived ideas to their advantage. A comparative study of various OSN and E-Commerce models has been presented in this paper. From the literature survey it is inferred that the issue in social networking like protection, privacy, etc. can be solved by using different techniques such as diffusion modeling, probabilistic modelling, etc. There are several potential future directions for expanding these models of social control to overcome perceived drawbacks such as scalability and performance. A combination of these models can produce more accurate results and help to overcome individual limitations.

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