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# The Impact of Digital Communication on Social Networks: A Review

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**Abstract—** *The growing of demand for the huge data transmission made the digital communication systems increasingly attractive, greatest of communications have become digital due to the advantages of digital communication over analog communication. The advantages of digital communication are helped to develop the social networks during the years to the modern-era diversity which uses digital media. The researchers in this paper were eager to review how digital communication led to the emergence of social networks by review the history of digital communication, social networks. Also, this paper discussed some facts and statistics about some popular social networks.*

**Keywords:** *Digital communication, error protection, social network, Mobile Networking, WWW, Satellite communication*

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## 1. Digital communication

### 1.1 Introduction

The growing of demand for the huge data transmission made the digital communication systems increasingly attractive. Digital transmission proposed data processing option flexibilities not available with analog transmission. The great demand for voice (VOIP), Data and internet connections is the motivated power behind the growth in telecommunication. The fastest growing area in communication engineering is the design and manufacturing of hardware and software for digital communication networks [1].

Greatest of communications have become digital due to the advantages of digital communication over analog communication. Digital communication is robust in the sense of invulnerable to channel noise and distortion. Regenerative repeaters along the transmission route can detect a digital signal and refresh the transmitted signal and retransmit a new noise-free signal. This prevents the noise to accumulate along the path. Digital signals can be coded to produce extremely low error rates and high fidelity [2].

The subject of digital communication involves the transmission of information in digital form from a source that generates the information to one or more destination. Knowledge of basic rules of operation of digital communication system is crucial factor in understanding contemporary communication. Digital communication systems can be treated as a medium for many different systems and services. Digital TV, cellular telephony or internet access are only three prominent examples of such services. Basically, each kind of communication between human beings and between

computers requires a certain kind of transmission of digital represented messages from one location to another or, alternatively, from one time instant to another, as it is in the case of digital storage [3].

## 1.2 History of digital communication

### Telegraph

The telegraph was achieved by Samuel Morse. With few words transmitted by Morse's electric telegraph between Washington, D.C., and Baltimore, Maryland, in 1844, an entirely revolutionary means of real-time, long-distance communications was started. The telegraph, ideally appropriate for manual keying, is the indication of digital communications. Explicitly, the Morse code is a variable-length code utilizing an alphabet of four symbols: a dot, a dash, a letter space, and a word space; short sequences represent frequent letters, whereas long sequences represent infrequent letters [4].

### Telephone

The telephone was invented by Alexander Graham Bell in 1875. Real-time transmission of speech made up with telephone by encoding the electrical signal and replication of sound a practical reality. The original version of the telephone was simple and weak; enabling users to talk over short distances only. Especially, in 1897, A. B. Strowger, and mortician from Kansas City, Missouri, invented the automatic step-by-step switch that bears his name. Over all the electromechanical switches invented over the years, the Strowger switch was the most popular and commonly used. Harry Nyquist, 1928, published his classical paper on the theory of signal transmission in telegraphy. In particular, Nyquist established criteria for the accurate reception of telegraph signals transmitted over dispersive channels in the absence of noise. Much of Nyquist's early work was applied later to the transmission of digital data over dispersive channels [5].

Alex Reeves invented the pulse-code modulation PCM technique in 1937, PCM technique means encoding digitally the speech signals. In the World War II, the PCM technique was developed to make the encryption of speech signals is possible; actually, a full-scale, 24-channel system was exploited in the field by the US military at the end of world war. However, PCM technique had qualitative change with the innovation of the transistor and the development of large-scale integration of circuits for its commercial utilization. In 1948 Claude E. Shannon published his entitled paper "A Mathematical Theory of Communication" [6].

This was the foundation of the digital communication. Shannon has presented that a communication system can be considered to be digital, without loss of optimality and can be divided the transmission system into two parts, Source coding and Channel coding. It is significant that prior to the published paper of Shannon's, it was considered that increasing the rate of data transmission over a noisy channel would increase the probability of error. The communication theory community was taken by surprise when Shannon shown that this was not correct, provided the data transmission rate was below the channel capacity [6].

## 1.3 Error protection

Basically, in the communication systems, the data are transmitted as a series of binary bits, which are modulated to analog signal and transmitted over a communication channel. Though, these bits might corrupt in the noisy channel and might get interference through transmission over the communication channel. At the receiver, the received signal will be demodulated into binary bits [7]. Throughout the transmission, possibly bits error might occur depending on the characteristics of the channel, and the number of bit error depends on the amount of noise in the communication channel. Such errors, naturally occur after the signals transmission, storage, or processing of information in digital form. Error control coding enables the processes of detection and correction which leads to protect the transmitted digital information from those errors may have occurred. Error-control code techniques are now applied in almost the entire range of information communication, storage and processing systems. Industrial development advances in electronic and optical devices have aided the implementation of very powerful codes with close to optimal performance. Furthermore, new kinds of code, and new decoding methods, have recently been developed and are starting to be applied [8].

One of the expectations made in the Shannon's channel coding theorem is more sophisticated coding technique applied to the system can convert a noisy channel (unreliable transmission) into an error-free channel (reliable transmission) [9]. Validation of the theorem about the possibility of having error-free transmission is done by applying a coding technique of a random nature [10]. In digital communications, there are two main techniques of error-control structures: Automatic Repeat re-Quest (ARQ), which are commonly utilized in wire line communication systems, and Forward-Error Correction (FEC) schemes, also known as channel coding, which are applied in the wireless systems [11]. The automatic repeat request (ARQ) combines the error detection and retransmission, to get accurate provides of data, even though the occurrence of errors during transmission. On the other hand the FEC efforts to correct errors at the receiver, by applying the techniques of error control coding designed for that purpose. There are basically two procedures for adding redundancy, related to error-control coding techniques [5a], firstly, block coding and the second is convolutional coding. In past decade, for the practical standard digital communication the source encoder and decoder, channel encoder and

decoder, and modulation-demodulation has been designed independently. More explicitly, the source encoder and decoder have been designed without knowledge about the statistical channel encoder and decoder [12]. In 1979, the idea of jointly designing the source-channel coding, begun with the work of [13]. It has been reported that, in noisy channels the design of joint source-channel encoder and decoder can improve the performance dramatically.

Digital communications devices and techniques have been around for ages. The 1980's popularization of the computer and the birth of the Internet was a quantum shift in field of communication and an evolutionary step for human society. The Digital Revolution marked the final phase of the information age. People in far parts of the world not connect immediately and information flow has shrunk the world. One of the biggest changes recently is the interconnected immediacy of social networking. Digital communication has led to invent the social networking by three important applications of digital which represented by: the internet- World Wide Web (WWW), mobile communication, and satellite communication [14].

1. Internet- World Wide Web (WWW)
  - The World Wide Web or WWW, is an information service that is on the Internet. It is an attempt to organize the Internet so you can find information easier moving threwh document to document. If you know how to utilize the Net, in just five minutes you could send and receive information and comments with millions of people all over the world, get a fast answer to any question, computing, technical, business, investment, or any other subject [15].
  - People in all kinds of businesses and industries are sharing a wide spectrum of educational, business, and personal interest on the Net. Many people learned English language by using internet. A growing number of companies are generating substantial sales of their products, but the Internet is not just for academics, business, and professional use. It could also be really fun [15].
2. Mobile communication network
  - Mobile networks are providing voice and data connectivity that can improve billions of lives. They are helping to boost local economies, deliver important social services like healthcare and education, improve democracy and generally raise standards of living. They are cheaper and easier to use, they don't need a regular power supply and can be used by people who don't have a previous experience of technology [16].
3. Satellite communication
  - Since the beginnings of the long distance telephone network, there has been a need to connect the telecommunications networks of one country to another. This has been accomplished in several ways. Submarine cables have been used most frequently. However, there are many occasions where a large long distance carrier will choose to establish a satellite based link to connect to transoceanic points, geographically remote areas or poor countries that have little communications infrastructure. Groups like the international satellite consortium Intelsat have fulfilled much of the world's need for this type of service. They are used for mobile applications such as communication to ships, vehicles, planes, hand-held terminals and for TV and radio broadcasting [17].

## 2. Social Networks

### 2.1 History

Social networks have developed during the years to the modern-era diversity which uses digital media. The social network is not that new and it didn't start with the computer but instead the telephone. Through the 1950s, phone phreaking, the concept used for the hustler searching of the telephone network. This procedure was completed by the use of home-made electronic devices that facilitated unlicensed access to the telephone system to make free calls. Phreaks were able to find telephone corporation test lines and conference circuits to achieve their task. Brett Borders stated phreaks were able to breakthrough into company unused voice mailboxes to host the first blogs and podcasts [18][19].

Over the 1960s, the emergence of the email to the public [19]. But, the internet was not accessible to the public until 1991. The main objective of email is to transfer messages between two computers, but the both computers must be online. Nowadays, E-mail service will accept and store messages that allow users to access e-mail in what they see fit. In 1969, ARPANET, established by Advanced Research Projects Agency (ARPA), a U.S. government agency, was developed. ARPANET was an "early network of time-sharing computers that formed the basis of the internet." CompuServe, the third development of the 1960s, was also established in 1969 with a task to supply time-sharing services by leasing time on its computers. With too high fees, this service was very expensive for many [20][21].

In recent years social networks have become very famous because of the growing affordability and spread of internet enabled devices such as mobile device, computers and other more modern innovations such as internet tablets. This is

illustrated through the growing popularity of so many online social networks such as Facebook, Twitter, Google +, Instagram and LinkedIn. Such as these social networks have lead to a massive explosion of centralization network data in a wide range of scenarios. social networks can be defined either in context of site such Flickr which are designed for a various service such as content sharing, but it also allow an wide range level of social interaction, or in the context of system like Facebook which are explicitly design for social interactions[22].

Generally, a social network has been defined as a network of relationships and interactions, where the nodes composed of active actors and the edges composed of the interactions or relationships between these active actors. A popularization of the social networks idea is that of information networks, the nodes in these social networks consist either entities or actors, and the relationships between them indicated by edges. Obviously, the social networks term is not limited to the particular condition of an internet-based social network such as Facebook; in often the social networking problem has been studied in the field of sociology in concepts of generic interactions between and group of active actors. With such interactions may be in any traditional or non-traditional form, whether they be telecommunication interactions, E-mail interactions, face to face interactions or postal mail interactions [22][23].

In general, the traditional studies on social network analysis have not concentrate on online interactions, and have historically preceded the emergence and popularity of computers or the internet. A conventional example of this is the study of [24] in the sixties before the innovation of the internet, who hypothesized the possibility that any pair of active actors on the planet are separated by at six degrees of separation. Whilst such hypotheses have widely stayed conjectures during the last decades, the online social networks development has made it possible to exam such hypotheses at least in an online setting. This is also indicated to as small world phenomenon. This phenomenon was examined in the context of MSN messenger data, and it was illustrated in [25] that the average track length between two MSN messenger users is 6.6. This can be considered a verification of the largely known of "six degrees of separation" in social networks. This examples are by no means, a various collection of online data is available now which has been used to proof the fact of a host of other conjectures such as that of preferential attachment or shrinking diameters [26]"*The shrinking diameter conjecture hypothesizes that the diameters of social networks shrink in spite of the addition of new nodes, because of an increase in the density of the underlying edges. The preferential attachment conjecture hypothesizes that new nodes and edges in the social networks are more likely to be attached to the dense regions of the network*".

## **2.2 Positives and Negatives of social Networks**

Relatively a social networking is new advance in technology, they are various sites that people can make personal profiles, share their pictures, videos to their family, friends and other people from all the world. So it's easy to get carried away with interactions and attentions you can have 24 hours per day on social networks sites, but there are many positives or negatives of these social networks on our social life [27][28].

### **A. Positives of social Networks**

1. The main goal of the social network is to be able to keep in touch to families and friends in today's fast-paced and ever changing worlds.
2. Social networking is a wonderful method to finding people with common interests
3. Social networks are invaluable promotional tool. Organizations, Musicians and artists can meet an impossibly great and varied amount of audience using social network sites. This helps them to deliver their products in a way that has never been seen before.
4. By social network sites breaking news and other important information spreads unbelievable quickly.
5. Social networks helps to catch and convict criminals. Sometime people often do not take in their account the consequences of what they post in their social site. Photograph of themselves when doing illegal things, or even they bragging to share about crimes they have committed are all things that law enforcement use to persecute these criminals. Also, they use these social sites to identify and solve existing cases.

### **B. Negatives of social networks**

1. Social networks perpetuates false and unreliable information, within hours or days anything can diffusion to millions of people on social networks. Unluckily, this also includes things that are not true or made up. this information can cause scare and intense misinformation in society.
2. Social networks causing great relationships problems. Although the social networks are used to starting new relationships, but ending many others.it is so easy to communicate and share plans or pictures with a person on social networks and keep it completely under wraps. This new seduction have been leading wedges into people's offline relationships, real life, oftentimes ending them for good.
3. Cyberbullying is a growing problem in social networks. Not always having access to people's lives at all times is a good thing. A new direction of cyberbullying is wreaking destruction all across the world. This is particularly true with young kids. They are publicly inconvenience one another, and posting defamatory things which are broadcasted to the entire cyberbullying world.

4. Social networks are used to profile and discriminate in the job world. Everyone has a social networks account that shows what they look like, the type of life that they live, what they look like, and how old they are. Workers are using to their benefits in some very worrying ways. Jobs that are looking for a some standard of person, but cannot legally express these standards, are using social networks to pre-screen their applications.
5. The addiction is real in social networks. One of the major problems with the social networks craze is that people are becoming more and more addicted to using it. it is the first time waster at job, at home, and in school.

Four types of social networks will be briefly discussed below by the researcher in this study as follows:

### **Facebook**

In Feb. 2004, Facebook was started as a social network site, and it is specially operated by Facebook headquarter [29]. Facebook was established by Mark Zuckerberg and his roommates when he was a student at Harvard College. In the beginning, the site was limited only to Harvard students. Later on the access was expanded to high school students and later to everyone that is 13 years or more. In Jan 2009, Facebook was ranked as the most used the worldwide of social networks. In Jul 2010, more than 500 million users has joined to the Facebook [30]. In May 2010, Google declared that the most sites in the world visited by people is Facebook. It announced that this was find out from findings on 1000 website around the world. Users in Facebook may create a user profile, add other users "friends", and interchange message, including photos, comments, and automatically notifications. In addition, Facebook active users may enrollment common interest user groups, organized by the work, college, school [31].

Every day, access to Facebook is in increase, it also became the top social network around 8 individual markets in Asia. On October 2007, Microsoft declared that it had bought a 1.6% share Facebook for \$240 million. Microsoft's buy comprised rights to place international ads on Facebook; other corporations have evenly followed suit. For example, in 2010 FIFA football world cup, Nike did ads with Facebook, within minutes, an average of 8 million viewers had registered with Facebook [32] [33].

### **Twitter**

Twitter was existed in 2006 while Facebook started to open its doors to people. Twitter acquired a lot of saleability because firstly it provided more different choices such as micro blogging and secondly it was used by some famous people [34][35]. Till 2010, there was many social networks produced, such Friend Feed in 2007 and gained by Facebook in 2009 [34]. In 2008 Ping.fm was created and defined as "the auto magic" micro blogging and networking site service that authorize users to post to several social networks at the same time [36][37]. In 2009, Net log previously known as Facebox and Binbox, is a Belgian social networking site was started particularly targeted at the European youth demographic [38]. Google buzz is a social networking and message tool was launched in 2010 that integrates a web based email program which will work via the Gmail service, will allow user to post photos, status update and links to members of their network, in addition to drag in their activity on other website such as Facebook or Twitter [39].

### **Instagram**

Instagram is a free mobile application was produced by Kevin Systrom and Mike Krieger in 2010. The service provided by Instagram was quickly gained popularity, in April 2012 over 100 million users and December 2014 over 300 million [40]. Instagram was disseminated through the Google Play, App Store, and Windows Phone Store[41]. Support for the app is available for iPad, iPhone, iPod Touch, and Android handsets, while third party Instgaram apps are available for Nokia-Symbain Device and Blackberry 10. the service was gained by Facebook in April 2012 for US\$ 1 billion in cash and stock. In 2013, Instgram grew by 23%, while Facebook, as the origin company, only grew by 3% [42][43].

Instagram is an online mobile video, photo sharing and social network service that authorize its user to take videos and photos and share them on a several social networks platforms such as Twitter, Facebook. In original, a special characteristic was that it limited photos to a square shape, similar to Kodak Onstamatic and Polaroid, on the other hand to the 4:3 aspect ratio usually used by cameras of mobile device. Version 7.5 was released in Aug. 2015 which allowing users to post their photos captured in any aspect ratio. Also, users can make digital filters to their photos [44] [45].

### **LinkedIn**

LinkedIn is a business oriented social network service was originated in Dec. 2002 and started on May 5, 2003, and it is basically used for professional networking [46]. From 2015, most of the website's income comes from selling access to information on its users to recruiters [47]. The members of LinkedIn were Increased to 20 million in 2006 [48]. In Oct. 2015, LinkedIn reports more than 400 million gained users over 200 countries and regions [49] [50]. LinkedIn website is available in 24 languages [51], such as German, Italian, Portuguese, Spanish, Dutch, Arabic, Chinese, and English [52] [53]. LinkedIn has 65.6 million monthly visitors form U.S in July 2, 2013, and 178.4 million worldwide [54], the number of user was increased to 184 million in 29 Oct. 2013 [55]. LinkedIn had 33.9 million unique visitors in June 201, up 63 %

from a year previously and overriding MySpace [56]. LinkedIn displaying to public in January 2011 and traded its first stake on 19 May 2011, under the NYSE symbol "LNKD" [57].

The main functionality of LinkedIn authorizes users to create "profile" and "Connections" to each other which may represent real world relationships. LinkedIn users can make invitation to anyone to become a connection even whether a website user or not. However, if the invited person select "I don't know" or "Spam", this will be against the inviter. If the inviter gains too many of same response, the user account may be closed or restricted [57]. Below the list connection that can be used in various ways:

- Getting introductions to the "connections of connections" which called second degree connections and "connections to second degree connections" which called third degree connections.
- Users can find Job, business opportunities suggested by someone else in one's contact network.
- Business owners can search and jobs for potential candidates.
- The LinkedIn can help the job seekers to review the profile of recruitment manager and find out which of their current contacts to introduce them
- To aid in identification, the users can post their photos and view photos of others
- Users can follow various corporations and can receive notifications on offers available and new joining
- Users can bookmark jobs that they would like to apply for
- Users can "congratulate" and "like" for other's new employments and upgrade.
- Users can know who has visited their profile page.

The gated access approach "(where contact with any professional requires either an existing relationship or the intervention of a contact of theirs)" is aimed to construct trust among the service's users. LinkedIn participates in the "EU's International Safe Harbor Privacy Principles"[58].

#### 2.4 Social Website in 2015

The fast truth can be summarized in one term, "mobile". Penetration of Smartphone has Increased as it the device have become more accessible and the wireless networks more quickly and everywhere. Now there are 7.2 billion people on our earth and of those the following numbers make interesting reading [59][60].

- More than 3 billion active Internet users which mean 45 percentages of the world's Internet users.
- Almost 2.1 billion people have Social network account
- There are 3.65 billion mobile users have access by smartphones and tablets to the Internet.
- Nearly 1.7 billion people have social network active account



Figure 1: Global digital Snapshot [31]

The increase of social networks that not speaking English in Russia and China like Qzone, are producing big social networks that override Twitter and Instagram. Below some social network's facts and statistics in 2015.

#### Facebook

1. There are close to 1.4 billion users on Facebook.
2. Total Facebook users are 47% of Internet users.

3. 4.5 billion Like are generated per day.
4. Almost 75% of Facebook's income comes via mobile announcements.
5. Upload of User videos direct to Facebook now override YouTube.

#### **Twitter**

1. There are 284 million Twitter users
2. 88% of Twitter users are on mobile
3. 500 million Tweets are generated daily

#### **Instagram**

1. There are 300 million of Instagram users
2. 70 million videos and photos are sent per day
3. Instagram's users ages ranging from 18-29, which make up 53% of Internet users

#### **LinkedIn**

1. 400 million registered users on LinkedIn.
2. \$643 million are total income at the end of 2014 "a growth rate of 44% over the previous period".
3. Recently, over 39 million students college graduates on LinkedIn.

#### **Other social media and network**

Facebook maybe the larger but there are many networks and other social media facts that should not be forgotten.

1. Over 200 million users on Viber.
2. In China there are 639 users of Qzone.
3. Whatsapp has 600 million users.
4. Wechat is close to 468 million users in China.
5. 500 million users on Facebook messenger.
6. 100 million monthly users on Snapchat and it has been estimated value at nearly to \$20 billion at the last evaluation.
7. 100 million users of VKontake in Russia's.
8. In 2015,\$8.3 billion the income of social networks from advertising.

### **3. Conclusion**

The overall theme of this study is how digital communication impact on social networks. This paper was discussed two important sides, the digital communication and social network. In digital communication the authors presented overview on the history of digital communication, error protection, Internet- World Wide Web, mobile communication system and Digital satellite system. While in social networks the authors reviewed history of social networks, positives and negatives of social networks and discussed four types of social networks. in the end, facts and statistics of social networks in 2015 was presented.

### **References**

- [1] Haykin, S. S., Moher, M., & Song, T. (1989). An introduction to analog and digital communications (Vol. 1). New York: Wiley.
- [2] Kattoush, A. (2005) . Digital communication. Dar Al-Manahej for Pub. & Distributing, Amman.
- [3] Shannon, C. E. (1998). Communication in the presence of noise.Proceedings of the IEEE, 86(2), 447-457.
- [4] Viterbi, A. J., & Omura, J. K. (2013). Principles of digital communication and coding. Courier Corporation.
- [5] Gorman, M. E. (1999). Alexander Graham Bell. Encyclopedia of Creativity, Two-Volume Set, 185.
- [6] Shannon, C. E. (2001). A mathematical theory of communication. ACM SIGMOBILE Mobile Computing and Communications Review, 5(1), 3-55.
- [7] J. Li and K. Narayanan, "Rate-Compatible Low-Density Parity-Check Codes for Capacity-Approaching ARQ Scheme in Packet Data Communications," Int. Conf. on Comm., Internet, and Info. Tech. (CIIT), November 2002.
- [8] Farahin Bt Tajul Arifin, N., Othman, N. S., & Ahmed, A. M. (2014, November). Overcomplete source expansion aided, soft-bit assisted speech transceiver. In Telecommunication Technologies (ISTT), 2014 IEEE 2nd International Symposium on (pp. 326-329). IEEE.
- [9] Nandan, S., & Deepthi, P. P. (2012, November). Joint Source Channel Coding Using LDPC Codes. In Computational Intelligence and Communication Networks (CICN), 2012 Fourth International Conference on(pp. 355-358). IEEE.
- [10] Carlson, A. B., Crilly, P. B., & Rutledge, J. C. (1986). Communication systems: an introduction to signals and noise in electrical communication.Guía Académica, 129.
- [11] Costello, D., & Lin, S. (2004). Error control coding. New Jersey.
- [12] Ali, K. (2005). An Enhanced Joint Source-Channel Decoder (Doctoral dissertation, McGill University).
- [13] Modestino, J. W., & Daut, D. G. (1979). Combined source-channel coding of images. Communications, IEEE Transactions on, 27(11), 1644-1659.
- [14] Kaul, V. (2012). The Digital Communications Revolution. Online Journal of Communication and Media Technologies, 2(3), 113.
- [15] Kahn, R. E., & Cerf, V. G. (1999). What is the Internet (And What makes it Work)?.
- [16] Zaki, Y. (2012). Future mobile communications: LTE optimization and mobile network virtualization. Springer Science & Business Media.

- [17] Hart, D. (2000). Satellite communications.
- [18] Edosomwan, S., Prakasan, S. K., Kouame, D., Watson, J., & Seymour, T. (2011). The history of social media and its impact on business. *Journal of Applied Management and entrepreneurship*, 16(3), 79-91.
- [19] Borders, B. (2009). A brief history of social media. Retrieved July 05, 2015 ,<http://socialmediarockstar.com/history-of-social-media>.
- [20] Rimskii, V. (2011). The influence of the Internet on active social involvement and the formation and development of identities. *Russian Social Science Review*, 52 (1), 79-101.
- [21] Ritholtz, B. (2010). History of social media. The Big Picture.
- [22] Aggarwal C. C. (2011). An Introduction to Social Network Data Analytics, IBM T. J. Watson Research Center, Yorktown Heights, NY 10598, USA.
- [23] Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210-230.
- [24] Milgram, S. (1967). The small world problem. *Psychology today*, 2(1), 60-67.
- [25] Leskovec, J., & Horvitz, E. (2008, April). Planetary-scale views on a large instant-messaging network. In *Proceedings of the 17th international conference on World Wide Web* (pp. 915-924). ACM.
- [26] Leskovec, J., Kleinberg, J., & Faloutsos, C. (2005, August). Graphs over time: densification laws, shrinking diameters and possible explanations. In *Proceedings of the eleventh ACM SIGKDD international conference on Knowledge discovery in data mining* (pp. 177-187). ACM.
- [27] Futureofworking. (2015). 10 Advantages and Disadvantages of Social Networking. <http://futureofworking.com/10-advantages-and-disadvantages-of-social-networking/>. Retrieved October 25, 2015.
- [28] Teacher, H., & Hur, B. What are the advantages and disadvantages of social networking sites?.
- [29] Facebook. (2004, 2 4). Facebook Inc. Retrieved October 10, 2015, from Facebook.com: <http://www.facebook.com>.
- [30] Boyd, D. (2007). Social Network Sites: Definition, History, and Scholarship. *Computer Mediated Communication*, 3-20.
- [31] TIMES, L. (2010). The business and culture of our digital lives, . Los Angeles Times, 1.
- [32] STONE, B. (2007). Microsoft to Pay \$240 Million for Stake in Facebook . *NewYork Times*, 1.
- [33] kevthefont (2010). Curse of the nike advert-it was written in the future. Bukisa, 1.
- [34] Jasra, M. (2010, November 24). The History of Social Media [Infographic]. Retrieved May 20, 2015, from *Web Analytics World* : <http://www.webanalyticsworld.net/2010/11/history-of-social-media-infographic.html>
- [35] Tweeternet. (2010, December 2). What is twitter and why does it keep following me around?
- [36] Pirillo, C. (2010, December 02). Social Media updates. Retrieved November 15, 2015, from Chris Pirillo: <http://chris.pirillo.com/what-is-ping-fm/>.
- [37] AppAppeal. (2010, December 02). Social Networking, Netlog Review. Retrieved November 15, 2015, from AppAppeal: <http://www.appappeal.com/app/netlog/>.
- [38] Hendrickson, M. (2008, March 31). Ping.fm Centralizes Status Updates, But Is It Enough? Retrieved November 20, 2015, from *TechCrunch*: <http://techcrunch.com/2008/03/31/pingfm-centralizes-status-updates-but-is-it-enough/>
- [39] Gross, D. (2010, February 09). Google Buzz goes after Facebook, Twitter. Retrieved November 20, 2015, from *CNN Tech*: [http://articles.cnn.com/2010-02-09/tech/google.social\\_1\\_google-web-networking-sites-search-engine?\\_s=PM:TECH](http://articles.cnn.com/2010-02-09/tech/google.social_1_google-web-networking-sites-search-engine?_s=PM:TECH).
- [40] DesMarais, C. (January 20, 2013). "Facebook's Instagram says it has 90 million monthly active users". *PC World*. Retrieved October 30, 2015.
- [41] Murph, D. (April 3, 2012). "Instagram comes to Android, available to download now". *Engadget*. Retrieved October 30, 2015.
- [42] Stern, J.(April 9, 2012). "Facebook Buys Instagram for \$1 Billion". *ABC News*. Retrieved June 27, 2015.
- [43] Kate, K. (January 21, 2014). "Instagram is growing faster than Twitter, Facebook, and Pinterest combined"
- [44] *Frommer, D. (November 1, 2010). Here's How To Use Instagram.*
- [45] Fiegerman, S. (Dec 11, 2014). "Instagram tops 300 million active users, likely bigger than Twitter". *Mashable*. Retrieved June 27, 2015.
- [46] "LinkedIn - About". LinkedIn Corporation. 2015. Archived from the original on August 1, 2013. Retrieved August 10, 2015.
- [47] LEMANN, N. (2015), <http://www.newyorker.com/magazine/2015/10/12/the-network-man>
- [48] Von Rosen, Viveka (2012). *LinkedIn Marketing An Hour A Day*. Indianapolis, Indiana: John Wiley & Sons Inc. p. 2. ISBN 9781118358702.
- [49] "LinkedIn Blog". LinkedIn.com. <https://engineering.linkedin.com/blog>. Retrieved, October 29, 2015.
- [50] "400 Million Members!". LinkedIn Blog. LinkedIn. October 29, 2015. Retrieved October 29, 2015.
- [51] Hempel, Jessi (July 1, 2013). "LinkedIn: How It's Changing Business". *Fortune*. pp. 69–74.
- [52] Posner, Nico (June 21, 2011). "Look who's talking Russian, Romanian and Turkish now!". LinkedIn Blog. LinkedIn. Archived from the original on June 25, 2011. Retrieved October 21, 2015.
- [53] "LinkedIn launches in Japan". *TranslateMedia*. October 20, 2011. Archived from the original on October 26, 2011. Retrieved November 1, 2015.
- [40] "LinkedIn.com Traffic and Demographic Statistics". *Quantcast*. Archived from the original on August 1, 2013. Retrieved August 30, 2015.
- [54] "LinkedIn Q3 2013 Earnings Call". *Slideshare.net*. Retrieved October 06, 2015.
- [55] Womack, Brian (July 8, 2011). "LinkedIn Passes Myspace to Become No. 2 U.S. Social Network". *Bloomberg L.P.* Archived from the original on November 30, 2011. Retrieved October 8, 2015.
- [56] Pepitone, Julianne (January 27, 2011). "LinkedIn files for IPO, reveals sales of \$161 million". *CNNMoney.com* (Cable News Network). Archived from the original on January 29, 2011. Retrieved October 28, 2015.
- [57] Account Restricted | LinkedIn Help Center". [Help.linkedin.com](http://help.linkedin.com). 2013-12-20. Retrieved October 28, 2015.
- [58] "Privacy Policy". LinkedIn. July 14, 2006. Retrieved October 17, 2015.
- [59] Bullas, J. (2015 )." 33 Social Media Facts and Statistics You Should Know in 2015". <http://www.jeffbullas.com/2015/04/08/33-social-media-facts-and-statistics-you-should-know-in-2015/>.
- [60] Kemp , S. (21 January 2015 )." Digital, Social & Mobile Worldwide in 2015". <http://wearesocial.net/blog/2015/01/digital-social-mobile-worldwide-2015/>