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Analysis and Evaluation of Privacy Protection Behavior and Information Disclosure Concerns in Online Social Networks

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A B S T R A C T

Online Social Networks (OSN) becomes the largest infrastructure for social interactions like: making relationship, sharing personal experiences and service delivery. Nowadays social networks have been widely welcomed by people. Most of the researches about managing privacy protection within social networks sites (SNS), observes users as owner of their information. However, individuals cannot control their privacy and it's been controlled by groups. Using OSNs is making concerns about privacy related to online personal data. According to number of studies, till now so many efforts has been done to protect confidentiality and security of data on social networks, but it seems that understanding the concept of privacy protection is too essential for people. The purpose of this article is to analyze tools and algorithms that proceed concerns about privacy protection and data security situation in social networks among adults, adolescents and children. These statistical tools and algorithms, analyze collected data. The results of this literature review showed that most distribution of these articles in this case are related to 2014. Furthermore, survey method was most current of collecting information in these researches.

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1. INTRODUCTION

Since Social Networks Sites are growing, their effect on users' privacy have been studied by researches. Recently researchers claimed that they have spread the scope of their search about collective privacy beside individual privacy. Indeed, when information is disclosed for others, it would have joint owners [1]. Social networks become something necessary in Human's modern lives for making connections. Most of the online society use online social networks such as Facebook, Google plus, Twitter and LinkedIn, which ease sharing experiences and presenting online services. Through online social networks lots of personal data would be published online and would be accessible for all users around the world [2]. The content of social web which has been created by user mostly include opinions, users' experiences and knowledge and also personal information such as name, contact information and personal data. Online disclosed information digitally stored. Therefor, they are repeatable, searchable and sharable continually. So, users would face online identity management challenges. In fact, users which are anxious about their privacy in social web, they don't show it to the same extent in their acts and behaviors. This issue known as privacy paradox [3].

The purpose of this article is to analyze tools and algorithms that can be used in subjects like privacy protection, information security, information leakage and information disclosure. In this work, 37 tools and algorithms has been studied which most of the algorithms are statistical. Some software like SPSS, AMOS and NVIVO has been used as tools for analyzing data. In the following, we will see that which tools and algorithms have been mostly used and what conclusion have been reached about privacy protection and data security on social networks.

The sections of this paper are organized as follows: section 2 literature review which describes a little bit

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about each tools and algorithms. The methodology presented in sections 3, 4, 5 and 6, respectively tools and algorithms assortments, analyzing collecting information and articles assortment are discussed. In the following, discussion is described in section 7 and section 8 is dedicated to conclusion and future research.

2. LITERATURE SURVEY

2. 1. Concerns About Privacy and Self-disclosure
According to articles, exploratory factor analysis is used for analyzing inner scale structure and scale reliability has been measured by Cronbach's alpha [1]. In the articles with focus on privacy and self-disclosure, tools and algorithms like Likert scale, Partial least square, Snowball sampling, Variance and Average, Assortment, Correlation matrix, Factor analysis, Test track, Multivariable test, Sobel test, Regression, Bonferroni error control, Frequency distribution table, Logarithmic function, automatically encoded, coding pattern, SPSS software and AMOS software and NVIVO software, have been used. The results showed that women are most worried about their personal information and having high security knowledge will reduce the concerns about information leakage [4 , 5]. Also, the more people use social network, the more technological tools they have for managing their privacy settings. Researches shown that 65% of users have activated their privacy setting and have managed it [7]. New technologies in social media makes it difficult to protect privacy and also may create digital traffic [8]. Findings showed that all youth have been shared at least a picture of themselves and have been disclosed their real name. According to studies youth with high sense of narcissism would disclosed more normative information in social networks. Totally adolescents with high narcissism and low power significantly understand less danger [9]. Youth disclose more information than adults and use less privacy settings. According to statics, youth put more time for social networks than teenagers, also women wants to control their information more than men [10]. Table 1 summarized 25 articles with the focus on concerns about privacy protection and self-disclosure.

2. 2. Anonymity on Social Networks
The existence of third-party privacy certification could be very useful in e-commerce area, so users can trust with more peace of mind [16,17]. Partial least square, Cronbach's Alpha and Factor analysis have been used in articles with focus on anonymity on social networks which it is summarized in Table 2.

2. 3. Concerns About Information Leakage
Three statistic methods of average, variance and standard deviation effectively used to analyze collecting data.

TABLE 1. Privacy protection and self-disclosure concerns

No.	Ref.	Concentration	Findings
1	[11]	Concerns of privacy protection through self-disclosure among adolescent	1. There is no connection between concerns of privacy and location based information systems 2. The more students use smart phones the more they will know about online privacy
2	[13]	Concerns of teenager's information disclosure	1. Negative experiences have high effect on precautionary behavior 2. Educating teenagers to understand the concept of privacy would reduce negative experiences on social networks
3	[14]	Concerns of information disclosure among teenagers	1. Two motivation of searching for information and communication has effect on information disclosure and privacy protection concerns 2. It's useful that children learn the concept of privacy protection behavior
4	[15]	Concerns of information disclosure and privacy protection among youths	1. Having law of privacy would have positive effect 2. It would be helpful that parents be friend with their children about privacy protection on OSN

According to studies people have less reliability to shop online and chat online because of their privacy and old people have less information about how to protect their privacy on online social networks and sites [18]. Some articles about this context have been pointed in Table 2.

2. 4. User's Profile Privacy
Results are shown that users want to consider their opinion about how to protect their privacy on social networks. The ones who are more active in social networks feel more in relation and try more for protecting their privacy [12 , 19]. According to studies they have applied Aprioroi algorithm, frequently distribution and analyzing diagrams for articles with focus on user's profile privacy are summarized in Table 2.

3. RESEARCH METHODOLOGY

The main scope of research is about tools and algorithms which are used to analyze information about protecting confidentiality and data security on social networks. For this regard articles were chosen from international and professional journals which are listed in Table 3.

TABLE 2. Confidentiality and security in e-health scope, self-protection on OSN, anonymity on social networks, information leakage concerns and user's profile privacy

No.	Ref.	Concentration	Findings
1	[20]	Personal health records user's privacy protection	1. PHR is the only interface between data protection and privacy dangers for users because of inability of PHR application developers and builders to rely on privacy agreements.
2	[21]	Privacy and self-protection	1. Reduction of efficient and reasonable strategy's information cycling for maintaining the integrity of personal information
5	[22]	Privacy and self-protection	1. The big concern of confidentiality with advent of the internet and electronic messages
11	[23]	Information distribution, information leakage	1. Determination of protocol based on encryption by showing the security and execute it with XML.

TABLE 3. Journal's list in current research

Journals	Journals
IJARCSSE	Computer Science
ECRA	Computer Networks
ICCSE	Computer in Human Behavior
Computer and Electronic Engineering	Computers in Human Behavior
Distributed and Parallel Databases	Computers, Environment and Urban Systems
Information Sciences	Computers and Security
SPPS	Adolescent Research
ICDE	Computer Law and Security Review
Decision Support Systems	Ethics and Information Technology
Journal of Strategic Information Systems	Telecommunications Policy
Telematics and Informatic	Journal of ADOLESCENT Health
IJSPTM	Social Network
Information and Management	Learning Media and Technology

According to requirements articles were catagorized based on different scopes:

- Articles about protecting privacy and self-disclosure or information disclosure were analysed.

- Articles that focus on anonymity, security and confidentiality of information on online social networks were selected.
- Articles of privacy management for preventing information leakage were studied.

As can be seen in Figure 1, 36% of articles were focused ing on "concerns about privacy". The subject that have lowest percentage coverage in the articles is "security and confidentiality in mobile commerce" which is in last place with 2%. According to analysis which was conducted, it seems that providing a flowchart based on how we have chosen articles could be useful. As it's obvious from Figure 2, articles were chosen that are related to issue and had analyzed the subject.
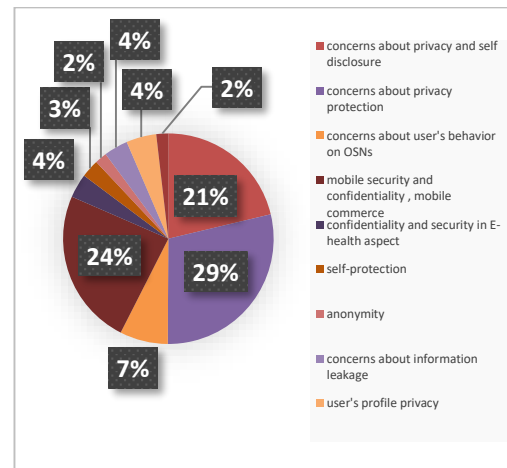

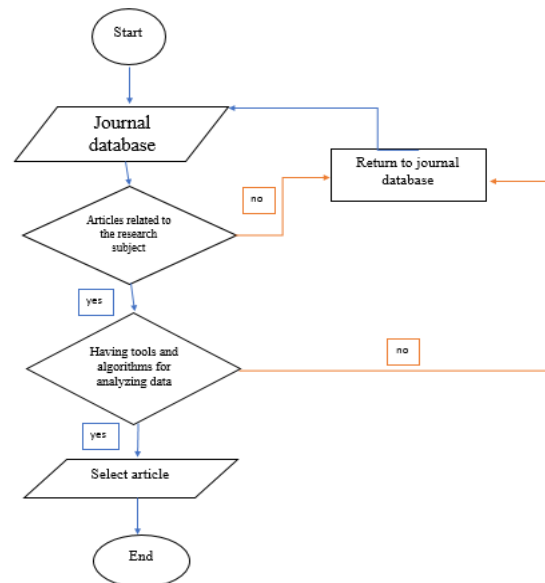**Figure 1.** Percentage of covered topics

Figure 2. Research flowchart

4. FINDINGS

In spite of user's understanding that their information confidentiality in social networks may be attacked and be in danger, again they used it for playing games and making connection with global society on social networks [24]. According to requirement, different methods were used, methods of collecting information were included questionnaire, survey, interview, sampling, site, anonymous-K, GPS. Based on conducted studies, women were more worried about their privacy than men [25]. As can be seen in Figure 3 survey is the most helpful method of collecting information in analyzed articles, after questionnaire the most useful method was interview which had the third place.

As internet knowledge increase, because privacy protecting applications update their technologies, people have less concerns about their privacy on social networks [5]. Methods which used in 2016 are questionnaire and interview. In this section article's properties, such as publication year, journal publisher name, authors nationality and so on, have been studied. Elsevier, Springer and IEEE have been known as publishers which have been published many journals about this subject.

Elsevier publishing has been published 18 journals mostly connected with subjects like privacy protection among women and men, information disclosure, managing privacy, staying anonymous on social networks, protecting the security of personal E-health records, self-protection, security of user's profile on online social networks. Elsevier has first place among publishers in this review, the second place goes to Springer and in third place IEEE.

5. DISCUSSION

For managing privacy, people need to develop the privacy rules around them and in groups [1]. Most of online social networks or social network sites are encouraging people to share their real personal information in their profiles to increase respect and reliability on social networks, but people had concerns whether the information they share is permeable or not [2]. Many previous studies have failed in making direct connection to user's privacy concerns on social networks. To this regard, the "privacy paradox" concept have been invented [26]. Social networks sites have tendency to share information as much as possible, to solve this paradox with privacy protection, users have two choices: 1) disclosing information and introducing themselves to people is not a big deal for them and it is not important. 2) if they have concerns about their privacy and they want to introduce themselves on online social networks; they should use privacy management strategies [27, 28].
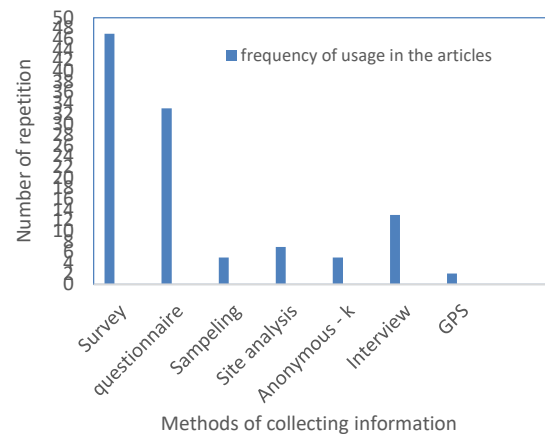

Figure 3. Method of collecting data from literature

With developing mobile technologies and popularity of smart phones, day after day people become more curious about protecting their privacy, so presenting tools with higher quality for protecting privacy and providing security is really important [29]. Despite the fact that health social networks data bases have classic solutions for protecting patient security, in wider scope these kinds of solutions are not enough for ensuring patient privacy [30]. Sometimes having more experiences about internet and social networks, reduce threats to user's privacy [31,32].

Analyzing youth's information disclosure have been shown that youths do not disclose every information about themselves equally, but because of finding friends and making relationship they disclose unimportant information [33]. Online social networks have become a common platform for discovering daily information like news, events and people's ideas [34]. Incentive talks of parents with children reduce negative online experiences and children will have more tendency to share their problems on social networks with their parents [35,36]. Companies should have a straight and clear commitment about various type of e-commerce ethics such as privacy issues and data security in e-commerce which should be analyzed in each part of the organization [37,38].

6. CONCLUSION AND FUTURE RESEARCH

We have tried to analyze tools and algorithms which are used for analyzing protecting privacy on social networks. Findings are shown that data which were analyzed with Cronbach alpha, their informations were collected using survey and questionnaire methods. Regression analysis used for data for the obtained informations were collected by survey, questionnaire and interview. Survey method with 47 repetitions in articles was the most useful collecting information

method. Most articles scopes which were analyzed in 2014 they were seriously concern for their privacy of information leakage, protecting confidentiality and data security. Journal of computers in human behavior had the most articles in this content. Elsevier have published most journals in this scope as well. One of the research limitation was the number of articles, 100 articles were analyzed since 2008 til today (2018). To this regard more researches required in this content.

Findings showed that nowadays privacy concerns on social networks are epidemic. Also, women are more worried about their privacy than men. Educating people to have knowledge about probable risk of information leakage and personal information disclosure could be recommended as an effective solution.

More studies about information leakage, information disclosure, privacy protection on smart phones and among youths in future researches are recommended. Also, there is another recommendation about Iran, additional studies are required and more researches should be conducted on online privacy, information disclosure prevention and providing data security on social networks according to its culture and society's beliefs.

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چکیده

شبکه‌های اجتماعی برخط به بزرگترین زیربنا برای تعاملات اجتماعی مانند: برقراری ارتباط، به اشتراک‌گذاری تجربه‌های شخصی و تحویل خدمات تبدیل شده است. امروزه شبکه‌های اجتماعی به طور گسترده‌ای مورد استقبال مردم قرار گرفته‌اند. بیشتر تحقیقات درباره‌ی مدیریت حفاظت حریم خصوصی در شبکه‌های اجتماعی کاربران را به عنوان صاحبان اطلاعات در نظر می‌گیرند. با این حال، افراد نمی‌توانند حریم خصوصیشان را کنترل کنند و این کنترل توسط گروهی تعیین می‌شود. استفاده از شبکه‌های اجتماعی برخط نگرانی‌هایی در مورد حریم خصوصی مرتبط با داده‌های شخصی برخط به وجود آورده است. با توجه به مطالعات انجام شده، تابه امروز تلاش‌های زیادی برای حفاظت از محرمانگی و امنیت داده‌ها در شبکه‌های اجتماعی انجام گرفته است. امّا به‌نظر می‌رسد که درک مفهوم حفاظت حریم خصوصی برای مردم بسیار ضروری است. هدف این مقاله تجزیه و تحلیل ابزارها و الگوریتم‌هایی است که به نگرانی‌های حفاظت حریم خصوصی و موقعیت امنیتی داده‌ها در شبکه‌های اجتماعی میان بزرگسالان، نوجوانان و کودکان پرداخته‌اند. این ابزارهای آماری و الگوریتم‌ها داده‌های جمع‌آوری شده را بررسی کردند. نتایج مرور بر ادبیات نشان داد که بیشترین پراکندگی در این زمینه مربوط به سال 2014 است. علاوه براین، روش نظرسنجی بیشترین روش مورد استفاده برای جمع‌آوری اطلاعات در این تحقیقات بوده است.

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