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Scientific mapping of “Social Information” field in Web of Science database: a bibliometric study

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Abstract

Introduction: Access to social information focuses on those technologies that put the users in interaction with the information, to provide the users more accessibility to the information.

Objective: The analysis of intellectual structure of the published studies of social information field in the Web of Science (WoS) database according to bibliometric analysis and centrality indicators in WoS database in the period 1983 to 2018, is done through examining the effectiveness and impressionability of this field to recognize its studied fields and effective factors.

Methodology: method of the research was descriptive that used bibliometric approaches based on the scientific data in WoS database; The common techniques such as co-word and co-author were used. The social information extracted data were analyzed by social network analysis centrality indicators of VOSviewer, Excel, and UCINET software.

Results: The results shown that the most of these articles within social information field were published in USA, Germany, England, France, and China, and also some research outputs have been done in that fields in Korea and Iran. According to the scientific outputs of researchers in the WoS database, on the period 1983 to 2018, USA took

the first place with 1496 articles. Authors such as Sheldon, *Lalande*, *Webster*, *Karius*, *Nocera*, *Forceman*, and *Laaksonen* have had the most cooperation in the production of social information field scientific outputs. Based on co-words analysis of web of science category (WC) and subject categories (SC), social information area in this study was divided into four clusters which their topics included *social recognition*, *social behavior confronted with outer environment*, *social networks*, *learning and social information processing in human and software*. Also, high degree into different centrality measure is related to Psychology, Telecommunication, behavioral sciences, evolutionary biology, and psychology, multidisciplinary in WC and SC.

Keywords: social information, information processing, social information visualization, co-word analysis, co-author analysis.

Introduction

Access to social information focuses on those technologies that put the users in interaction with the information, to provide information more accessible to the users. These technologies are focused on all backgrounds of information accessibilities, such as search, review, and suggestions (Brusilovsky and He, 2018).

Information created in different domains. Presence of information in virtual and web environment and the capabilities and facilities which are offered by technology has raised the expectations level of formats of information. Information had a key role in supporting scientific studies and enhancing efficiency. Basic functions of information come from the publication of research outputs and having full access to those services. Yet, the function of the capabilities of information can be offered by suggesting communicative opportunities to the people. This affected the function of information and people's satisfaction, and, on the other hand, caused more addressing their technical criteria and aspects in order to improve other aspects of information such as the social web.

Social web (or web 2.0) has changed the role of web users from simple information through operating systems such as Wiki, Weblogs, Tweeter, or Facebook...The purpose of using technologies in social information is to access modern social information and applications (Brusilovsky, 2008). Internet develops individuals' ability greatly to interact with networks. Privacy is a significant aspect to access the social information. Secrecy is very important for users and systems in these networks.

In social information of a social network, the need for information is also proposed. The meaning of social network is to show and study of relation between this group and the flow of knowledge and information between them (De Nooy, Mrvar, & Batagelj, 2018). The appearance of social networks took place with the aim of forming and speeding up the communications and to transfer the knowledge. Communication is an important and much - discussed thing in social networks. Aristotle was the first one who talked about communication; searching for achieving all available appliances and facilities to encourage and satisfy other people has a special place in the social network of communications (Borgatti, Everett, & Johnson, 2018).

Changing technologies, information explosion and shifting knowledge-based libraries from printed papers to e-books, have affected behavior of users. These information areas need special attention to collection developments, systems and services. The main element of development and progress in these information centers is information. In fact, information has a significant priority in today society. Information production needs human efforts, spending money, energy and time. It is obvious that information and decision making require spending money, time and other relevant factors. The fact that spent time to create different lists, thought, organization, and other related activities leads to produced information are available just in lieu of spending money (Kaur & Sharma, 2018).

the bibliometric technique had been used for mapping the structure of science to show scientific fields better. Mapping can be applied to indicate the intellectual structure of different fields using methods such as citation analysis, scientific cooperation (collaboration), co-citation analysis and co-word analysis. Using the author co-citation analysis, many approaches, can be discussed such as investigation of the intellectual structure of the fields, identification of influential people in the field, the relationship between researchers, paradigms occurred in the fields, appearance procedure, growth and decline of scientific fields, identification of main specialties of a field and etc.. For this reason, doing such research using co-word method, not only determines the main purpose, that is examining the condition and state of intellectual structure of social information field, but also, due to multiplicity of outputs obtained from this kind of studies, the results can be applied in different contexts related to scientific information in this course and in other courses. On the other hand, social information in psychology, informative behavior, and science are other topics.

This study examines the process of knowledge distribution in the field of social information among different scientific fields through analyzing studies over time. Examining the process of knowledge distribution in the way of co-word and co-author techniques are effective methods for visualizing science structure which is used to present an image of the intellectual framework of a research field that comes along with an increasing science production. In this study, social information field, among many other interdisciplinary fields, is considered as an interdisciplinary intellectual identity that provides a bridge for the extended areas of different fields. This field has owned many articles and researches in the context of psychology, sociology and etc.

Objective:

The aim of present study was analysis of intellectual structure of the scientific outputs of social information field in WoS database. This purpose done through examining the effectiveness and impressionability of this field according to bibliometric approaches and centrality measures of scientific concepts of social information, to recognize focus of studies in this field.

Ongoing this aim, it is necessary to be investigate by co-word network analysis, the extracted clusters belong to which topics in social information; Also, top authors based on researcher's centrality indicators; and scientific map of partner countries cooperation in scientific outputs of Social Information field; and Finally, drawing of applied subject category (SC) table and concepts of authors' keywords (WC) in Social Information field.

Literature review:

Considering subjective extent of social information field, there are multiple histories in this context. While studying social information, Lin and Playheart (2015) achieved the results which showed that social information obtained from social media, is a relatively uncommon network which affects individuals' recognition and behavior in the organization. This research has provided the most important role in developing a theoretical understanding of social media characteristics in the organizations.

In a study, Wang and Chiang (2018) achieved some results in depiction of scientific map. These researchers refer to three cases of their main finding. First, developing a scientific map with the Open Directory Project (ODP) classified information can help to absorb an enriched set of communities. Second, while drawing the scientific map, the social information should be considered, and third, this study shows the scientific maps which reflect a clear and simple path in knowledge.

Valira (2017) investigated the effectiveness of social information on user's interactive searching and their behavior, and found these results: a) the effectiveness of searching using information visualizing and social ranking has improved compared with content ranking. Improvement of searching effectiveness can lead to using the social information and personal priority, which is confirmed by a study of follow-up simulation. Social information can be presented in the interactive searching process using the suggested graphics from different information sources. They also showed that a combination of social ranking information and personal information increases the effectiveness of searching and decreases the necessity to consulting with external information.

Lio, Lin and colleagues (2016) investigated the effect of social information on question and answer (Q and A) system. Using the data set collected from Stack Overflow website, the experiments were done. The results showed that different social information makes different contributions to upgrading the Q and A system and correct use of social information may improve diversity and function, and consequently leads to satisfying improvement of problem solving of the system. An algorithm for this system is also presented in this study.

In another study Everest, Bernoeither and Jyoti (2016) investigated the effect of social info on absorption and innovation system. The aim of this study is reviewing the effect of social information systems on absorption capacity (AC) and innovation in small and medium enterprises in Austria. The results show that the **SIS** ability can centralize positive effects on governance components of AC, which are focused on each other and have positive effect of SIS capabilities on innovation. Our findings offer some helpful messages for research and industry (B.V Elsevier, 2016).

Methodology:

The methodology of the present research was descriptive that used bibliometric approaches based on the scientific data in WoS database. The **population** of current research is all articles published in the field of social information in WoS database. The WoS database was applied to identify the core of documents that compound the research topic since it was suggested to index the most relevant documents of the different research areas. Furthermore, in this database is important as a primary criterion in academic decisions. The term referred to Social Information. then the following search strategy was employed:

TOPIC = “social information”, in the period 1983-2018.

The criteria were considered original articles and excluded all of conferences and review articles in this study. The common techniques were used such as co-word and co-author networks. These data were extracted and excluded duplicate data for analysis using by VOSviewer, software. The VOSviewer software was used to obtain information about the collaboration among countries and produce a map representing the countries co-authorship. Data gathering is important for bibliometrics. All of these data were retrieved into text before analysis and in this study assessed indicators of Centrality, Co- word networks and Authors networks. Also in this stage performed using UCINET. The UCINET a comprehensive package for the analysis of social network data as well as other 1-mode and 2-mode data.

The Centrality measure has many indicators. in this study Centrality measure include in Degree Centrality (Degree centrality shows people with many social connections), Eigenvector Centrality (Betweenness centrality describes people who connect social circles), Betweenness Centrality and Closeness Centrality (Eigenvector centrality is high among influential people in the network).

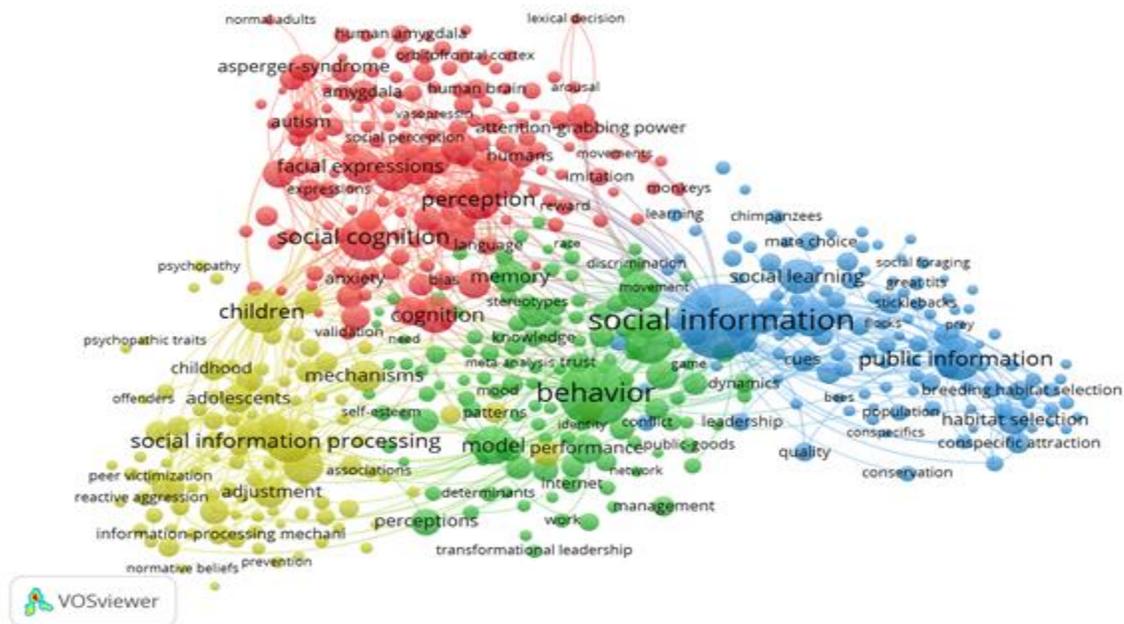
Findings:

In this study 3346 queries were retrieved based on the Social Information. using co-word and co-author network analysis the structure of knowledge related to social information was analyzed.

Clusters of a scientific map based on co-word in social information

Based on the co-word network analysis, the extracted clusters of social information depended on 4 topics (red, blue, green, yellow color). Analyzing scientific map of Social Information shown this field include 4 subject categories of clusters in which the focused on social information, behavior, social information processing, and social recognition (fig. 1).

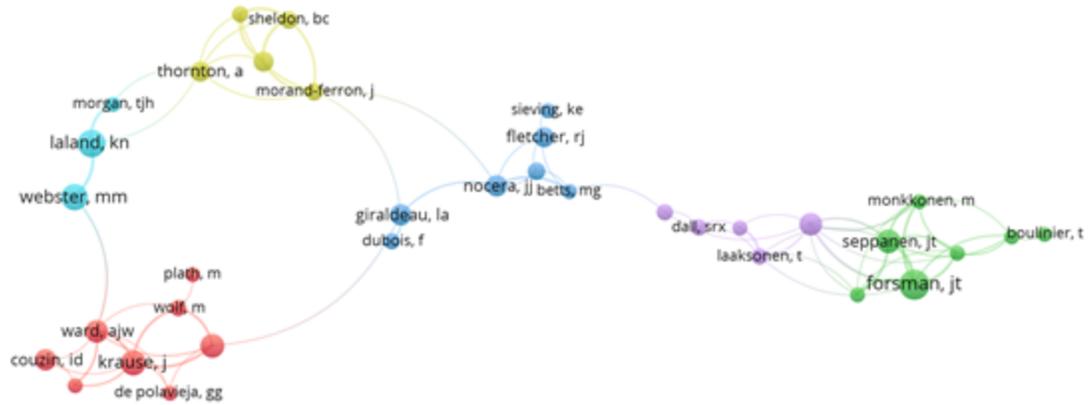
Fig. 1: Scientific map of social information based on WoS database during 1983-2018.



Clusters of co authorship network in social information field

There are 6 clusters of co-authors based on the researchers' centrality indicators in the social information field in WoS database. Formed clusters, based on authors co-author analysis, showed the most basic and common authors who have played in social information field. As can be seen, they are Sheldon, Lalande, Webster, Karius, Nocera, Forceman, and Laaksonen are famous and influential authors of this field (fig.2).

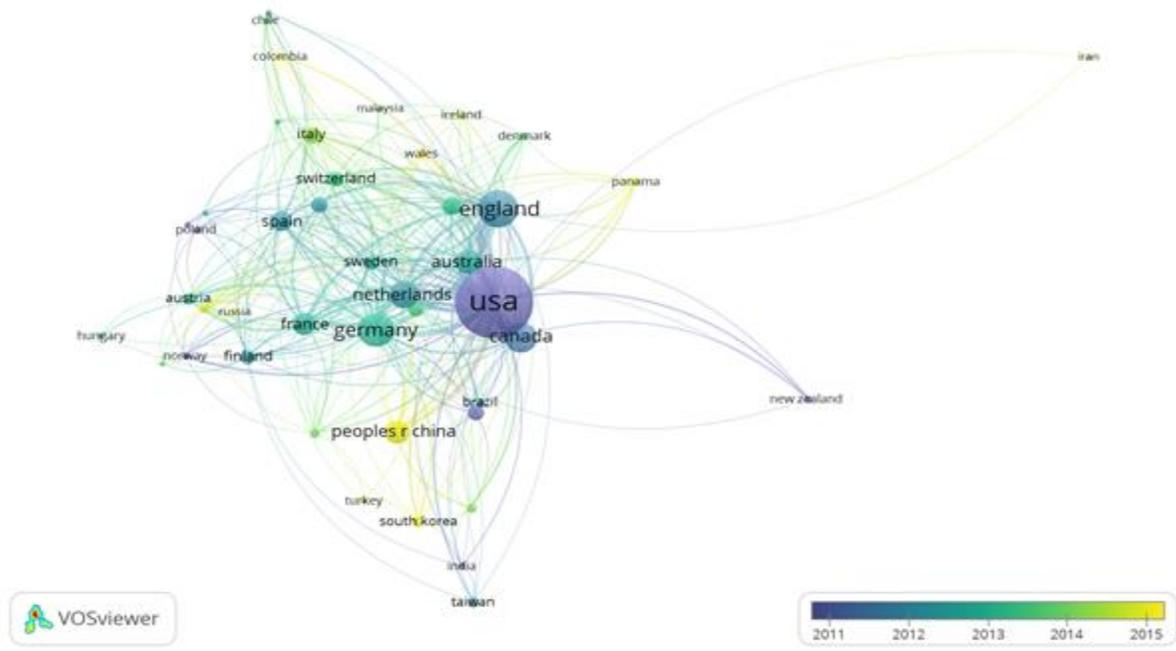
Fig. 2: the map of co-authorship network in the social information field in WoS database from 1983 to 2018.



Scientific map of countries in the social information field

Findings shown the period 2011-2015, USA, Germany, England, France, and China played into the studies of social information. The period of social information field efflorescence began since 2011, and most of these studies have been done in USA (fig. 3).

Fig. 3: Scientific map of countries in social information field in WoS database the period 1983-2018.



Centrality measures of web of science category (WC)

the centrality measures of extracted clusters of web of science category (WC) in social information field was calculated based on the co-word network analysis. social network analyzing of social information field word' shown in table 1. WC with high measures of Degree, Closeness, Eigenvector, Betweenness were shown in table. Investigation show that most of the word concepts, considering existing centrality in applied clusters, are related to informative behavior, zoology, neuroscience, ecology, and psychology.

Table 1: centrality measures of authors' keywords in social information field in WoS database 1983-2018

No.	WC	Degree	Closeness	Eigenvector	Betweenness
1.	behavioral sciences	<u>731</u>	536	1	1100.067
2.	Zoology	<u>511</u>	570	0.796	386.036
3.	Neurosciences	<u>502</u>	549	0.368	1177.115
4.	Ecology	<u>501</u>	575	0.505	1358.688
5.	Psychology	<u>398</u>	561	0.171	612.075
6.	psychology, experimental	346	565	0.21	487.034
7.	Biology	333	614	0.297	559.118
8.	Psychiatry	291	576	0.042	373.762

9.	psychology, biological	248	599	0.196	18.257
10.	psychology, developmental	232	579	0.061	109.168
11.	evolutionary biology	194	652	0.115	25.084
12.	Management	178	572	0.003	585.559
13.	computer science, information systems	166	621	0	304.141
14.	psychology, multidisciplinary	159	531	0.1	1332.722
15.	psychology, clinical	156	588	0.014	272.283
16.	psychology, applied	154	580	0.004	311.638
17.	clinical neurology	131	617	0.017	196.547
18.	Rehabilitation	116	595	0.004	373.75
19.	family studies	115	606	0.002	72.099
20.	psychology, social	107	569	0.006	371.255

Centrality measures of subject categories (SC)

the centrality measures of extracted clusters of subject categories (SC) in social information field was calculated based on the co-word network analysis. social network analyzing of social information field word' shown in table 2. SC with high measures of Degree, Closeness, Eigenvector, Betweenness were shown in table. Investigation shows that most of word concepts, considering existing centrality in applied clusters, are related to psychology, behavior science, natural environment, zoology, and neuroscience.

Table 2: centrality measures of subject category (SC) of social information field in WoS database 1983-2018

No.	SC	Degree	Closeness	Eigenvector	Between
1	Psychology	<u>814</u>	232	1	1505.34
2	behavioral sciences	<u>696</u>	266	0.158	317.246
3	environmental sciences & ecology	<u>516</u>	256	0.024	1110.25
4	Zoology	<u>495</u>	285	0.077	136.326
5	neurosciences & neurology	<u>478</u>	265	0.164	787.896
6	life sciences & biomedicine - other topics	332	315	0.012	99.16
7	Psychiatry	261	280	0.069	205.456
8	evolutionary biology	194	333	0.002	12.744
9	computer science	160	282	0.003	274.298
10	business & economics	143	273	0.061	264.536
11	family studies	115	309	0.041	18.908
12	Rehabilitation	113	297	0.01	73.863
13	education & educational research	100	291	0.009	85.766

14	information science & library science	93	316	0.001	54.464
15	genetics & heredity	85	285	0.004	139.073
16	Engineering	78	271	0.003	542.029
17	criminology & penology	67	313	0.025	3.814
18	social sciences - other topics	63	263	0.005	478.541
19	biomedical social sciences	50	299	0.015	79.226
20	Telecommunications	49	344	0	7.327

Discussion:

Based on findings obtained from the analysis of 3346 articles in the citation WoS site, co-word and co-authorship occurrences were analyzed. The results indicated that the most of these articles within the field of social information were published in USA, Germany, England, France, and China, in the period 2011-2018. Based on the scientific outputs of analyzing data in WoS database during 1983 to 2018, USA with 1496 articles has been the most prolific country. In the recent years, countries such as Korea, China and Iran have done some published articles in the field of social information. Authors such as Sheldon, Lalande, Webster, Karius, Nocera, Forceman, and Laaksonen have had the most cooperation in the field of social information.

The maps obtained from visualizing social information knowledge shows 4 clusters. These clusters are identified under the topics of social cognition, social behavior confronting with outer environment and social networks, learning and social information processing in human and software.

Cluster 1 which is in red, indicates the role of social cognition. The topic of social cognition is related to psychology that it is high degree centrality measure of authors. It causes an effective concept in this filed and shows widespread network and it can be said social information is related to individual characteristics, this relation appears in order to get information from childhood. In this period of life, it is necessary to overcome the factors which cause anxiety while getting the information and also the effectiveness factors of these cognitive skills which lead to anxiety reduction and less trauma (Luebbe, Bell, Allwood, Swenson, and Early, 2010). In the different investigation of social information processing, overcoming anxiety and depression in childhood and adolescence lead to optimum relationship to other people in adulthood that factors are related behavioral sciences and have high degree centrality measure in subject category and subject of area (table1,2). In this cluster the subject of disorders which leads to lack of social relation and social development in people, also can be seen which among them the most important cognitive disorders are anxiety, Asperger syndrome, cognitive and personal disorders, autism, sensory-motor disorders, and physical abnormalities; these people suffer from lack of social skills and teaching skills (Mazza et al, 2017). Moreover, one of the most important factors in social information processing in the human brain is Dopamine secretion which is effective in the functioning and social relation (Lee, Lionnet, Kato, & Goto, 2018) .it was explained related neuroscience to which high betweenness centrality measure in the subject category (table2). This cluster also refers to the models of information processing. These models, in addition to specifying social interactions, can specify the reasons and relational problems and people behavior in different ages. Another

important model of social behaviors in the library is the nematode *c. elegans*, which is used to identify social communications (Srinivasan et al, 2012). Mental understanding, intelligence and the interaction of relations between words and brain are also referred to in information processing, which indicates automatic processing of information (Wentura, Rothermund, & Bak, 2000). this part related to Telecommunications that has high closeness centrality measure in WC. Many normative models are considered in social behavior which can be measured in different settings. For example, when someone enters a library they observe silence which is due to the processing of environmental information. In these interactions a close and strong relationship is established between environment and the norm. An environment is an automatic mental revision of behavioral norm and behavior itself, which is formed in people after the information processing (Aarts and Dijksterhuis, 2003).it is related to environmental sciences & ecology have third- degree centrality measure in subject category (table 2) and refer to biology in word category. One of the issues has models of Social information. There are other informative models such as BSDS which receive information from social information services and then they change them into the required information, which is obtained from social information services in these models, based on analysis of emotions and motives. Obtained the information, in fact, comes from the interactions between real data (Ali, Hamilton, Thevathayan, and Zhang, 2018a) and it is considered to psychology and experimental. social media is another item which is considered in social information, these media have appeared as a free source of general data, and considering the variety of social information operating system, their analysis tools are considered as a similar identity in all social media, and these systems are classified and analyzed according to applied and functional characteristics (Ali, Hamilton, Thevathayan, and Zhang, 2018a) and it is refer to environmental sciences and ecology in degree centrality measure (table1,2). In this cluster, the concept of language also had been considered. Having a common language leads to information literacy and close relation with other people. One of the most important topics in communications is a common understanding of language in informative places (libraries). The difference between people's language, especially librarians and all the people in general challenges the understanding of information in two different levels, and it leads to negative effects and evaluations. This situation can be the reason for people's disgust and escape from these places and also can affect their motivation for learning and feeling need for knowledge. Enrichment of information searching skills in schools is effective in students' information overload. This is possible through education, and librarians take on this role as the supporters a multiplier of people's information literacy (Lin, 2010).

Cluster 2, in green, indicates the role of behavior in social media and it is shown in closeness centrality measure in order to heart of a social network. the social media and behavior concepts are interdependent so that information sharing in the social media is performed in different ways which one of these services is simple notification service (SNS) network. Information verification has especial importance in SNS. Identification of dominant characteristics which affect people behavior in information sharing is very effective in marketing behavior understanding and development of effective marketing strategies in the social network of SNS. Choosing the subject is the most influential factor which shows that suggested motivations in SNS social network have an important role in decision making on information distribution (Shi, Lai, Hu, and Chen, 2018). It is clear that this concept become subject category or word category (table1 2). Since marketing service presentation is based on trading (buying and selling),

information behavior in these services is just based on **people's informational benefits**. Technologies which are used in information services make two kinds of accessibility possible which are access to information and to social information service. These technologies are used for security of access to information. In an information technology context, secrecy is also considered in which a lot of demographic information is obtained via user Facebook or Google plus. Access to information system is highly depended to information offered by users and so it should provide a wide range of privacy for users to share personal information. Although information systems usually are for public use, this kind of information is applied in different cases and the outputs of this process may result in unwanted consequences for users' privacy. In these systems, those soft wares and robots which have security adaptive systems should be used (Knijnenburg, 2018)

In understanding social behavior, perception of social signs and textual signs are considered; social signs are more effective in people's social comprehension, and databases (information sites) are aimed to social networks. In these databases (sites) the main importance is for direct contact with addressees, in which people's informational needs are measured. Moreover, choosing the information to estimate marketing is very important and it is called as social intelligence and this way it is used for choosing the information in these sites (Marques and Vidigal, 2018). Here, information sharing in a participatory approach through the web is considered which can be seen in many academic settings. There are 19 identified factors affecting successful cooperation between people and web. They are divided into six divisions: environment, membership, process/ structure, communications, goal, and resources. Mutual respect, mutual understanding and trust (confidence) belong to membership division which are among the most important factors in bilateral cooperation (Yue and He, 2018) and it refer to computer science of word category.

Cluster 3, shown in blue, indicates the role of social information which has the most relation with social learning and public and it seems related to psychology and multidisciplinary. Also, this subject is shown in the social network as a high betweenness centrality measure in word category. Our society is increasingly changing its information resources via networks and technologies. For example, there have been e-mails in the past and today there are wide spread social media which caused information wave. There are three different kinds of networks: human-centered networks, document-centered networks, and mixed networks which is the combination of the two other networks. The information obtained from these networks is for computing the role of similarity (at individual level), identification of network clusters (at people relations level) and computing the whole network (at social level). The resulted information from these networks mostly is for helping their problems in searching of documents or even of people (Han and He, 2018). Social information is not specifically for human beings but it also appears in animals and nature in wide range. A lot of animals' behavior are understood through evolutionary models such as converting signals to concept. Social learning is another subject in social information which is obtained from environment (Dahl, Wyss, Zuberbühler, & Bachmann, 2018). Relation between human and the environment is formed in childhood and this relation has a significant role of perception and understanding of information in adulthood.

Cluster 4, in yellow, is based on social information processing. In academic libraries, social media are the places for improvement of services and students and researchers' purposes. Most of these communications were developed through the Facebook, Instagram, Snap chat, Tweeter, and YouTube. MySpace was also used as a mobile digital

library. In social tools which are available in library platform, most of people's visits are in relation with business news, library news, and widespread news of university. Most of using of social media by libraries are for marketing purposes (Howard, Huber, Moore, & Carter, 2018). In addition, people use social media while searching health information. The results of studies showed that social media and specific applications for information support, emotional support, health needs satisfaction and people's beliefs through these media, and also people's health notification, were useful. Social information processing models play into behaviors and norms. Successful development of social interactions involves building relationships and people recognition, which are measured through different models. this section related to computer science and information systems in subject category and word category that are overlapping in two tables.

Libraries with the aim of building social communications, a setting offering services and accessibility to content via applications such as ANObii, SociNet, digital libraries and so on, and also social media like Facebook, Instagram, Snap chat, Tweeter, and YouTube... can provide accessibility to information content in a proper context. Access to electronic resources should be performed with respect to different communities of users and integration of resources and this cluster related to librarian and information science that has a high closeness centrality measur.it display influential term in social information network.

Conclusion:

Social information is considered from two aspects: 1) access to information and its resources, 2) users and their characteristics. In accessing to information part, the models and soft wares from which we get information, can be mentioned and most of the analyses of social information are based on derived data from soft wares and resources. This part has centrality measure in social network that issues related to behavior, zoology, neuroscience, ecology, and psychology to be high degree centrality measure in concept of authors. Another part relevant users and cognitive and personal characteristics and also their communicative skills should be considered in the psychological, cognitive context and in different interactions with soft wares and information acquisition. this section is related to psychology, behavioral sciences, and environmental sciences. These terms are high degree centrality measure in subject category of authors that show effective of this subject and psychology is high Eigenvector as influential node in social network Also Telecommunications is high closeness centrality measure as heart of connection in social network.

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