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A Bibliometric Analysis of Deep Web Research during 1997-2019

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ABSTRACT

This study provides a bibliometric account of global deep web research published from 1997 to 2019. A total of 1995 records were imported from the Scopus database in a bibtex file. The bibliometrix package in RStudio was used for analyses. Publication Growth, Citations, Authorship, Country and Affiliations has been analysed. It was found that deep web research had a slow growth rate. In the last four years it has seen a recovery in the growth rate. Furthermore, this study shows the distribution of highly cited papers in the field over 23 years. It shows the country and institutional affiliation pattern of prolific authors. It also presents the most preferred sources, search terms and preferred medium of research communication. It is found that deep web research had a slow growth rate, but since 2016 it is picking up. China is the leading contributor of publications followed by the United States of America, Japan, and the United Kingdom. India is the fifth largest contributor. Contribution of citable publications has been led by Canada and USA with 81.9 per cent of efficiency followed by Australia (79.7 %), France (73.4 %) and Spain (73.1 %). It is also found that most of the prolific authors (by number of publications) do not appear in highly cited publications' list. Deep web researchers mostly preferred using conference publications to communicate their findings. 'Machine Learning' and 'cryptomarkets' are two contemporarily popular terms being used by deep web researchers also, which indicates interest towards these topics.

Keywords: Deep web; Darknet; Hidden web; Bibliometric analysis; Bibliometrix; Literature growth; Citation.

1. INTRODUCTION

The Deep web, hidden web or invisible web is a subset of the world wide web which remains hidden due to many reasons and is not indexed by search engines.[1] The term 'Deep web' has been first used by Bergman.[2] He categorised the whole internet in two parts, first part of world wide web is 'Surface web', which very easily indexed by the search engines and visible to the public; the second part is 'Deep web', the websites which are not indexed by the search engines and not found very easily, but contains publicly accessible information. Recognizing the immeasurable value of the publicly accessible content of the deep web in this information age, BrightPlanet™ attempted to quantify the size and relevance of the deep web. Its results were very surprising. In comparison to world wide web publicly available information was 400 to 550 times more. The Deep web seemed to contain 7500 TB of information in comparison to surface web, which was 19 TB only. The Deep web contained nearly 550 billion documents till the year 2000 compared to only one billion at the surface web. More than 2 lakhs of websites existed in 2001 which must have increased in numbers in the last 18 years, keeping in mind the increased internet penetration worldwide. Sixty of the largest deep-web sites contained a total 750 terabytes of information, which exceeded the size of the surface web forty times. The deep web has become the largest growing category of new information on the internet since 2001. Deep web sites appear narrower, with content hyperlinked deeply, than traditional surface sites. Total quality content was found to be 1,000 to 2,000 times greater than that of the surface web. It was found to be highly relevant to every information need, market, and domain; and it is indeed true in today's information age. More than half of the deep web content resides in topic-specific databases, which makes them more utilizable for particular users. A full ninety-five per cent of the deep web is publicly accessible information not subject to fees or subscription.

Devine and Egger-sider[3] analysed the concept of invisible web and its implication in academic librarianship. In their article they offered guidance to different tools to access the inaccessible parts of the web to mine the invisible web and promote the library services. They argued in support of the use of invisible web for reference and promotion services of libraries beyond just Google™ Search.

Further the Dark web is also an important subset of the worldwide web which cannot be ignored, although it is a relatively small part of the internet or hidden web. It is responsible for huge negative impact on the society. The term 'Darknet' was coined in the 1970s, these were the networks which received the communicated information but did not respond to pings or inquiries sent to them, finally appearing nonexistent over the network. It was isolated from ARPANET (which later evolved into the Internet) for security purposes.

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The terms 'Dark web' and 'Dark net' are used interchangeably. Dark web is a very important area of investigation because it is the highly used medium for illegal activities like drug trade, human trafficking, child pornography, money laundering etc... Even Some evidence suggest that terrorism activities also have been performed over dark web. Over the years these activities led to extensive research in the area.

Indexing the unindexed hidden web is a tedious job. Even the search engine giants like Google have attempted over the years to develop a range of crawler algorithms to index the hidden networks; and all these resulted in publication of a lot of scholarly literature. Hereby in this paper we have attempted to quantify that literature's growth, identify prolific contributors and review most impactful research outcomes along with some other observations like prolific institutions, journals preferred form of publications etc..

2. LITERATURE REVIEW

There has been no quantitative study of the research performed on the topic of 'Deep web' till date. This paper is the first quantitative evaluation of the research performed on the topic. To accomplish this, we turn to the methods of bibliometrics. Bibliometrics is a quantitative analysis methodology to assess the amount of research work performed in a domain, the domain has to be defined by coverage year, scope, keywords etc. It measures the amount of research, by calculating different indicators using multiple publication related data, as suggested by bibliometricians over the years.

Gupta, Bala and Khitig[4] evaluated worldwide research performed on the topic of 'cataract'. The worldwide annual publication output was 27053 papers from 2002 to 2011. Annual publication of 2025 papers in 2002 increased to 3080 papers in 2011. Average annual growth rate was 4.89 per cent, it was used as a growth measure. Elango, Rajendran and Manickraj[5] performed an evaluation of 'Tribology' Research. They used Cumulative Annual Growth Rate as the growth measure of literature in the field of Tribology. To assess the growth of literature, it is a general consensus to calculate Annual Growth Rate (AGR) and Cumulative Annual Growth Rate (CAGR). Rai, Singh and Varma[6] have used (Relative Growth Rate) RGR and doubling time as growth measures of research documents, and asserted that it is a better measure than AGR. Sethi and Panda[7] performed a scientometric study to find visibility index of social science research. They found that most prolific authors belong to the most productive countries and affiliated with prolific institutions. Calculating the number of publications by individual authors and corresponding citations leads us to find the most prolific authors.

Moreover, analysing the document-wise and country-wise publication data leads to understanding which are the most preferred form of communication and the most productive country in this particular field of study. Author assigned keywords are a measure which gives us the author-perceived popular working areas and specific topics of impact in a domain.

3. OBJECTIVES

The main objective of the present study is to study the growth of global research on the deep web. Moreover, the study has been performed:

- To analyse the year wise distribution and Growth of the literature on deep web during 1997-2019;
- To know the highly cited documents and their distribution over the years;
- To identify prolific authors, affiliations and highly contributing countries;
- To identify author-preferred sources, keywords and communication medium.

4. METHODOLOGY

The present study is a bibliometric analysis of deep web research publications. Figure 1 shows the workflow of this study.

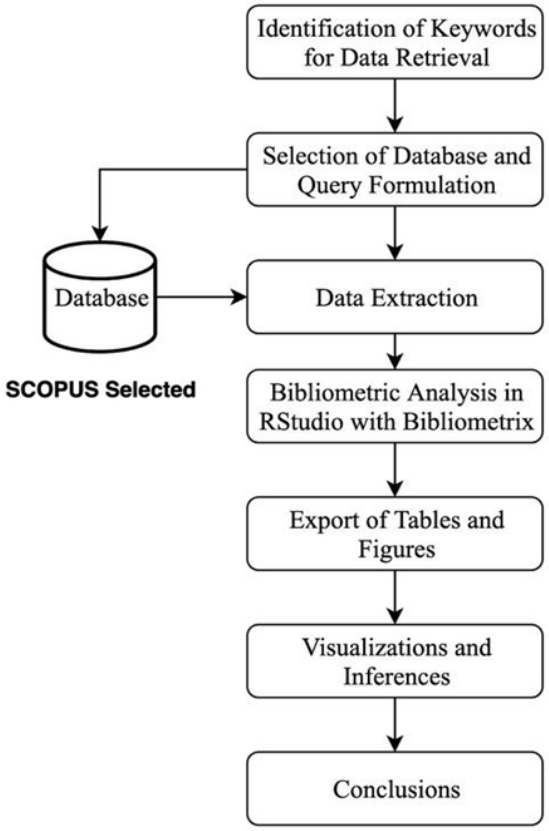

Figure 1. Workflow of present work.

A total of 1995 records have been extracted from the Scopus database[8] in the 'Bibtex' format covering the period (1997-2019). The search string used for data extraction is:

TITLE-ABS-KEY ("*Hidden web"* OR *"deepweb"* OR *"darkweb"* OR *"darknet"* OR *"darknet"* OR *"invisible web"* OR *"deep web"* OR *"dark web"*)

This search has been refined to limit the period from 1997 to 2019. The initial year is set as 1997 as the first scholarly document on the topic appears in this year. Data filtering has been performed manually to remove irrelevant record entries. Bibliometrix[9] Package in RStudio[10] has been used for analysing the data and Google-sheets[11] has been used for tabulation and visualisation of Results.

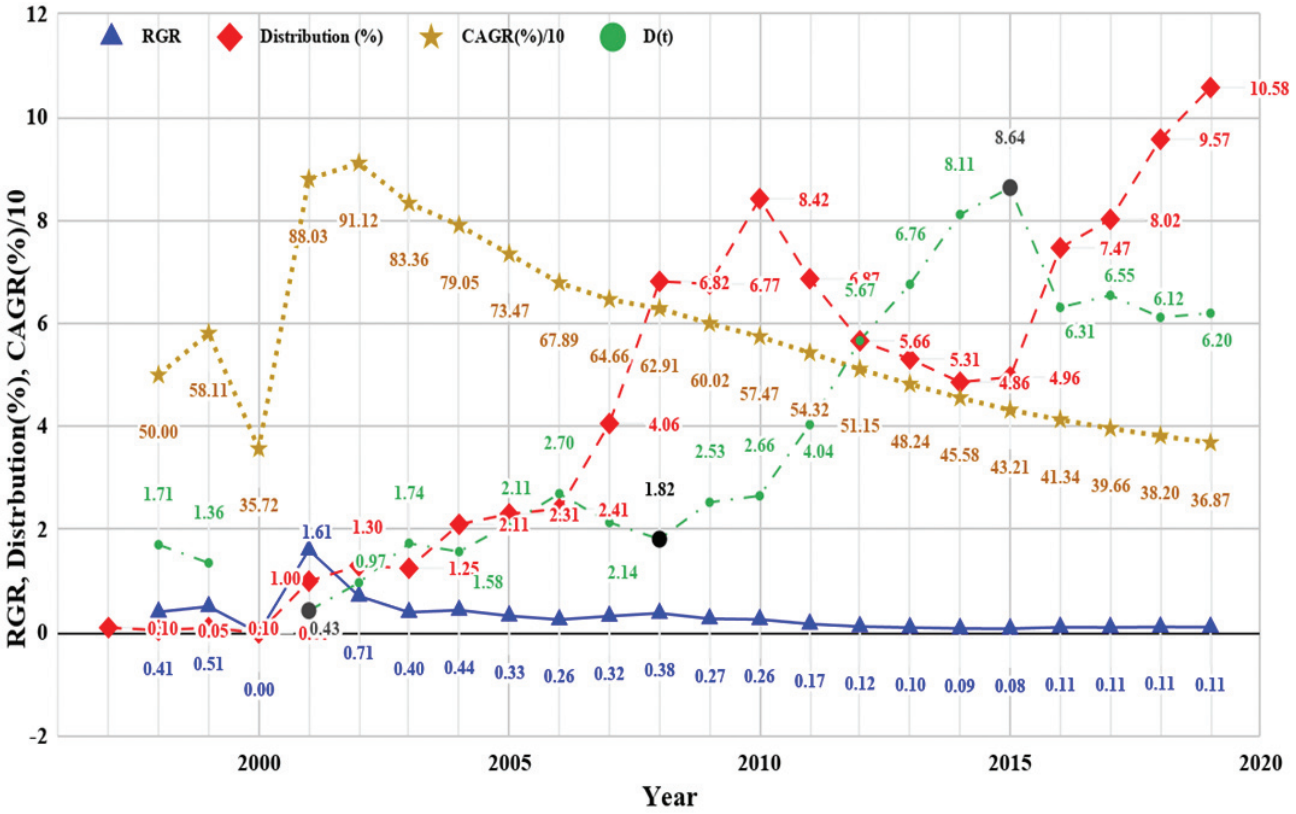

Figure 2. Year wise distribution, growth and doubling time of publications.

5. RESULTS AND DISCUSSION

5.1 Growth of Publications

5.1.1 Year Wise Distribution of Publication

Figure 2 shows the year wise distribution of publications indexed in the Scopus database within the specified period (1997-2019) and total 1995 research documents were published during the period of 23 years with an annual growth rate of 24.84 per cent.

5.1.2 Compound Annual Growth Rate

Scholars frequently use two measures to assess the growth rate of literature in any field. First one is Compound Annual Growth Rate (CAGR) and the second one is Relative Growth Rate (RGR). These two growth rates often measure the annual increase or decrease in the number of publications in a particular discipline. CAGR is determined as per the formula given below. The formula is given as:

$$CAGR = \left(\frac{N_t}{N_p}\right)^{\frac{1}{\Delta t}} - 1 \qquad (1)$$

Where,

N_t = Number of total publications in present year.

N_p = Number of total publications in initial year.

Δt = Difference between present year and the initial year.

Figure 2 shows a plot of CAGR which has been plotted as a yellow dotted line with labels of CAGR percentage values. CAGR has a decreasing trend since 2002.

5.1.3 Relative Growth Rate and Doubling Time

A relative measure of growth Relative Growth Rate (RGR) is the difference of natural logarithms of total number of publications at two points of time divided by the time interval. Bhaskaran[12] has used the equation of RGR and Doubling Time (DT) to understand the growth of literature. Which is:

$$RGR = \left(1 - 2^{r}\right) = \frac{in\left(w_2\right) - in\left(w_1\right)}{t_2 - t_1} \qquad (2)$$

Where,

w_1 = Total Number of publications at initial time.

w_2 = Total number of publications at final.

$t_2 - t_1$ = Difference between the initial year and the final year.

In Fig. 2, RGR is represented with a blue colored line plot. RGR also has a similar trend as the CAGR and its value has been decreasing since 2001.

Doubling Time of the published literature is a good measure to get an estimate of the time after which total literature gets double. It is equal to the natural logarithm of 2, divided by RGR.

$$\text{Doubling Time} = D(t) = \frac{0.693}{RGR} \qquad (3)$$

Figure 2 also represents the doubling time of documents, plotted in green dash-dot line. An increasing doubling time for a research area means research interest is on decline and vice versa. Here, we found that the doubling time of deep web

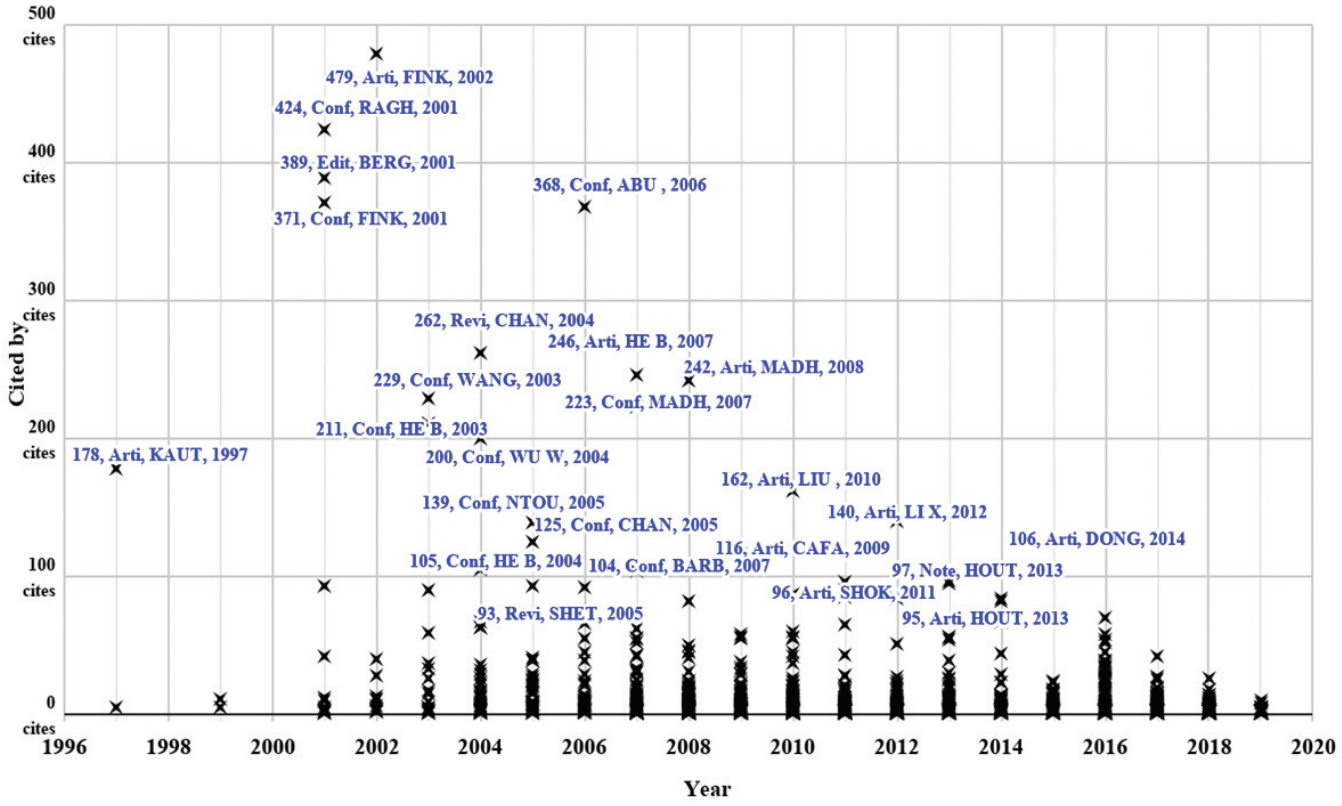

Figure 3. Distribution of most cited documents over 23 years (Label: Citations, Format, Author, Year).

Table 1. Top 25 highly cited documents

Document	Cited by	ACPY
FINKELSTEIN L, 2002, ACM TRANS INF SYST	479	25.21
RAGHAVAN S, 2001, VLDB - PROC INT CONF VERY LARGE DATA BASES	424	21.20
BERGMAN MK, 2001, J ELECTRON PUBL	389	19.45
FINKELSTEIN L, 2001, PROC INT CONF WORLD WIDE WEB, WWW	371	18.55
ABU RAJAB M, 2006, PROC ACM SIGCOMM INTERNET MEAS CONF IMC	368	24.53
CHANG KCC, 2004, SIGMOD REC	262	15.41
HE B, 2007, COMMUN ACM	246	17.57
MADHAVAN J, 2008, PROC VLDB ENDOW	242	18.62
WANG J, 2003, PROC INT CONF WORLD WIDE WEB, WWW	229	12.72
MADHAVAN J, 2007, CIDR - BIENN CONF INNOVATIVE DATA SYST RES	223	15.93
HE B, 2003, PROC ACM SIGMOD INT CONF MANAGE DATA	211	11.72
WU W, 2004, PROC ACM SIGMOD INT CONF MANAGE DATA	200	11.76
KAUTZ H, 1997, AI MAG	178	7.42

Document	Cited by	ACPY
LIU W, 2010, IEEE TRANS KNOWL DATA ENG	162	14.73
LI X, 2012, PROC VLDB ENDOW	140	15.56
NTOULAS A, 2005, PROC ACM IEEE JOINT CONF DIGIT LIBR	139	8.69
CHANG KCC, 2005, BIENN CONF INNOVATIVE DATA SYST RES , CIDR	125	7.81
CAFARELLA MJ, 2009, PROC VLDB ENDOW	116	9.67
DONG XL, 2014, PROC VLDB ENDOW	106	15.14
HE B, 2004, KDD PROC TENTH ACM SIGKDD INT CONF KNOWL DISCOV DATA MIN	105	6.18
BARBOSA L, 2007, INT WORLD WIDE WEB CONF	104	7.43
HOUT MCV, 2013, INT J DRUG POLICY-a	97	12.13
SHOKOUHI M, 2011, FOUND TRENDS INF RETR	96	9.60
HOUT MCV, 2013, INT J DRUG POLICY	95	11.88
SHETH A, 2005, J DATABASE MANAGE	93	5.81

*ACPY = Average Citations Per Year

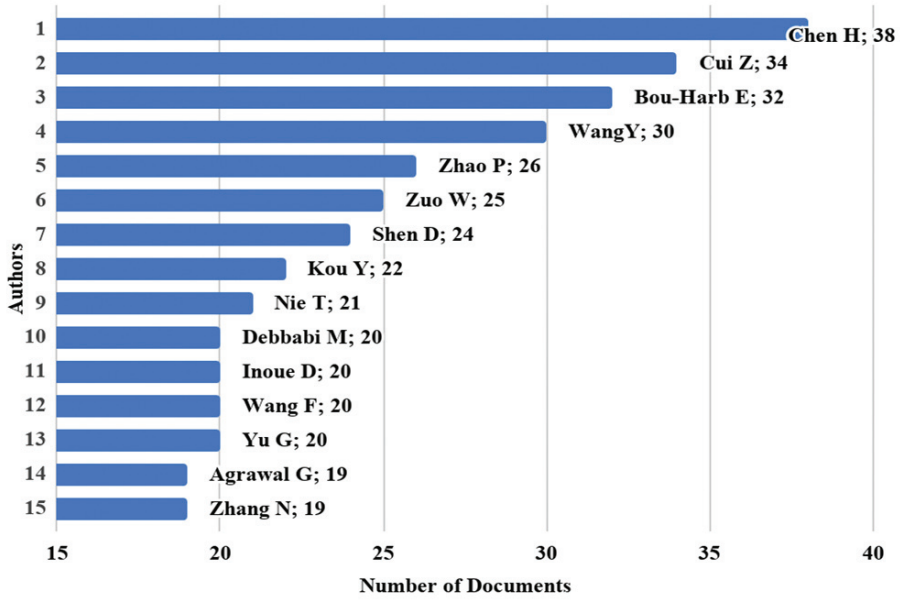

Figure 4. Top 15 highly productive authors.

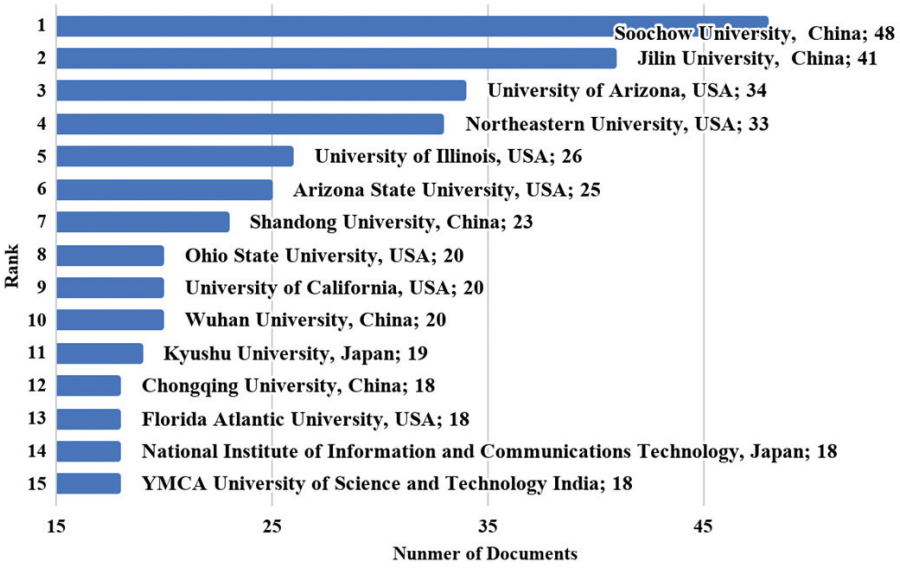

Figure 5. Most prolific institutions.

research has been lowest in 2001 only and it has been increasing since then. Although it has been infrequent until 2008, after 2008 it increased steeply to reach 8.64 in 2015; it implies that research growth has declined between 2008 and 2015. But in the very next year sudden fall from 8.64 to 6.31 in doubling time is the result of increasing interest in the area. For the last four years it has been slowly decreasing and stayed between 6.2 to 6.55, which indicates increasing research interest producing more publications.

5.2 Highly Recognised Documents Over 23 Years.

Figure 3 represents highly cited top 25 research documents in deep web research which are listed in Table 1. "Placing Search in Context: The Concept Revisited" is the most cited publication published as a journal article by Finkelstein (2002) and it has been cited 479 times according to the Scopus database; it was also presented in a conference in 2001 and was published as conference article, and that has been cited 389 times. The second most cited article "Crawling the Hidden Web" by Raghawan (2001) is referenced 424 times according to the Scopus. Third highest cited document is "The deep web: Surfacing hidden value" by Bergman (2001) cited 389 times. Abu Rajab (2006) is the fourth most cited document with 368 citations. All these publications have received more than 300 citations. Next five documents have been cited between 200 to 300 times. These consists of a review written by Chan (2004), a journal article written by He (2007), articles by Madhawan (2008), a conference paper by Wang (2003), a conference paper by Madhawan (2007), a conference paper by He (2003) and a conference paper by Wu (2004). Next 13 articles have been cited between 90 to 200 times, the oldest document among these is the Kautz's (1997) article and the latest highly cited article is written by Dong (2014) which has received 106 citations till date. A further analysis of references given by Dong (2014) revealed that it is not linked to deep web research directly, but it has used a method from a deep web article written by Dong (2013) titled as *'Truth finding on the Deep Web: Is the problem solved?'*. The years 1997, 2001 and 2002 appear to be pioneering years in deep web research, years 2003, 2004, 2005, 2006 and 2007 had propelled deep web research with moderately highly citable publications. Beyond this each year has at least one highly cited publication.

Further Its found that an article written by Liu (2010), an article by Li (2012), an article by Dong (2014) and an article and Note by Hout (2013) has an average citation per year greater than 10, which has been a common characteristic of highly cited pioneering papers; and these articles are published in top sources. So it is expected to observe a good increase in citations of these articles. Moreover, Shokouhi (2011) and Cafarella (2009) have average citation per year value of more than 9, so these are also somewhat important papers. We have also observed that citations of the documents published in 2016 are also much higher than 2015 which indicates the year 2016 must have again recharged the growth and a positive future can be expected.

5.3 Prolific Authors, Institutions and Countries.

5.3.1 Ranking of Prolific Authors

Figure 4 shows ranking of highly productive authors in terms of number of research publications, "Chen H" contributed most number of documents in the investigated time frame with 38 records, next two authors "Chui, Z" and "Bou-

Harb, E" contributed next most number of articles for the time frame with 34 and 32 records each; authors "Wang, Y" and "Zhao, P" are ranked fourth and fifth with 30 and 26 articles respectively.

5.3.2 Prolific Institutions

Figure 5 indicates institution-wise research productivity. It is noted that Soochow University, China; 48 contributed the highest number of research publications and ranked first in publications followed by Jilin University, China; 41 and University of Arizona, USA;33. University of Illinois, USA;26 and Arizona State University, USA;25 are at fourth and fifth position respectively. Moreover, it was found that Japan also has two of its institutions highly contributing to deep web research, these are National Institute of Information and Communication Technology, Japan; 18 and Kyushu University, Japan; 19. From India YMCA University of Science and Technology, India; 18 is the only Institution as a top 15 contributor.

5.3.3 Geographical Distribution of Publications

The geographical distributions of the contributions are presented in Fig. 6. During the period of study, total 1995 research papers were contributed by scholars from 70 countries. Among these China, USA, Japan, UK and India are top contributing countries. China 729 stands at first place followed by the United States at second place 721 and Japan at third place with 188. Although China has produced the largest no of papers but its performance in terms of citability is questionable, it has only 55.2 per cent citable documents. Similarly, India stands at fifth place by publication numbers, but it is the worst performer in terms of citability out of all four weak performers with below 60 per cent citable publications, which are India, South Korea, Malaysia and China. The USA (81.97 %) and Canada (81.91 %) are leading countries producing citable documents largely followed by Australia (79.76 %), France (73.44 %) and Spain

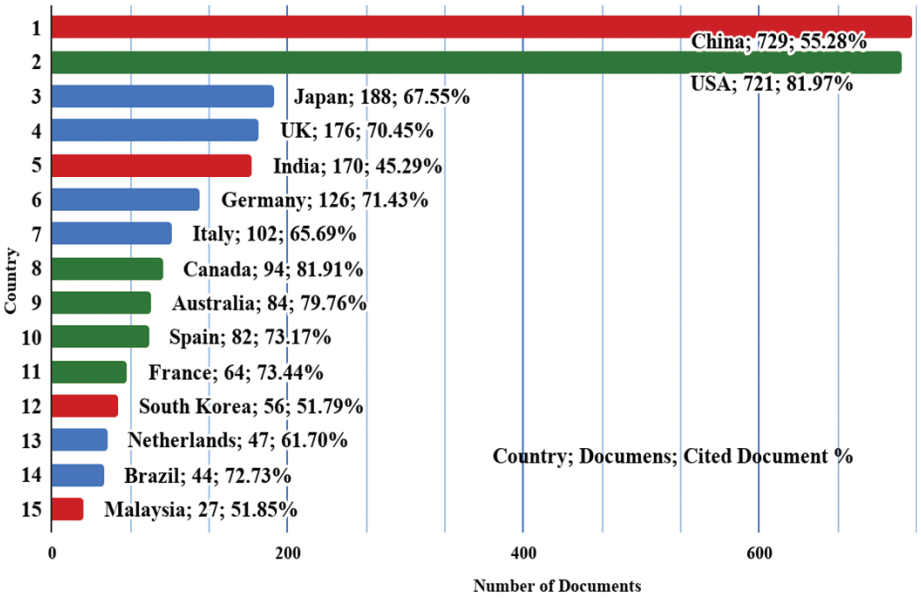

Figure 6. Geographical distributions of publications.

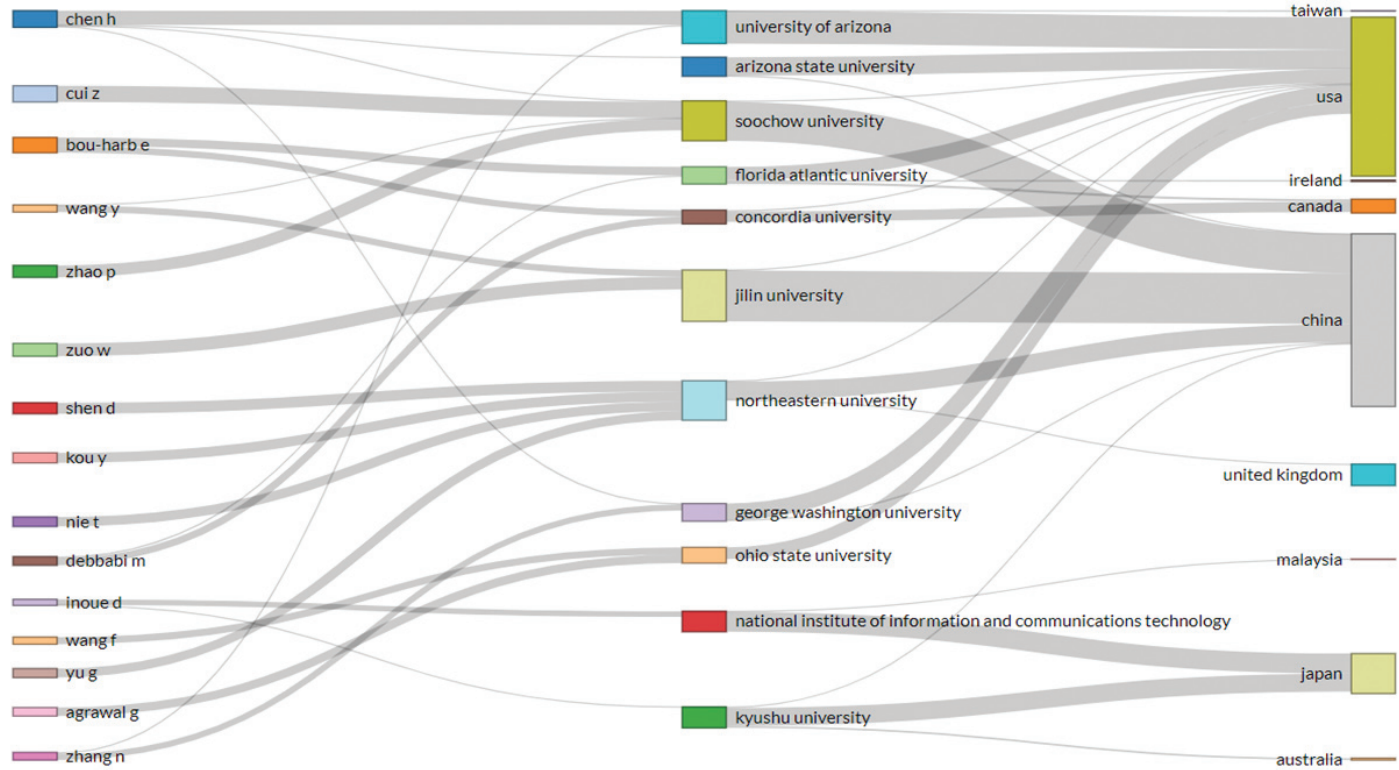

Figure 7. Prolific authors, their affiliations with country.

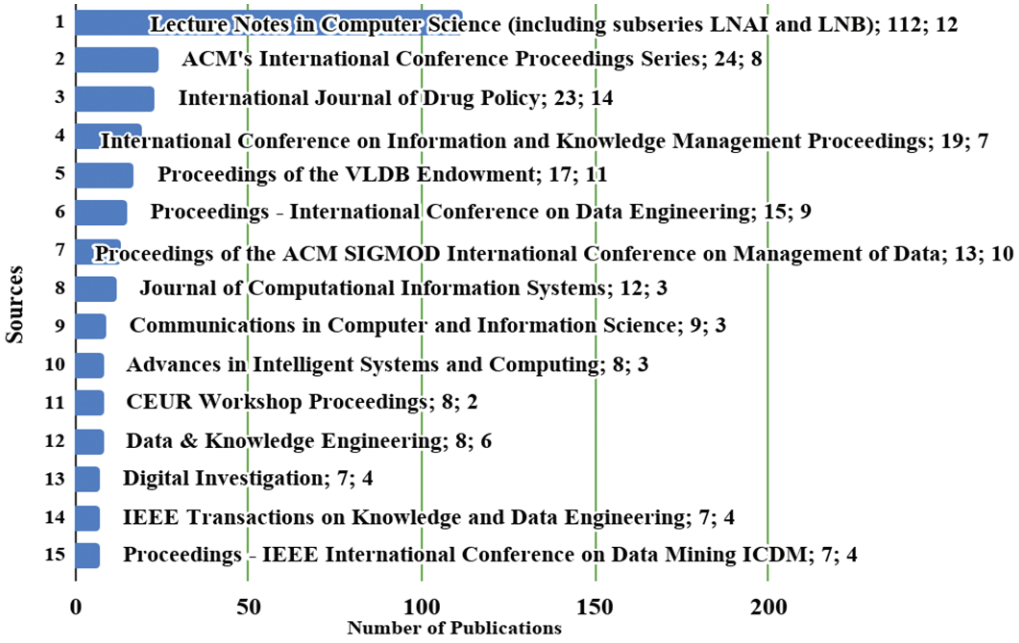

Figure 8. Top 15 prolific sources.

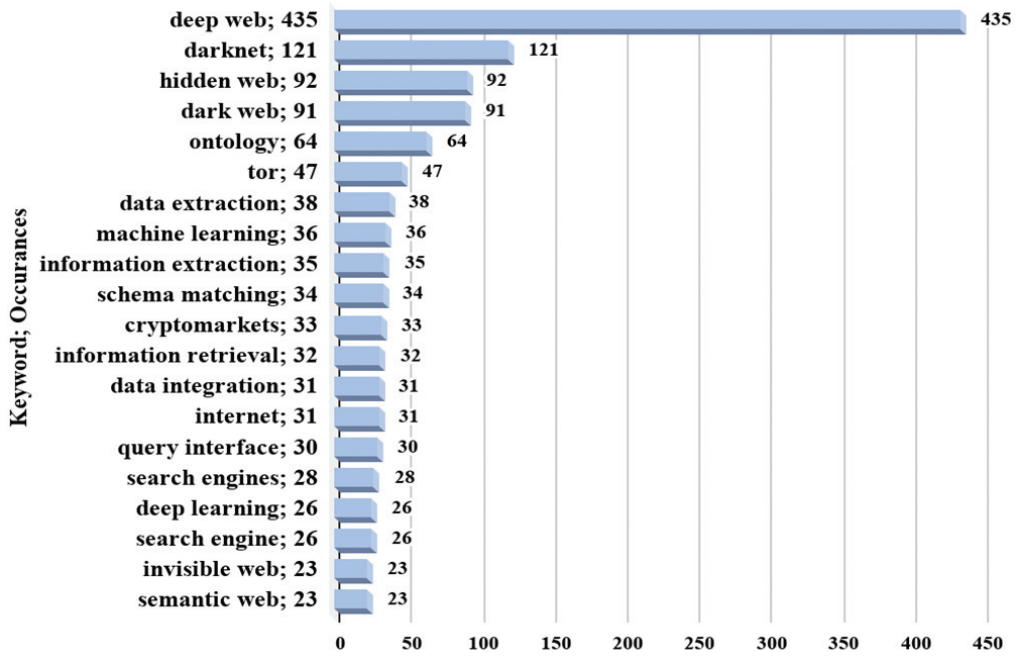

Figure 9. Top 20 frequently used keyword.

(73.17 %). Furthermore, Germany (71.43 %), Brazil (72.73 %), UK (70.45 %), Japan (67.55 %), Italy (65.69 %), Netherlands (61.70 %) are countries, which has moderate number of citable documents out of their contributions.

5.3.4 Prolific Authors, Country and Institutions

Figure 7 represents the linkages of the prolific authors shown in Fig. 4 with different Institutions and to various countries. First most prolific author Chen's main affiliation is University of Arizona and he belongs to the USA, simultaneously he is also associated with Arizona State University, Soochow University and George Washington University. Second prolific author Cui's main affiliation is only Soochow University along with the fifth prolific author Zhao. Third prolific author Bou-Harb's two affiliations are observed with equal strength which are Florida Atlantic University and Concordia University; his colleague Debbabi M is also associated with these two institutions but more strongly with Concordia University. Fourth prolific author Wang's main affiliation is Jilin University along with sixth prolific author Zuo W, Wang has also collaborated with researchers at Soochow University. Shen D., Kou Y., Nie T., along with Yu G., are only affiliated with Northeastern University. Wang F. and Agrawal G. are affiliated with Ohio State University. Further, 11th prolific author Inoue D is affiliated with NIICT, Japan and Kyushu University. NIICT and Kyushu University are highly contributing institutions from Japan. It can be seen in Fig. 7 that most of the prolific authors are related to the United States of America, China and Japan.

5.4 Author Preferences

5.4.1 Top 15 Most Prolific Sources

Figure 8 provides the rank list of top 15 journals preferred by the authors during the publication phase of 1997-2018. The total 1995 publications were scattered in 1008 sources, out of which 701 sources have received at least one citation; Fig. 8 shows top 15 sources out of those 701 citable sources along with the number of citable articles and h-index of the source. Highest number of citable documents (112) are published in Lecture Notes of Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) (LNCS) which has an h-index of 12, followed by ACM's International Conference Proceedings Series with 24 citable articles and an h-index of 8. Here we can easily observe that although the journal has a large number of citable articles, the h-index is relatively lower than other journals which have lesser number

of citable articles. For example, *International Journal of Drug Policy* has the highest h-index of 14 which is higher than LNCS but has published lesser citable documents. Proceedings of the VLDB Endowment is at fifth place with h-index of 11 and 17 citable publications. This ranked list can be thought of as the citable authors' preferred source list to publish their research.

5.4.2 Top 20 Author-Assigned Keywords

Total 3273 keywords were provided by the authors of these publications. Figure 9 shows the top 20 keywords being used frequently in the area of research. The keyword 'Deep web' has usage frequency of 435 (13.29 %), followed by 'darknet' 121 (3.7 %) at second, 'hidden web' with 92 (2.81 %), 'dark web' with 91 (2.78 %), these first four keywords are same as we used in our query for data retrieval.

Next ten keywords are 'ontology' 64 (1.96 %), 'tor', 'data extraction', 'machine learning', 'information extraction', 'schema matching', 'cryptomarkets', 'information retrieval', 'data integration', 'internet'. All these highly frequent keywords have been in use for many years in deep web research except for 'machine learning', 'cryptomarkets', 'deep learning'; we suspect that these are newly emerging topics, it can be further validated by detailed analysis of thematic mapping for these years.

5.4.3 Types of Document

The study found that the major preferred mode of communication in deep web research is conference paper which is 53.0 per cent of the total, while article comprises 33.40 per cent only. There is a significant percentage of communications as conference reviews. Book chapters and review 2.6 per cent and 2.4 per cent respectively. Figure 10 shows that conference papers and journal articles account for 86.4 per cent of publications.

6. CONCLUSIONS

Deep web research literature is growing with an annual growth rate of 24.84 per cent. In the last three years, research interest has been increasing which can be inferred by nearly constant RGR and doubling time.

Finkelstein (2002), Raghavan (2001), Bergman (2001) and Abu Rajab (2006) are the most highly cited documents with more than 350 citations. Among the documents published during the last decade Liu (2010), Li (2012), Dong (2014) and Hout (2013) have more than 10 average citations per year.

These research articles have the potential to propel the future of deep web research. These papers are mainly related to two areas which are 'utilisation of information or knowledge on the web for different purposes' and 'cybercrime like drug trafficking etc.'. Most of the 15 prolific authors (Fig. 4) do not appear in 25 highly cited publications list (Fig. 3).

China, USA and Japan are the top three prolific countries by numbers but the USA, Australia and Canada are the top three countries by percentage of citability; on the other hand, India, Malaysia, South Korea and China are the last four in terms of 'citability of publications' among the top 15 prolific contributors.

Top 15 prolific authors are related to the most prolific countries by number of contributions. The Wuhan University, Chongqing University, University of Illinois and YMCA University India are in top 15 prolific affiliations but none of the prolific author belongs to these institutions; Which implies that although the number of publications produced by these institutions are high, authors of these institutions had not been focused on deep web research. Which may be a symbol of the average quality contributions because these institutions (except University of Illinois) belong to the countries with lower citability (Fig. 6).

Springer's Lecture Notes in Computer Science (Including subseries LNAI and LNB), ACM's International Conference Proceedings Series and *International Journal of Drug Policy* are top three citable prolific sources. 'Cryptomarket', 'Machine Learning' and 'Deep Learning' are prospective topics for future research work in conjunction with deep web. Conference paper is the most preferred mode of communication in deep web research. Further, a mapping of keywords and collaborations can be helpful to reveal the trend and structure of deep web research domains.

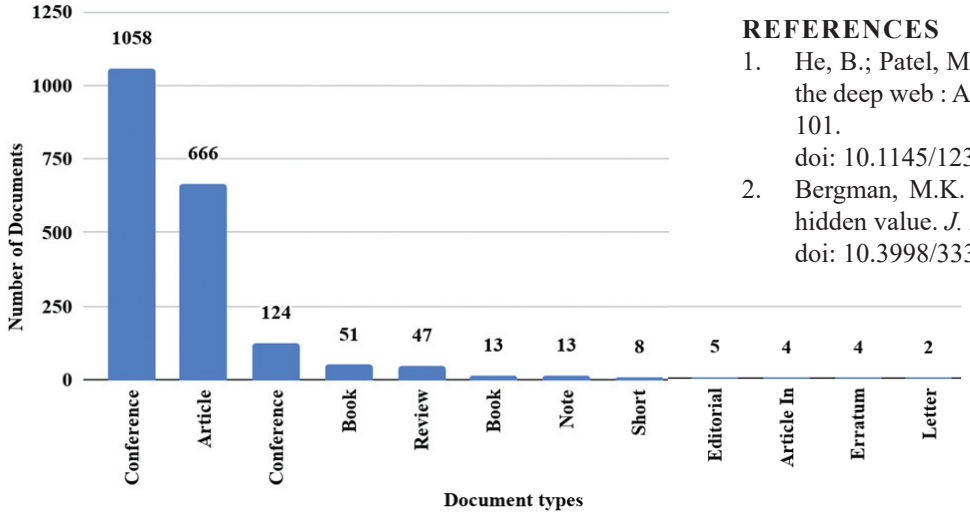

Figure 10. Types of document.

REFERENCES

1. He, B.; Patel, M.; Zhang, Z. & Chang, K.C.C. Accessing the deep web : A survey. *Commun. ACM*, 2007, **50**(5), 94-101. doi: 10.1145/1230819.1241670.
2. Bergman, M.K. White paper: The deep web: Surfacing hidden value. *J. Electron. Publishing*, 2001, **7**(1). doi: 10.3998/3336451.0007.104.
3. Devine, J. & Egger-Sider, F. Beyond Google: The invisible web in the academic library. *J. Acad. Libr.,* 2004, **30**(4), 265-9. doi: 10.1080/15367961003627047.
4. Gupta, B.M; Bala, Adarsh & Kshitig, Avinash. World cataract research: A scientometric analysis of publications output during 2002-

11. *Libr. Philos. Pract. (e-journal)*, 2013, 895. https://digitalcommons.unl.edu/libphilprac/895. (accessed on 27 December 2019).
5. Elango, B.; Rajendran, P. & Manickraj, J. Tribology research output in BRIC countries: A scientometric dimension. *Libr. Philos. Pract. (e-journal)*, 2013, 935. https://digitalcommons.unl.edu/libphilprac/935 (accessed on 27 December 2019).
6. Rai, S.; Singh, K. & Varma, A.K. Global research trend on cyber security: A scientometric analysis. *Libr. Philos. Pract. (e-journal)*, 2019, 3339. https://digitalcommons.unl.edu/libphilprac/3339. (accessed on 27 December 2019).
7. Sethi, Bipin Bihari & Panda, Krushna Chandra. Visibility index of social science research: A scientometric dimension of emerging trends. *Libr. Philos. Pract. (e-journal)*, 2013, 874. https://digitalcommons.unl.edu/libphilprac/874 (accessed on 12 November 2019).
8. www.scopus.com (Accessed on 12 November 2019).
9. https://www.bibliometrix.org/ (Accessed on 12 November 2019).
10. https://rstudio.com/ (Accessed on 12 November 2019).
11. https://docs.google.com/spreadsheets/ (Accessed on 12 November 2019).
12. Baskaran, C. Research productivity of Alagappa University during 1999-2011: A bibliometric study. *DESIDOC J. Libr. Inf. Technol.*, 2013, **33**(3). doi: 10.14429/djlit.33.3.4609.

CONTRIBUTORS

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Contribution in the current study : Performed Data Analysis using Bibliometrix package and google spreadsheet; final Tabulation and Plotting. Final writing of the typescript.

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