Visualization Analysis of Top Papers in the Subject Category of Computer Science, Information Systems Based on ESI

Baozhong Yuan[1]* and Jie Sun[2]

[1]College of Plant Science and Technology, Huazhong Agricultural University, Wuhan city, Hubei province, PR China, 430070
[2]Library of Huazhong Agricultural University, Wuhan city, Hubei province, PR China, 430070

∗ Corresponding Author Email: yuanbz@mail.hzau.edu.cn

Abstract. All of 1,647 top papers for Computer Science, Information Systems from 2009 to 2019, which included 1,642 highly cited papers and 32 hot papers. All papers were written in English, from 69 countries/territories and listed in 115 journals. Top 5 core journals were *IEEE Communications Surveys and Tutorials, Information Sciences, IEEE Access, IEEE Internet of Things Journal, MIS Quarterly*. The research was separated 9 clusters.

1. Introduction

Bibliometrics technique has been adopted in the subject category of Computer Science, Information Systems, such as: a bibliometric analysis of twenty years of research on event-based control [1], brands as relationship builders in the virtual world [2], studies in Informatics and Control [3], discovering rehabilitation trends in Spain [4]), computer-aided diagnosis [5], a bibliometric analysis of 20 years of research on software product lines [6], Visualizing the knowledge structure and research evolution of infrared detection technology studies [7]. This paper analyze papers in the subject category of Computer Science, Information Systems during 11 years period from 2009 to 2019.
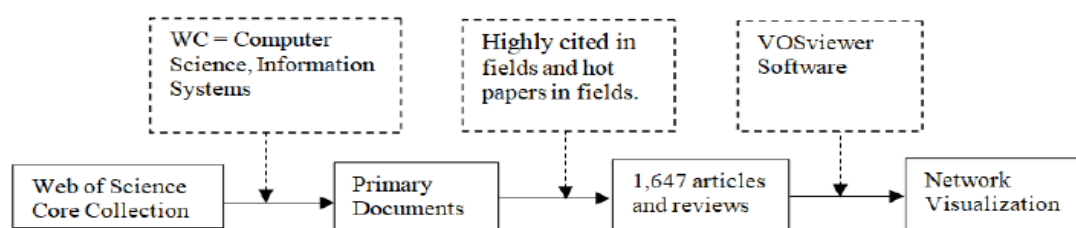
2. Data and Methodology

2.1. WoS and Essential Science Indicators (ESI)

The Essential Science Indicators database has been updated as of March 12, 2020, to cover an 11 year period, January 1, 2009 – December 31, 2019.

2.2. Data Collection and Analysis

It was completed on the single day on April 22, 2020. Four process were separated to get the top papers in the field (Figure 1).

Figure 1. A framework of Computer Science, Information Systems

2.3. VOSviewer
VOSviewer (version 1.6.11, 2019, Leiden University, Leiden, The Netherlands) was used to show the international collaboration and the research trends through all keywords [8].

3. Results and Discussion

3.1. Document Type and Language of Publication
Based on WoS Index, the 1,647 papers were Science Citation Index Expanded (1,647), Social Sciences Citation Index (352), Conference Proceedings Citation Index-Science (25), Conference Proceedings Citation Index-Social Sciences and Humanities (1).

Among the 1,647 papers, articles were 1,541 (93.564%), reviews (106, 6.436%), proceedings papers (25, 1.518%) and data paper (1, 0.061%), published in English. There are 32 hot papers and 1,642 highly cited paper.

3.2. Publication Output
Figure 2 shows the research trend. The average publication was 149.73, and the highest value is 264 in 2019. Total citations each year were power increased from 2009 to 2019.
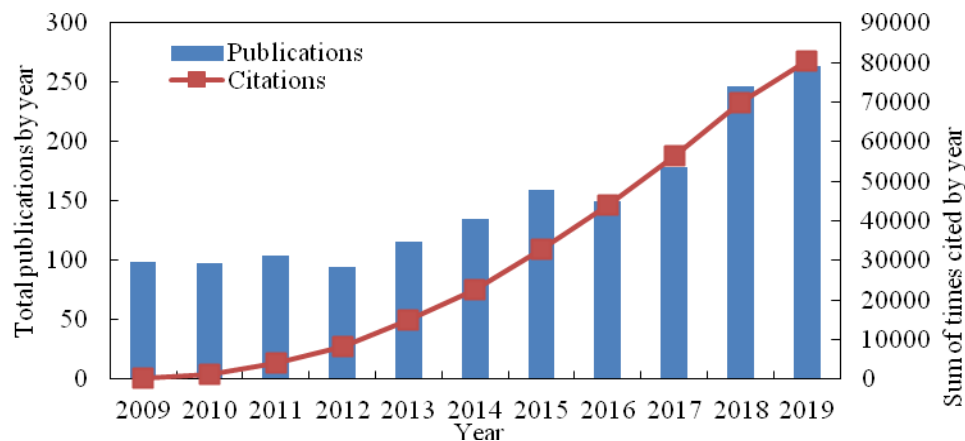
Figure 2. Number of top papers of Computer Science, Information Systems per year.

3.3 Web of Science Categories and Research Areas
There are total 23 Web of Science subject categories and 17 research areas (Table 1).

Table 1. Top 10 WoS categories and research area for Computer Science, Information Systems

Rank	WoS Categories	TP	Ratio	Research Areas	Records	Ratio
1	Computer Science Information Systems	1647	100	Computer Science	1647	100
2	Telecommunications	763	46.327	Telecommunications	763	46.327
3	Engineering Electrical Electronic	583	35.398	Engineering	583	35.398
4	Information Science Library Science	259	15.726	Information Science Library Science	259	15.726
5	Computer Science Hardware Architecture	148	8.986	Business Economics	114	6.922
6	Computer Science Interdisciplinary Applications	145	8.804	Medical Informatics	88	5.343
7	Computer Science Software Engineering	132	8.015	Health Care Sciences Services	67	4.068
8	Computer Science Artificial Intelligence	113	6.861	Operations Research Management Science	58	3.522
9	Management	106	6.436	Chemistry	48	2.914
10	Medical Informatics	88	5.343	Pharmacology Pharmacy	32	1.943

TP: Total publications; Ratio: Ratio of 1,647(%).

Table 1 show the top 10 Web of Science Categories and research areas in the subject category of Computer Science, Information Systems. The 5 top categories include Computer Science Information Systems (1,647 papers, 100% of 1,647 papers), Telecommunications (763, 46.327 %), Engineering Electrical Electronic (583, 35.398 %), Information Science Library Science (259, 15.726 %), Computer Science Hardware Architecture (148, 8.986 %). The 5 top research areas include Computer Science (1,647 papers, 100 % of 1,647 papers), Telecommunications (763, 46.327 %), Engineering (583, 35.398 %), Information Science Library Science (259, 15.726 %), Business Economics (114, 6.922 %).

3.4. Core Journals

Based on JCR 2018 data (published in 2019), there are 155 Journals of the Web of Science Categories for Computer Science, Information Systems. All the 1,647 publications were published in 115 journals.

The top 12 core journals were displayed in the Table 2 with total articles each more than 30 top papers, Journal impact factor as IF2018 and IF5 year, rank and Quartile in Computer Science and Information Systems. The top 5 Journals and top 12 Journals published about 40.984 % and 60.777 % of the total top papers, respectively. Top 5 Journals were *IEEE Communications Surveys and Tutorials* (180,10.929 %), *Information Sciences* (176, 10.686 %), *IEEE Access* (165, 10.018 %), *IEEE Internet of Things Journal* (86, 5.222 %), *MIS Quarterly* (68, 4.129 %).

Table 2. Top 12 Journal indexed in the web of science during period from 2009 to 2019

Rank	Journal	TP	Ratio	IF2018	IF5year	QC
1	IEEE Communications Surveys And Tutorials	180	10.929	22.973	25.222	Q1
2	Information Sciences	176	10.686	5.524	5.305	Q1
3	IEEE Access	165	10.018	4.098	4.54	Q1
4	IEEE Internet of Things Journal	86	5.222	9.515	11.216	Q1
5	MIS Quarterly	68	4.129	4.373	9.608	Q1
6	IEEE Transactions on Information Theory	67	4.068	3.215	3.409	Q2
7	Journal of the American Medical Informatics Association	65	3.947	4.292	4.54	Q1
8	IEEE Wireless Communications	57	3.461	11	10.145	Q1
9	IEEE Transactions on Knowledge and Data Engineering	41	2.489	3.857	4.561	Q1
10	IEEE Network	34	2.064	7.503	7.344	Q1
11	Journal of Chemical Information and Modeling	32	1.943	3.966	4.297	Q1
12	Information Management	30	1.821	4.12	5.346	Q1

TP: total publication; Ratio: Ratio of 1,647(%); QC: Quartile in Category of Computer Science, Information Systems. Data were from the 2018 edition of Journal Citation Reports.

3.5 Countries Co-occurrence Analysis

All top papers were contributed by 69 countries/regions (Figure 3).
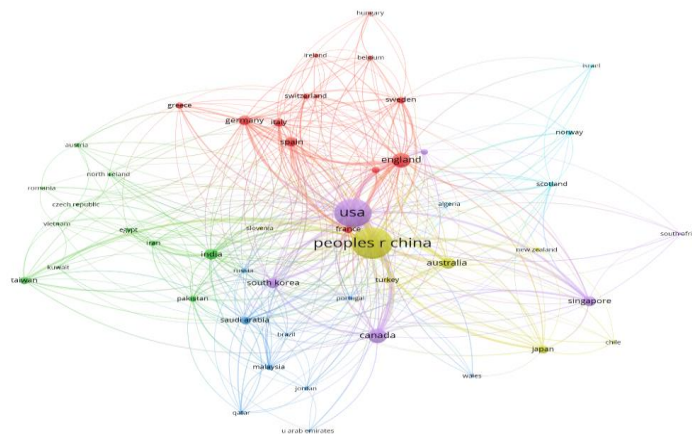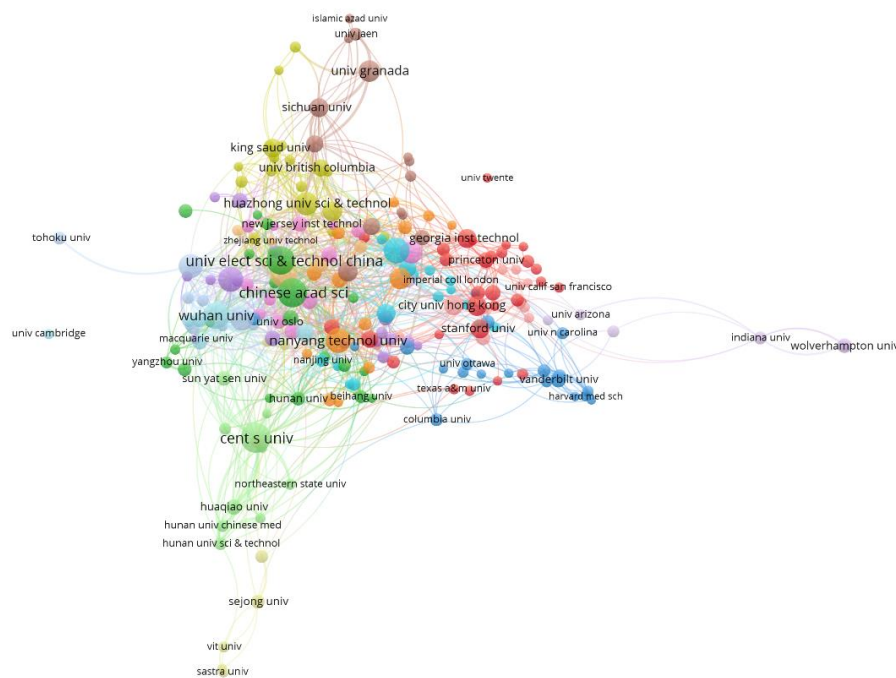

Figure 3. The country co-authorship network of Computer Science, Information Systems.

As we can see from Figure 3, Peoples R China, USA, England, Canada and Australia are the five biggest circles. The first cluster consisted of 13 countries and regions (red color), England, Germany, Spain, Italy, France, Sweden, Greece, Netherlands, Switzerland, Belgium, Ireland, Denmark, Hungary. The second cluster consisted of 11 countries or regions (green color), India, Taiwan, Pakistan, Iran, Egypt, Austria, North Ireland, Czech Republic, Vietnam, Kuwait, Romania. The third cluster consisted of 9 countries (blue color), Saudi Arabia, Malaysia, Portugal, Qatar, Russia, Jordan, Brazil, U Arab Emirates, Wales. The fourth cluster consisted of 7 countries and regions (yellow color), Peoples R China, Australia, Japan, Turkey, New Zealand, Chile, Slovenia. The fifth cluster consisted of 6 countries and regions (violet), USA, Canada, South Korea, Singapore, Finland, South Africa. The sixth cluster consisted of 4 countries and regions (shallow blue), Norway, Scotland, Israel, Algeria. Here, Taiwan as a part of China shows the stronger research in the field.

3.6 Organizations Co-authorship Analysis

There are 1,563 organizations contributing the 1,647 top papers in this study. Of the 1,563 organizations, there were 224 organizations meet the thresholds of 5, but only one organizations no connected to each other, so, left 223 organizations in Figure 4. The VOSviewer software divided these 223 institutes into 16 clusters with different colors. The different colors group, the different clusters formed by sets of organizations. The 16 clusters each include 30, 21, 20, 18, 17, 16, 14, 14, 13, 13, 10, 9, 8, 8, 7, 5 organizations.

Figure 4. The organizations co-authorship network of Computer Science, Information Systems related publications from 2009 to 2019.

3.7 Keywords Co-occurrence Analysis

Figure 5 shows the network map. Of the all 7,879 keywords, there were only 495 keywords meet the threshold more than 5 times included in the map. There are 9 main clusters focused on systems model and information-technology (red), algorithm classification (green), networks design and 5G (blue), information decision-making (yellow), security of cloud computing (violet), wireless sensor networks (shallow blue), internet (orange), experimentation (crown), efficiency (pink).

3.8. The most Frequently Cited Articles

Figure 6 shows the top 9 papers of total citations more than 2,000 times, which they are from the

different journal. Eight most frequently cited articles have been cited more than 2,000 times since their initial publication to April 22, 2020.
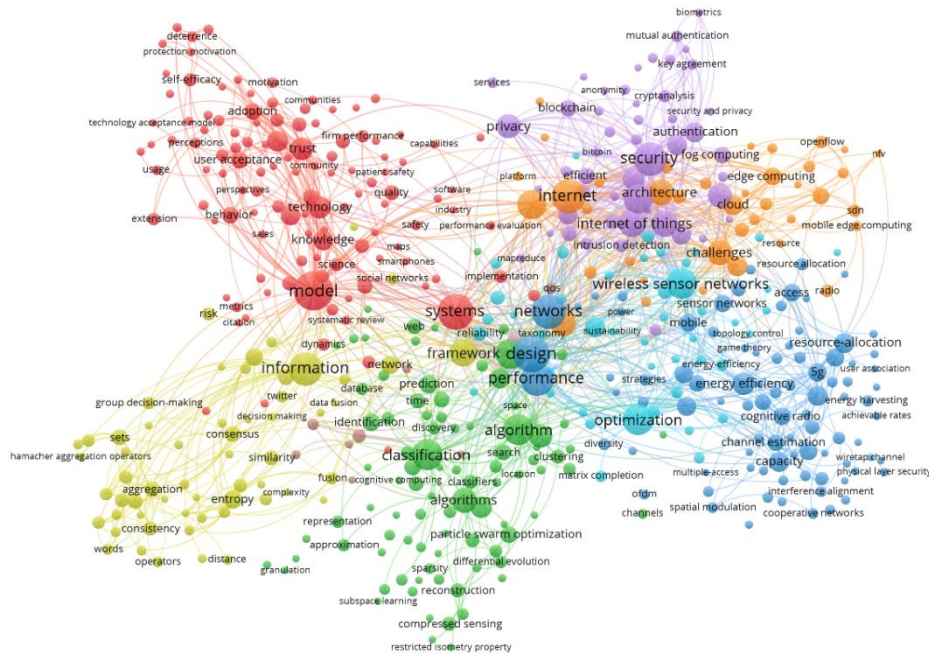

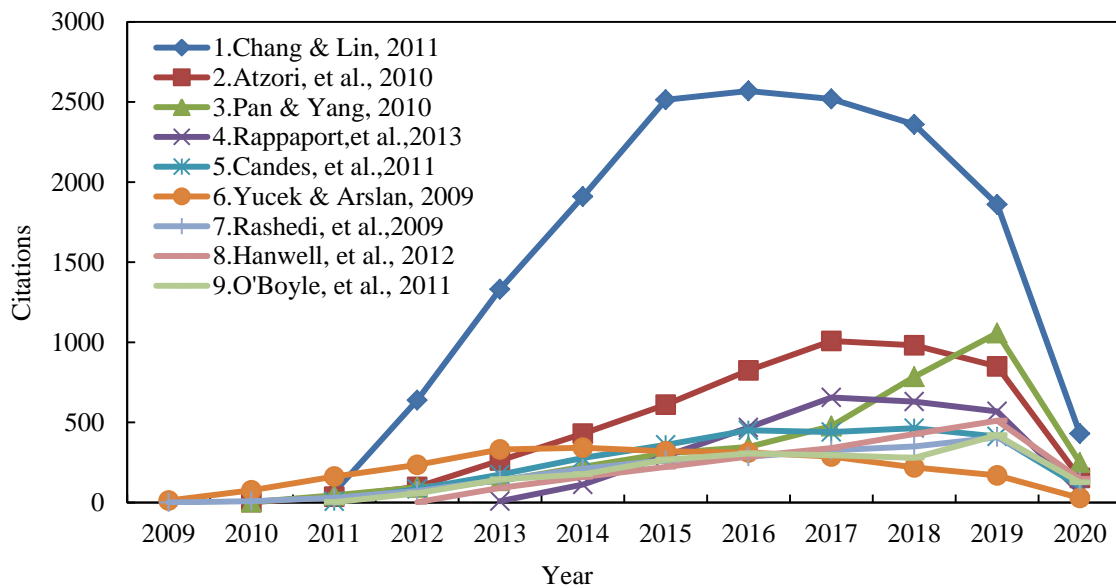**Figure 5**. VOSviewer co-occurrence Network for all keywords.

Figure 6. Comparison of the citations of the top nine papers from their initial publications to April 22, 2020

4. Conclusions

The 1,647 top papers include 1,642 highly cited papers and 32 hot papers in the field. Results showed that these papers, all written in English, were 69 countries/territories, listed in 115 journals in the field of Computer Science, Information Systems. All keywords were separated into nine clusters.

5. Acknowledgements

6. References

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