

**Proceedings
of
10th International Conference on
Webometrics, Informetrics
and Scientometrics &
15th COLLNET Meeting 2014**



September 3-5, 2014

Technische Universität Ilmenau, Germany

Edited by

**Bernd Markscheffel • Daniel Fischer •
Daniela Büttner • Hiltrun Kretschmer**



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Index

Index	v
Invited Papers	1
Eugene Garfield and Alexander Pudovkin.....	3
Journal Impact Factor Reflects Citedness of the Majority of the Journal Papers	
Liming Liang and Zhen Zhong	9
Uncited Papers, Uncited authors and Uncited Topics	
Weiping Yue	17
A Scientometric Study on Collaboration between Academia and Industry – Case studies of Chinese leading universities and companies	
Hildrun Kretschmer and Theo Kretschmer	21
Three-dimensional Visualization and Animation of Emerging Patterns by the Process of Self-Organization in Collaboration Networks	
I. K. Ravichandra Rao and K. S. Raghavan	49
Seven years of COLLNET Journal of Scientometrics and Information Management (2007 -2013)	
Full Papers	69
Amir Reza Asnafi and Maryam Pakdaman Naeini	71
A Survey on Collaboration rate of authors in producing Scientific Papers in Quarterly Journal of Information Technology Management during 2009-2014	
André Calero Valdez, Anne Kathrin Schaar, Tobias Vaegs, Thomas Thiele, Markus Kowalski, Susanne Aghassi, Ulrich Jansen, Wolfgang Schulz, Guenther Schuh, Sabina Jeschke and Martina Ziefle.....	77
Scientific Cooperation Engineering Making Interdisciplinary Knowledge Available within Research Facilities and to External Stakeholders	
Arshia Kaul, Sujit Bhattacharya, Shilpa and Praveen Sharma.....	87
Measuring Efficiency of Scientific Research	
Ashkan Ebadi and Andrea Schiffauerova	91
How do scientists collaborate? Assessing the impact of influencing factors	

Barbara S. Lancho Barrantes.....	103
Benefits of scientific collaboration	
Bernd Markscheffel and Johannes Schmidt.....	109
A Bibliometric Indicator for the Consideration of Time Related Aspects Following the Example of Twitters Influence Passivity Score	
Bharvi Dutt and Khaiser Nikam.....	111
International Collaboration in Solar Cell Research in India	
Carey Ming-Li Chen	121
The Application of Funding Acknowledgment on the Path Analysis of Knowledge Dissemination of Granted Researches	
Carlos Olmeda-Gómez, María Antonia Ovalle-Perandones, Juan Gorraiz and Christian Gumpenberger	129
Excellence, merit and research team size: a library and information science case study	
Chen Yue, Zhang Liwei, Wang Zhiqi, Liu Shengbo, Su Lixin and Hou Yu.....	139
Influential Bloggers and Active Bloggers on ScienceNet: An Analysis of Popular Blogs	
Chun Wang, ZhengYin Hu, Miaoling Chai and Hui Wang.....	145
Legal Status Prediction for US Patents on Thermocouples	
Divya Srivastava, Arvind Singh Kushwah and Mona Gupta.....	153
An Analysis of Collaboration Pattern of Indian S & T Papers (Published during 2005-09)	
Divya Srivastava, Arvind Singh Kushwah and Mona Gupta.....	163
Impact of Indian S&T Research Papers – Published during 2005-09: through Citation Analysis	
Divya Srivastava, Sandhya Diwakar and Ramesh Kundra	173
Current status of Medical research across the Countries: India, China and Brazil	
Farideh Osareh and Ismael Mostafavi.....	179
Visualizing the co-authorship relations in surgery discipline outputs among Iranian and Global cities	
Fatemeh Helaliyan Motlagh and Mohammad Hassanzadeh.....	191
Studying the status of knowledge management components in Petrochemical Companies (case study: South Pars Energy Economic Special Zone » Assalouyeh «)	
Fatemeh Nooshinfar, Aref Riahi and Elham Ahmadi.....	201
Study of Barriers to Scientific Collaboration of female Scientifics (Case Study of Iranian Women members of University of Tehran)	

Gayatri Paul and Swapan Deoghuria	209
Indian Journal of Physics: A scientometric analysis	
Grant Lewison and Richard Sullivan	217
Conflicts of Interest Statements on Biomedical Papers	
Hailong Wang and Minyu Wang	227
Core technology fields and innovation cooperation network of electric vehicle industry	
Hamideh Asadi and Mahsan Poorasadollahi.....	237
Structure and Evolution of Library and Information Science in the top Countries of Middle East in terms of Scientific Productions during the years of 1992-2012	
Hamzehali Nourmohammadi and Abdalsamad Keramatfar	247
The relation between the number of countries' Rich Files on the web and countries' economic development	
Hamzehali Nourmohammadi, Mahdi Keramatfar and Abdalsamad Keramatfar.....	257
Research in what fields? Determining Iran's research priorities according to their impact on economic development	
Handaru Jati.....	265
Weight of Webometrics Criteria using Entropy Method	
Hongfang Shao, Qi Yu and Zhiguang Duan	269
Detecting the milestones of epigenetics development from 2002 to 2013: a Scientometrics perspective	
Hou Haiyan, Zhao Nannan, ZhangShanshan, Liang Yongxia and Hu Zhigang	281
Characteristics of the development of NB converging technology	
Jiang Chunlin, Liu Xue and Zhang Liwei.....	293
Data Fetching and Group Characteristics Analysis Based on Sina Microblog	
Jiang Chunlin, Zhang Liwei and Liu Xue	301
Survey of the Editorial Board Members for Journals of Library and Information Science in China	
K. S. Raghavan and I. K. Ravichandra Rao	309
Mapping Engineering Research in India	
Leila Nemati-Anaraki and Roya Pournaghi	317
The Effect of Geographical Proximity on Organizational Knowledge Sharing	
Li Gu, Weichun Yan and Shule An.....	327
The Relationship between internet attention and market share of operation systems for personal computers	

Liu Xiaomin, Sun Yuan and He Jing	335
Impact of articles in non-English language journals – A bibliometric analysis of regional journals of China, Japan, France and Germany in Web of Science	
Lutz Bornmann, Moritz Stefaner, Felix de Moya Anegón and Rüdiger Mutz	345
Ranking and mapping of universities and research-focused institutions worldwide: The third release of www.excellencemapping.net	
M.H. Biglu and M. A-Farhangi.....	353
Infometrics analysis of Scientific-literature in Pediatrics obesity	
Marzieh Yari Zanganeh and Nadjla Hariri.....	359
Transactions Reports Analysis Islamic Azad University Marvdasht – branch website: A Case Study	
Marzieh Yari Zanganeh and Sedigheh Mohammad.....	367
Use of Six Sigma Concept in University Libraries: A Case Study of Fars province Medical Sciences Library University	
Masaki Nishizawa and Yuan Sun.....	373
How is scientific research reported in newspapers? – Comparison between press releases and two different national newspapers in Japan	
Meera and Surendra Kumar Sahu	381
Research Output of University College of Medical Science, University of Delhi: A Bibliometric Study	
Mohammad Hassanzadeh and Babak Akhgar.....	395
Relationship between Development Indicators and Contribution to the Science: Experiences from Iran	
Mursheda Begum and Grant Lewison.....	403
European cancer research publications, 2002-13	
Nabi Hasan and Mukhtiar Singh	413
Library and Information Science Research Output: A study based on Web of Science	
R. D. Shelton and T. R. Fade	427
Which Scientometric Indicators Best Explain National Performance of High-Tech Outputs?	
Roya Pournaghi and Leila Nemati-Anaraki.....	437
The Mutual Role of Scientometrics and Foresight	
S. L. Sangam, Devika Madalli and Uma Patil	449
Indicators to Measure Genetics Literature: A Comparative Study of Selected Countries	

Sandhya Diwakar and K. K. Singh	459
Analysis of the Financial Assistance to Non-ICMR Biomedical Scientists by Indian Council of Medical Research (ICMR) 2009 - 2013	
Shantanu Ganguly, P K Bhattacharya and Tanvi Sharma.....	465
Growth of Literature in Biofuels Research: A Resource Analysis	
Shilpa, Arshia Kaul and Sujit Bhattacharya.....	481
Salient Aspects of India's Publication activity	
Soheila Bagheri and Mohaddeseh Dokhtesmati.....	485
Comparative study of outputs and scientific cooperation of world's countries in Biomedical engineering field in Science Citation Index in the years 2002-2011 with an emphasis on co-authorship networks	
Tahereh Dehdarirad, Anna Villarrojo and Maite Barrios.....	497
Women in Science and Higher Education: a bibliometric study	
Tariq Ashraf	507
Pattern of Research & Citations: A Study of Three Central Universities Located in Delhi-India	
Thuraiyappah Pratheepan and W.A. Weerasooriya	529
International research collaboration of Sri Lanka in the last 02 decades (1994 – 2013) based on the SCOPUS database	
Umut Al and Zehra Taşkın.....	539
Relationship between Economic Development and Intellectual Production	
Umut Al, İrem Soydal, Umut Sezen and Orçun Madran	549
The Impact of Turkey in the Library and Information Science Literature	
Vijayakumar M, Debojyoti Nath and Annapurna SM	559
A study on Indian collaboration among SAARC Countries using Webometrics Methods	
Wen-Yau Cathy Lin	569
Comparative Study of Journal Impact Factor and Self-Citation Across Asian International Journals	
Xianwen Wang, Wenli Mao and Chen Liu.....	575
Does The Open Access Advantage Exist? An Empirical Study on Citation and Article View Data	
Xiaoyu Zhu, Zeyuan Liu, Chaomei Chen and Haiyan Hou.....	581
Statistical analysis on interlocking directorate in Chinese listed companies	

Yang Zhongkai, Xu Mengzhen and Hanshuang	587
Measurement and Changing Trends of Originality Index Value – In view of NBER Patent Citation Database	
Yunwei Chen, Yong Deng, Fang Chen, Chenjun Ding, Ying Zheng and Shu Fang	597
A Co-author Based CCS Index Used for Evaluating Scientists’ Performance	
Zhao Qu, Xiling Shen and Kun Ding	609
Comparative Analysis on Technologies between Chinese and American Large-sized Oil Companies based on Patentometrics	
Posters	619
List of Accepted Posters.....	621

Invited Papers

Weight of Webometrics Criteria using Entropy Method

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Abstract

The aim of this study was to propose some of the basic tools for Decision Making. The purpose of this paper is to show a methodology test for the selection of the weighted method, as aid to decision making in the design stage in the area of webometrics. Selecting the weighted method is one of the problems of Multicriteria Decision Analysis in which decision-makers have had disadvantages in weighting assignment criteria. To resolve this problem arises weighting variables using the entropy method. The model presented in this article is limited to display application in a webometric case. This model can be applied as a way to supplement the technical studies to select the weighted method of a webometrics and it gives the relative importance weights of the various elements, and gives an empirical analysis, explain the role of the entropy weight in webometrics study. Entropy weighted method enables rank all the alternatives in question without decisor bias and calculates the specific weight of criteria.

Introduction

In the world there are thousands of universities, and since 2004 it has been published a Web Ranking which shows the results in every six months (January and July) and covers about 20,000 Higher Education Institutions worldwide. The composite index (Ranking) is calculated by combining standardized positions instead of values. The visibility is calculated giving an extra inbound links that are not from generic domain importance (.Com, .Org, .Net). Figures for rich files (pdf, doc, ppt, ps, Dox, pptx, eps) are combined and have not been treated individually. The intention with this system of analysis and projection of cybermetric indicators under the parameters set Webometrics is to strengthen and indicate the type of information being generated in each of the institutions and thereby improve certain characteristics that further enrich university of university webometrics ranking has changed the setting of higher education and is likely to continue to influence further development nationally and internationally. This moment is a new era for university, characterized by global competition, in which university ranking systems have assumed an importance factor for surviving. Their emergence *has also been* a matter of *controversy*, often controversial and subject to considerable debate, has been met with a lot of scepticism, some enthusiasm and an institutional unease. Academic rankings are here to stay and it is results that count for most of higher education's stakeholders.

Literature Review

Webometrics

Although the subfield of webometrics is considered as one of the most recent quantitative studies within the field of library and information science, there are already several international studies that address this topic. Many authors have directed their focus of study for this new environment, for finding web immense diversified network of information resources, easily accessible and still little explored. In this sense, Cronin and McKim (1996) argue that as the Web is becoming a medium increasingly important to science and academia , it is logical that quantitative studies extend well to this medium. Also Thelwall, Vaughan and Björneborn (2003) consider that being a global network of Web documents, initially developed for academic use and then extended to general users , it is obvious that it is a fertile field of research for

bibliometrics, the scientometrics and informetrics. The Webometrics is a ranking based on measurements of the presence of the universities on the Web. It is prepared by the Laboratory Cybermetrics, a group of research is part of the Superior Council of Scientific Research of Spain, and not for commercial purposes. In contrast to other rankings, Webometrics classifies a large number of universities, more than 20,000 in its latest edition (January 2012). Published twice a year (January and July). The system also allows universities ordered by country and region (Aguillo, Ortega et al. 2008). According to its website, the ranking aims to promote open access to information on the Internet by universities access. Also, as most of the rankings, insist on the superiority of his method: "As other rankings focused only on a few relevant aspects, specially research results, our ranking based on indicators of the presence reflects best the Web overall activity of the institutions, as there are many other tasks performed by teachers and researchers that appear on the Web. However, this method also has its limitations, since it favors large universities or those with large budgets for technology.

Entropy Method

The entropy method was developed as an objective method of allocation weights depending on the decision matrix without affecting the preference of the decision maker (Zeleny 1982), the relative importance of criterion j in a decision situation, w_j measure its weight is directly related to the amount of information provided by the intrinsically set of alternatives with respect to that criterion (Barba Romero and Pomerol 1997). How much have greater diversity in the evaluations of the alternatives greater importance should be the criterion. Far this diversity is conceptually based on solid and accepted concept of entropy in an information channel posed by Claude Shannon (Shannon and WEAVER 1949). The procedure is as follows:

- a. The evaluations ij ($i = 1, m$) ($j = 1, n$) are taken as normalized as a fraction of the sum ij Σ to the original assessments of each criterion j .

$$a_{ij} = \frac{k_{ij}}{\sum_{i=1}^m \sum_{j=1}^n k_{ij}} \quad \text{for } m > 1 \text{ and } i=1, 2, \dots, m; \text{ and } j=1, 2, \dots, n. \quad (1)$$

- b. Entropy (E_j) is calculated.

$$E_j = \left[\frac{-1}{\ln(m)} \right] \sum_{i=1}^m [a_{ij} \ln(a_{ij})] \quad (2)$$

where m = number of alternatives in the matrix standardized assessments and ij = Criteria or standardized attributes.

- c. Diversity criterion (D_j) is calculated.

$$D_j = 1 - E_j \quad (3)$$

- d. The normalized weight of each criterion (W_j) is calculated.

$$w_j = \frac{D_j}{\sum D_j} \quad (4)$$

Research Method

Weighted indicators that take into account are:

- Size: number of pages recovered from 4 search engines: Google, Yahoo, Live Search and Exalead (20%).
- Visibility: The total number of unique external links received (inlinks) by a site that you can den get consistently from Yahoo Search, Live Search and Exalead (50%).
- Rich files: the following file formats were selected after considering their relevance in academic and publication activities and considering the volume of use: Adobe Acrobat (pdf.), Adobe PostScript (ps.), Microsoft Word (. Doc) and Microsoft Powerpoint (.

Ppt). These data are extracted through Google, Yahoo Search, Live Search and Exalead (15%).

- Academic: Google Scholar provides the number of papers and citations for each domain academic. The results obtained from the database of Google Scholar papers, reports and other academic papers (15%).

Results

The four number of criteria that should typically be considered in selecting the best university website are Size(C1), Visibility (C2), Rich Files (C3), and scholar (C4). First of all we form the decision matrix, after that we compute h_i , d_i and w_i base on Shannon method that are shown in Table 1.

Table 1. Data

Universitas	Size	Visibility	Rich Files					Scholar
			.pdf	.ps	.ppt	.doc	Total	
Uni A	9950	177,321	259000	84200	9110	22900	375210	9950
Uni B	8970	307,113	390000	26400	10800	13400	440600	8970
Uni C	33200	4.616,437	317000	22300	18100	19900	377300	33200
Uni D	30100	362,854	268000	10100	8650	22800	309550	30100
Uni E	26700	113,286	269000	12900	20000	20500	322400	26700

We want to obtain a weight for each criterion by using the proposed approach. According to Eq.1, normalized matrix data are presented.

Table 2. Normalized Data

Size	Visibility	Rich Files	Scholar
0,040	0,014	0,501	0,040
0,000	0,043	1,000	0,000
1,000	1,000	0,517	1,000
0,872	0,055	0,000	0,872
0,732	0,000	0,098	0,732

The evaluations of these five alternatives according to the previously stated criteria, i.e., evaluation matrix, are displayed in Table 3.

Table 3. Normalized Data

Size	Visibility	Rich Files	Scholar
0,960	0,986	0,499	0,960
1,000	0,957	0,000	1,000
0,000	0,000	0,483	0,000
0,128	0,945	1,000	0,128
0,268	1,000	0,902	0,268

In our analysis we calculate diversity criteria and the result shows in the table 4.

Table 4. Diversity Criterion

	Size	Visibility	Rich File	Scholar
	-0,665112338	-0,683290598	-0,345859551	-0,665112338
	-0,693147181	-0,663312374	0	-0,693147181
	0	0	-0,334805162	0
	-0,088681645	-0,654732445	-0,693147181	-0,088681645
	-0,185945385	-0,693147181	-0,625181204	-0,185945385
E(C) = ln(2) *total sum	0,471151465	0,777463336	0,576787486	0,471151465
d = 1-E(C)	0,528849	0,222537	0,423213	0,528849

The final rank of each criterion by using the entropy weighted method can be seen in table 5. The obtained values of criterion Size, visibility, rich files, and scholar are 0,310458; 0,130639; 0,248445; and 0,310458 respectively.

We see that the rank of size and scholar are just better than the rank of rich file and visibility. Therefore, size locates at rank 1. Other criteria can be ranked in the same way. For problems with more complexity, with a small program (for example Excel) we can determine the rank of each criterion. In the last Table 5, the rank of each criterion can be seen.

Table 5. Weight of Criterion

Criteria	Weight (W) = d/total
Size	0,310458
Visibility	0,130639
Rich File	0,248445
Scholar	0,310458

Conclusion

There are several methods for obtaining the weights of criteria of an MADM problem, one of which is the entropy method. How to ascertain weights and subjectivity of evaluation model are the main aspects which influence evaluation result in the present quantitative evaluation methods. During ascertaining weights, either subjectivity can't be avoided, or calculation is too complex. On the other hand, subjectivity can't be avoided in some evaluation methods. based on entropy weight can avoid not only subjectivity or complex calculation in ascertaining weights but also subjectivity of evaluation model via the evaluation criteria of weighted relative adjacent degree. Entropy weighted method is a new advancement in quantitative evaluation methods for webometrics.

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