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International Journal of Electrical and Computer Engineering: a bibliometric analysis

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ABSTRACT

This study is focused on analyzing seven years of bibliometric data of the International Journal of Electrical and Computer Engineering (IJECE) from 2014 to 2020. The analysis of 2,928 papers exhibits multi-folded growth of 34.25%, rising from 109 articles in 2014 to 638 articles by 2020. In addition, the analysis of the structure of publications as well as the mapping of bibliographic data based on co-citation, bibliographic coupling, and co-occurrence showed the intellectual structure and connection between universities, countries, and contributing authors. As the journal's first retrospective, this study not only educates and enriches IJECE's global readership and aspiring contributors, but may also be useful to its editorial board, as it provides several inputs for navigating future research.

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1. INTRODUCTION

The International Journal of Electrical and Computer Engineering (IJECE) started its on-line publication in September 2011 and currently has more than 3,400 documents indexed in the Scopus database from 2014 to 2021. IJECE is an official publication of the Institute of Advanced Engineering and Science (IAES). The IJECE is open to submission from scholars and experts in the wide areas of electrical, electronics, instrumentation, control, telecommunication and computer engineering.

According to the journal's website, it aims is to provide an international forum for scientists and engineers to share research and ideas, and to promote the crucial field of electrical and power engineering, circuits and electronics, power electronics and drives, automation, instrumentation and control engineering, digital signal, image and video processing, telecommunication system and technology, computer science and information technology, internet of things, big data and cloud computing, and artificial intelligence (AI) and soft computing. It is currently in the 65th quartile in the area of computer science journals, ranking #76 out of a total of 221 journals reported by Scopus, and 51st in engineering journals, ranking #327 out of 670 in total. Its CiteScore for May 2020 was 2.3 as shown in Figure 1, which means that articles published by IJECE since 2016 and up to 2019 have received on average 2.3 citations in 2020. Its source normalized impact per paper (SNIP) score of 1.059, a field-normalized evaluation of journal impact, indicates that IJECE articles received 1.059 citations each from journals specifically in the fields of computer science and engineering.

Many other metrics can be performed to provide more in-depth information about IJECE. According to "Scimago Journal and Country Rank", the h-index [1] of IJECE is 19, however by analyzing more deeply the updated data from the Scopus database, it can be determined that by 2020 the h-index [1], [2] of IJECE was 23, which means that 23 IJECE articles have at least 23 citations as shown in Figure 2.

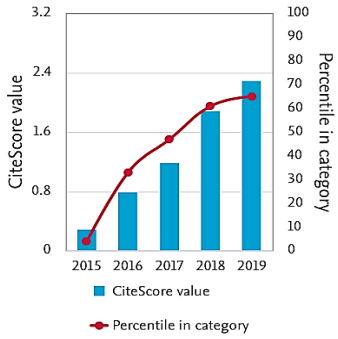

Figure 1. IJECE's impact on scientific production measured in the CiteScore value and the percentile in the category [3]

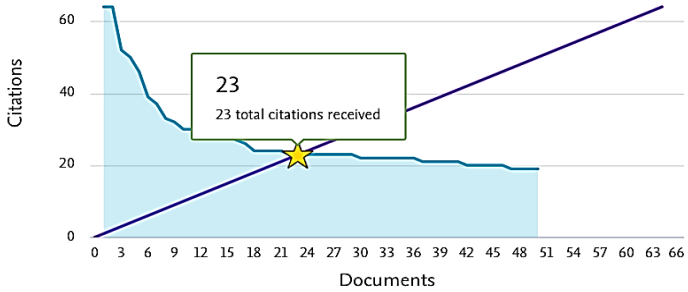

Figure 2. IJECE's h-index based on the number of documents cited [3]

The aim of our study is to provide a comprehensive analysis of IJECE by means of bibliographic analysis. It examines the journal's publishing activity in terms of annual publication, contributing authors and their institutions and affiliated countries. An analysis of the annual citation structure of the IJECE is also given, as well as the citing authors and their institutions and affiliated countries. Lastly, the study provides content and inter-temporal analyses to identify the main emphasis of the IJECE over time.

2. RESEARCH METHOD

The study of bibliographic data by means of statistical and numerical tools is called bibliometrics. The concept was developed by [4]. Bibliometrics can be used to determine the intellectual structure of a scientific discipline using quantitative methods [5]. In the present study, tools such as bibliographic coupling [6], [7], co-occurrences of authors' keywords and co-authorship analysis will be used to perform a retrospective analysis of IJECE. Bibliometric indicators are used to represent bibliographic data such as total number of articles and citations [8] with which the productivity and influence of authors can be measured. Other metrics such as citations per article and authors' h-index combine publications and citations.

The analysis of the Scopus database, analyzing IJECE in first quarter of 2021, has obtained a total of 3,207 records, after filtering for the 2014-2020 window (in order to analyze the growth of the journal), the base has been updated for 2,928 article records with which the entire analysis is developed. The bibliometric analysis is performed with tools such as Bibliometrix R-Package [9], Biblioshiny [10], and VOSviewer [11] to analyze the literature.

3. RESULTS AND DISCUSSION

3.1. IJECE publication and citation trends

Taking into account the results of the Scopus database, IJECE has published 2,928 articles between 2014 and 2020 (7 years), we can see how the number of articles published per year has increased from 109 in 2014 to more than 600 in 2020 (by April 2021, 279 new articles had already been reported, so we can accept that the trend is maintained), as shown in Figure 3. The number of issues per year has remained at six during all years of analysis. Table 1 lists the authors with the highest number of IJECE articles. This table ranks the top 20 authors publishing in IJECE between 2014 and 2020. It also shows the total number of IJECE

published articles (NP), the total number of citations of these articles (TC), the h-index, and the g-index [12]. The g-index, introduced as an enhancement to the h-index, measures the overall citation performance of a series of articles. The top countries in the scientific production of IJECE articles are Malaysia, India, Indonesia, Morocco and Iraq as shown in Figure 4. The lines represent the collaboration between countries that will be analyzed. Table 2 shows citations of IJECE articles where the 20 most cited articles worldwide are shown. The two most cited articles have 64 citations (TC). The data in Table 2 allow us to calculate the h-index of the journal, which had previously been determined at 23.

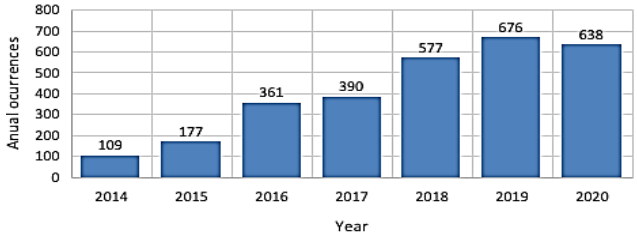

Figure 3. Distribution of IJECE articles between 2014 and 2020

Table 1. Top IJECE authors between 2014 and 2020

Autor	h-index	g-index	TC	NP
Sutikno, T.	8	13	210	28
Latrach, M.	5	8	88	19
Zbitou, J.	4	5	50	16
Errkik, A.	5	6	59	14
Rahim, Mka	5	5	48	14
Zakaria, Z.	8	9	99	13
Abdullah, Ar	4	7	64	10
Belfqih, A.	4	5	38	10
Boukherouaa, J.	4	5	38	10
Loan, Ntp.	1	1	1	10
Majid, Ha	3	5	33	10
Nikolovski, S.	3	5	31	10
Tajmouati, A.	3	5	38	10
Ali, Ah	4	6	47	9
Anh, Ndq.	1	1	1	9
Jiménez-Moreno, R.	3	3	18	9
Jung, H.	2	2	12	9
Ahmad, Na	3	5	25	8
Bri, S.	3	4	28	8
Hoyos, FE.	3	5	27	8

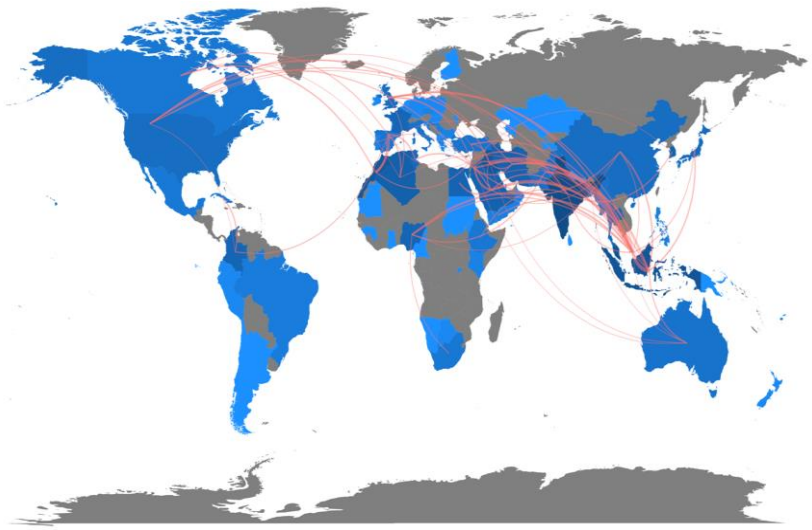

Figure 4. Top countries affiliated with IJECE authors between 2014 and 2020, and collaboration trends

Table 2. Annual number of IJECE citations of documents between 2014 and 2021

Authors and Reference	2017	2018	2019	2020	2021	TC
Ramya and Yuvaraja [13]	0	11	53	0	0	64
Hore, Chakraborty, and others [14]	11	18	9	17	9	64
Abdar, Kalhori, Sutikno, and others [15]	8	8	15	12	7	52
Ghorbani and Mokhtari [16]	5	11	14	8	3	50
Sutikno, Handayani, and others [17]	0	10	15	16	5	46
Dabbaghjamanesh, Moeini, and others [18]	8	11	6	1	2	39
Jyothi, Muni, Lalitha [19]	4	7	17	8	1	37
Gunawan, Yaldi, and others [20]	0	8	13	7	5	33
Navulur, Sastry, Giri Prasad [21]	0	7	9	13	3	32
Corno, Montanaro, and others [22]	0	6	11	8	5	30
Dixit and Nagaria [23]	0	2	7	16	5	30
Rghioui and Oumnad [24]	0	12	11	3	4	30
Subiyakto, Ahlan, and others [25]	3	7	14	2	1	30
Hariguna and Berlilana [26]	1	3	20	4	1	29
Bagheri and Shaltooki [27]	5	6	5	3	1	28
Salkuti [28]	0	5	11	9	2	27
Ramkiran, Madhav, and others [29]	3	8	11	3	0	26
Prakash, Darshaun, and others [30]	0	1	7	8	8	24
Wiharto, Kusnanto, and Herianto [31]	2	7	5	7	3	24
Iswanto, Wahyunggoro, and Cahyadi [32]	6	3	3	4	1	24

3.2. Keyword co-occurrence and co-authorship analysis

Figure 5 provides an oversight of the co-occurrence network of the keywords reported by the authors in the articles. The database contains a total of 10,670 keywords. For the analysis it has been determined that the minimum number of occurrences of a keyword is 10 to be considered in the co-occurrence network, this gives a total of 104 keywords to be considered in a total of 7 clusters. The dominant keywords in this network as represented by the size of the nodes are machine learning (66) followed by cloud computing (62), classification (53), and optimization (51).

It is widely believed that scientific collaboration has become a more dominant feature of scientific research activity in most countries. This trend is evident when looking at the affiliations and geographical location of co-authors of scientific publications [33]. Figure 6 shows the co-authorship network that has been generated with the countries of the authors affiliated to the IJECE. The size of the circle represents the number of co-authorship links for each country, i.e., the larger the circle, the more links that country has. The most frequent collaborations are between authors from Malaysia, Indonesia, and Iraq (analyzed by the thickness of the links). Very important collaborations are observed between authors from India and those from Asian nations. Some of IJECE's most outstanding areas of research involve Malaysia and Indonesia.

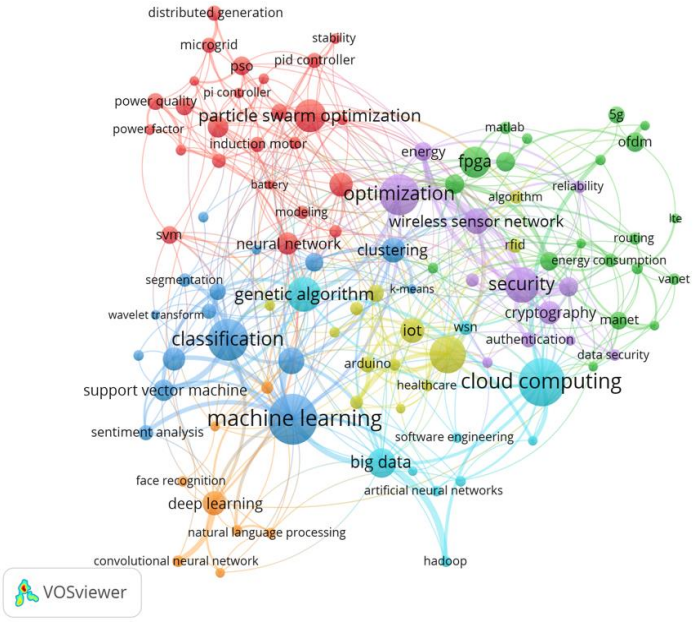

Figure 5. Author keyword network of IJECE articles

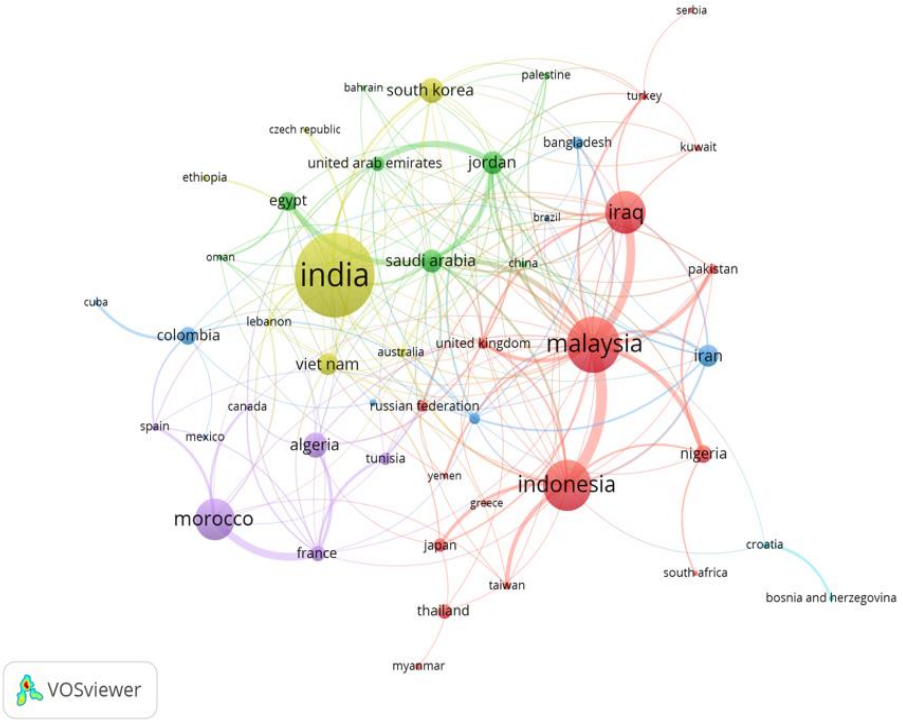

Figure 6. Co-authorship network among countries with IJECE authors

3.3. Inter-institutional cooperation in scientific production

Scientific collaboration between different institutions during 2014-2020 has been highest in Malaysia, India and Indonesia as shown in Figure 7. In general, the incidence of international collaboration is higher than national inter-institutional collaboration. However, it is possible to observe that larger countries in terms of scientific output also have higher rates of national collaboration. Figure 7 illustrates the scientific collaboration between the different institutions and countries, also taking into account the co-occurrences of author keywords in a three-field graph, or Sankey diagrams [34].

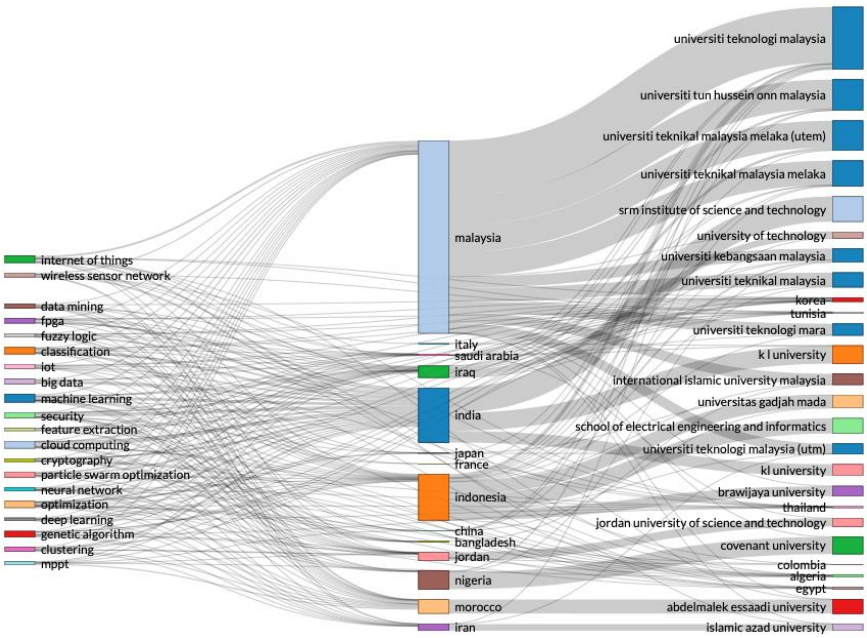

Figure 7. Three fields plot with author keywords (left), countries (center) and institution (right)

4. CONCLUSION

This study provides an overview of the evolution of IJECE between 2014 and 2020. It provides information on publication activity, citation trends, top topics, and the status of collaboration among IJECE contributors. Co-authorship analysis reveals that the majority of co-authorships involve authors from Malaysia. A cluster analysis reveals 7 clusters, of which about 80% of the articles appear in the first three clusters. Each cluster has a common theme. For example, articles in the largest cluster focus on the study of computational algorithms. The articles in the second largest cluster focus on research in cloud computing and big data analysis. IJECE articles cover a wide range of topics, such as machine learning, classification algorithms, cloud computing, genetic algorithms, optimization, clustering algorithms and security. However, a very important cluster focused on electrical and electronic engineering can be found, with a significant contribution in power electronics, power quality and electrical machines. Although the range of publication topics has expanded significantly since its inception, IJECE has not lost sight of its original mission: to act as a forum for the exchange of advances and generation of new knowledge in the field of electrical engineering and computing. IJECE continues to fulfill that mission.

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