Citation Metrics and Evaluation of Journals and Conferences

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Abstract

Citation analysis aims at evaluating the published scientific manuscripts, their authors, and the publication venues (journals/conferences). There are several popular metrics for measuring the impact of the journals, the Impact Factor being the most popular. Similarly, the H-index is a popular metric for evaluating and ranking conferences. We have presented a review of metrics for citation analysis, categorized according to their applicability for evaluating journals and conferences. The citation metrics may also be categorized as popularity measuring and prestige measuring. Prestige measuring indicators like SCImago Journal Rank and Eigenfactor have already gained popularity for evaluating journals. We discuss their role in evaluating the conferences. Indeed, some conferences have already started mentioning their prestige score in terms of the SJR of their conference proceedings.

We also propose a Normalized Immediacy Index (II_{norm}), a variant of the Immediacy Index (II), to measure the immediate relevance of articles published in a journal/conference. It is shown that the proposed metric can be used for immediacy relevance comparison irrespective of the publication schedule of the articles. Spearman correlation was run to determine the relationship between the values of the proposed II_{norm} and traditional metrics (H-index for conferences, IF for journals). A strong, positive monotonic correlation was observed between II_{norm} and H-index ($r_s = .67$, $n = 17$, $p < .01$) for conferences and between II_{norm} and IF ($r_s = .65$, $n = 20$, $p < .01$) for journals.

Keywords

citation metrics, bibliometrics, scientometrics, publication ranking, venue evaluation, conference, journal

1 Introduction

The research community is often required to evaluate the quality of research publications for which citations of the publications provide an important input. In the early days of evaluating the journals, the number of citations of a journal was considered an indicator of the quality metric of a journal. However, such an indicator needed to be used with caution as it had the potential of eliminating some small but important speciality journals[1].

While developing a new Science Citation Index (SCI) in the early 1960s, Eugene Garfield and Irving H. Sher needed an unbiased mechanism to identify the journals to be included in the SCI. So, they proposed Impact Factor (IF)—a citation-based metric, unbiased by the number of publications in a journal[1]. Since then, several citation-based metric have been developed, for example, H-index[2], and PageRank-based measures such as Eigenfactor (EF)[3] and SCImago Journal Rank (SJR)[4].

1.1 Citation Metrics

Citation metrics have been used in making important academic decisions regarding the allocation of research grants, shortlisting of subscriptions in a library, award of academic tenure, selection of speakers in conferences, and so on[5]. Given such high importance of the citation metrics, they must be robust, unbiased, and transparent[6].

Since different metrics may result in different rankings for the same publication venue (journal or conference), it is crucial to understand the characteristics of the citation metrics. For instance, a citation metric may be based on popularity (citation frequency) or prestige (reputation). The popularity of an article is measured as a function of how often other articles cite the article. The citation metrics measuring the popularity of a publication venue or an author, like IF, H-index, and citation count, weigh all the citations equally, irrespective of the prestige of the publication venue/author. On the other hand, citation metrics that measure prestige, such as SJR[4] and EF[3], recursively weigh the citations with the prestige of the citing publication venue/author.

Furthermore, a citation metric usually considers the citations of the articles published within a specific window of time (called *citation window*) during another window of time called the *census period*. Different citation metrics may allow different citation windows. A two-year IF allows the census period of one year and the citation window of the previous two years. On the other hand, EF allows the citation window of the previous five years.

1.2 Objectives of the Paper

The paper presents some widely known bibliographic databases (Section 3) used for citation analysis. The evaluation metrics and indexes offered by these databases are also outlined. After that, we present a review of the citation metrics (Section 4) for evaluating the conferences and journals.

In the context of conferences, we discuss the prevalent citation metrics like the H-index, directly reflective of the publication popularity (in terms of citation count), along with prestige-based metrics like EF and SJR. Furthermore, we discuss the applicability of prestige-based metrics for evaluating the conferences in the context of SJR values for conferences that have become popular in recent years.

In the present work, we propose a Normalized Immediacy Index (II_{norm}), a citation metric for evaluating publication venues (Section 5), that is shown to standardize and improve the Immediacy Index (II), an existing instantaneous year indicator for immediacy relevance. The immediacy relevance of a venue, a measure of how quickly the articles published at a venue are cited, is of value in identifying the most relevant venues in cutting-edge disciplines. Immediacy relevance value can also help in recognizing the quality of the latest venues.

In summary, the contributions of this paper are as follows:

- It presents some of the well known bibliographic databases (Section 3).
- It reviews citation metrics for evaluating the conferences and journals (Section 4).
- It discusses the relevance of prestige-based metrics, such as EF and SJR, for evaluating the conferences (Section 4.4.2).
- It proposes and validates a novel citation metric, Normalized Immediacy Index (II_{norm}), a standardized annual metric for evaluating the immediacy relevance of publication venues (Section 5).

2 Background and Related Studies

There have been several reviews of the use of indicators in research evaluation. Some of them including Van Raan[7], Moed[8,9], Adams[10], Abramo and D'Angelo[11], Wouters et al.[12], are focused on comparing the peer review with the bibliometric indicators for evaluating articles. Nicolaisen[13], Bornmann and Daniel[14] review the theories and studies of citing behaviour. Alonso et al.[15], Panaretos and Malesios[16], Egghe[17], Norris and Oppenheim[18] provide literature reviews on H-index and related metrics. Vinkler[19], Agarwal et al.[5] offer an overview of scientometric indicators for research evaluation. Mingers and Leydesdorff[20] provide a review of the field of scientometrics and bibliometrics as a whole. Wildgaard et al.[21] review the literature on citation metrics for evaluating the performance of researchers. In their book, Cronin and Sugimoto[22] provide a multifaceted picture of the current state of bibliometric research encompassing the history of the field, ethical issues, development of altmetric methods, and description of advanced methodologies for mapping and evaluating research. Kousha and Thelwall[23], Rijcke et al.[24], Thelwall and Kousha[25,26] present reviews on effects of the use of indicators in research evaluation. Waltman[27] is a review of the literature on citation impact indicators and bibliographic databases. Haunschild[28], O'Gara[29] analyse the problems and benefits of Google Scholar and Google Books as well as the download counts and social web impact metrics. Karanatsiou et al.[30] present a study of the evolution of research from bibliometrics to altmetrics. In a recent review of the basic concepts of citations and validity of citations as performance measures, Aksnes et al.[31] argue that although citations reflect the impact and relevance of research, they may be of little help in other key dimensions of research quality like solidity/plausibility, originality, and societal value. Glänzel and Chi[32] explore the possibility of comparing the social media metrics to other alternate metrics and bibliometric indicators.

3 Databases and Indexing

Jeyasekar and Saravanan[33] define a *bibliographic database* as "a database of bibliographic records, an organized digital collection of references to published literature". A *citation index* is a bibliographic database that indexes citations between articles, allowing the user to establish the citing and the cited documents.

In 1960, Eugene Garfield's Institute for Scientific Information (ISI) was the first to introduce the Science Citation Index (SCI) for scientific publications. The first automated citation indexing was done by CiteSeerX[34] (earlier known as CiteSeer) in 1997[35]. Citation indexes can be helpful in evaluating the importance of an article in terms of the frequency with which the article is cited in the literature and the context of the citations.

In the context of a journal, being represented in the relevant indexing service may allow increased visibility, readership, and ultimately reputability as a reliable source in the field of research[35]. In this section, we present some of the popular citation databases[36] including Web of Science, Scopus, Google Scholar, Microsoft Academic, and ArnetMiner.

3.1 Web of Science

Web of Science (WoS), produced initially by ISI and now owned by Clarivate Analytics, is a subscription-based collection of online citation indexes. WoS core collection publishes the Journal Citation Report (JCR) annually to provide information about scientific literature and citation metrics to rank and evaluate journals. The metrics include Impact Factor (Section 4.2.1), Cited Half-life[37], Citing Half-life[37], Immediacy Index (Section 3.1.1), Eigenfactor score (Section 4.2.2), and H-index (Section 4.4.1)— based on the depth of years of the subscription[37].

Citation indexes published by Clarivate Analytics include Science Citation Index Expanded (SCIE), Science Citation Index (SCI) (integrated with SCIE since 2020), Specialty Citation Indexes, Social Sciences Citation Index, Arts and Humanities Citation Index, Book Citation Index (BCI, BKCI), Conference Proceedings Citation Index (CPCI), Data Citation Index, Chinese Science Citation Database, Russian Science Citation Index, KCI Korean Journal Database, SciELO Citation Index, BIOSIS Citation Index, and Emerging Sources Citation Index (ESCI).

3.1.1 Immediacy Index

The Immediacy Index (II) measures the immediate relevance of the articles published in a venue. The metric may help in identifying venues specializing in cutting-edge research[38]. The II metric is computed as the average number of citations received by an article in the year it is published.

Let $\mathtt{n}^{\mathtt{m}}$ be the number of articles published by a venue in month $\mathtt{m}$ of a year. Let $\mathtt{C}^{\mathtt{m}}$ be the number of citations accrued in the publication year for the articles published by a venue in month $\mathtt{m}$ of the year. If a conference does not publish an issue in a month $\mathtt{i}$, $\mathtt{n}^{\mathtt{i}}=0$, $\mathtt{C}^{\mathtt{i}}=0$. The II for a venue, say A, in a given year, is computed as,

$$II(A) = \frac{\sum_{\mathtt{m}=1}^{12} \mathtt{C}^{\mathtt{m}}}{\sum_{\mathtt{m}=1}^{12} \mathtt{n}^{\mathtt{m}}}$$

When calculating the II values, since an article published early in the year has a better chance of being cited than the one published later in the year, a venue that publishes infrequently or late in the year can have a low II value.

3.2 Elsevier Scopus

Launched in 2004 by Elsevier, Scopus is a subscription-based abstract and citation database. Scopus indexes peer-reviewed articles as well as web sources in the fields of Science, Technology, Medicine, Social Sciences, and Arts and Humanities. Titles in several non-English titles are included, and English translations of the abstracts are provided with these articles. The metrics based on the Scopus database to measure the impact of a journal are SCImago Journal Rank (SJR) (Section 4.2.3), CiteScore metrics ([39]), and Source-normalized Indicator (SNIP)[40]. The metrics, except the CiteScore Tracker (one of the CiteScore metrics), are computed annually and are accessible free of charge. Scopus also calculates the H-index for authors[5].

3.3 Google Scholar

Google Scholar is a freely accessible online search engine that covers scholarly literature from academic publishers, preprint repositories, universities and other web sites. Google Scholar automatically computes an author's H-index, number of citations, and $I10$-index values. The $I10$-index, introduced in 2011, is defined as the number of papers with at least 10 citations.

3.3.1 Google Scholar Metrics

Google Scholar Metrics (GSM)[41], available since 2012[42], is a free of charge bibliometric tool. The metrics are calculated based on the citations received by the articles indexed in Google Scholar as of June 2017, including the citations from articles that are not themselves covered by Scholar Metrics. The metrics included in GSM are $H5$-index, $H5$-core, and $H5$-median.

$H5$-index calculates the H-index value by considering only those articles that have been published in the last 5 years. The H-core of an author/venue with h as the H-index value is the set of top-cited h articles. For example, an author with five publications $\{A, B, C, D, E\}$ cited by, respectively, 10, 7, 4, 3, and 2 articles, has the H-index of 3 and H-core set is $\{A, B, C\}$. The H-median of an author/venue is the median of the citation counts for the articles in its H-core. In the above example, the author's H-core set is $\{A, B, C\}$ and the citation counts of the articles in the set are $\{10, 7, 4\}$. Thus, the H-median value of the author is 7.

3.4 Microsoft Academic

Launched as Windows Live Academic Search in 2006, Microsoft Academic[43] provided a free academic search engine and citation index. Microsoft Academic published the ranking, the number of citations, and the H-index of authors, conferences, journals, and affiliations. In the early years, Microsoft Academic developed and maintained a citation metric called Field Rating[44]. According to Effendy and Yap[45], the Field Rating citation metric was similar to the H-index. Microsoft Academic was discontinued in 2021.

3.5 AMiner

Arnetminer, known as AMiner since 2012, is a free online service, first launched in 2006, to index and search academic and social networks. It automatically extracts researcher profiles and articles from online digital libraries. AMiner ranks the conferences and journals[46] based on (i) H-index, (ii) Rising Index, (iii) $TK5$-index, (iv) Basic Research Creativity Index, and (v) Applied Research Creativity Index. Rising Index evaluates the uptrend in the yearly citations received by a venue. Out of the top 100 articles (in terms of the citations received) published by a venue in the last five years, those with decreasing yearly citations are pruned. The Rising Index is the $H5$-index value of the filtered set[46]. For the top 10 citation articles of a conference/journal in the past five years, the $TK5$ value is the H-index of all the citing articles[46]. The median value of the 10 $TK5$ values defines the $TK5$-index value for the venue. Basic Research Creativity Index for a venue is computed based on all the articles published in the last five years. Of these articles, only the articles where the organization of the first author is an academic institution are considered. The average citation value of these articles is the Basic Research Creativity Index value for the venue. Applied Research Creativity Index is computed similarly, except that the articles where the first author works for industrial institutions or companies are considered.

4 Evaluation and Ranking Metrics

Citation metrics may be used to evaluate/rank venues (journals or conferences), researchers, countries, or institutions. Table 1 outlines the differences and similarities between the popular metrics. Citation analysis is the most common basis for evaluating the popularity and quality of a publication venue. One

Table 1. Popular citation metrics

Citation Metric	Data Source	Self-citation	Accessibility	Applicability	Type	Citation Window
IF	WOS	Includes	Subscription access	Journals	Popularity, Average	2 years
Cited Half-life	WOS	Includes	Subscription access	Journals	Popularity	-
Citing Half-life	WOS	Includes	Subscription access	Journals	Popularity	1 year
Immediacy Index	WOS	Includes	Subscription access	Journals	Popularity, Average	1 year
EF	WOS	Excludes	Open access	Journals, Conferences	Prestige, PageRank-based	5 years
SJR	Scopus	Limits journal self-citation to max of 33 %	Open access	All publications	Prestige, PageRank-based	3 years
CiteScore Metrics	Scopus	Includes	Open access	All publications	-	3 years
SNIP	Scopus	Includes	Open access	All publications	Popularity, Average	3 years
LiveSHINE	Google Scholar	Includes	Open access	Conferences	Popularity	-
GSM	Google Scholar	Includes	Open access	All publications	Popularity	-
Saliency	Microsoft Academic Graph	-	Open access	Conferences, Journals, Researchers, Organizations	Prestige	-
ArnetMiner Rankings	AMiner	-	Open access	Conferences, Researchers, Organizations	Popularity	-
H-index	-	Includes	Open access	Journals, Conferences, Researchers, Organizations	Popularity, Average	-
CORE Ranking	CORE	-	Open access	Conferences	Popularity	-
ABDC	ERA	Includes	Open access	Journals	Popularity	-

measure of the quality of a venue is the citations received from its published articles. Another approach for evaluating the quality of publication venues is to consult specialists in a given scientific field. However, the cost of consulting and collecting the opinion of a large number of specialists is exceptionally high. Also, venues for dynamic fields often cease to exist, and the quality of a venue may frequently change[47].

4.1 Evaluation of Journals

To this date, journals have always been the venue of prestige for publications. For researchers, the number of articles published in journals of high prestige is an essential factor in their career advancement. Therefore, evaluating the quality of academic journals continues to be necessary within the context of research performance evaluation.

In today's time, authors search for indexed journals to publish their articles, possibly a side-effect of organizations considering the number and ranking of the indexing services covering that journal as one of the indicators for evaluating the quality of the journal[35].

4.2 Metrics to Evaluate Journals

Since the introduction of the IF (Section 4.2.1) in the 1960s, many citation metrics have been developed to rank the academic journals including Cited Half-life[37], Citing Half-life[37], II (Section 3.1.1), EF (Section 4.2.2), SJR (Section 4.2.3), SNIP[40], H-index (Section 4.4.1), CORE ranking[48], and ABDC ranking[49].

4.2.1 Impact Factor

Impact Factor (IF), computed annually since 1975, is a widely accepted metric, possibly because it is the oldest and is simple to compute and comprehend. The IF value indicates the average number of times the articles in a journal published during the citation window (2 years) have been cited, during the census period, in other journal articles. For example,

$$\text{JIF for 2018 for Journal J} = \frac{\text{\# citations in 2018 to articles published in J in 2016-2017}}{\text{\# articles published in journal J in 2016-2017}}$$

As IF is based purely on citations the articles received, all citations are at par, ignoring the quality of the citing venue. Nevertheless, the journals with higher IF values also have higher visibility[50]. However, the IF metric, an average of the articles published in a journal over a year, provides summary information without saying anything about individual articles or authors[50]. Therefore, one may question the relevance of IF in assessing the quality of the researcher's publications.

The IF computation is influenced by self-citations (citing one's work), although from time to time, the journal citation report (JCR) tries to eliminate journals that include excessive self-citations[50]. Further, JCR mainly analyses English-language articles. Also, domains where citations typically accrue after a few years cannot gather high IF values. Moreover, the IF calculation may contain a citation in the numerator for which there is no corresponding value in the denominator[51]. In the calculation, whereas the numerator takes every citation to a journal's content from the previous two years, regardless of the article type, considering even news and views called as front matter[51], the denominator covers only those articles that fall under the category of primary research articles or review articles, as designated in WoS database[52].

4.2.2 Eigenfactor Score

Eigenfactor (EF) was proposed in 2007 by Bergstrom[3] to provide the research community with a free searchable database of EF scores for the journals covered in JCR[53]. EF scores are not available for conferences. Currently, EF scores are available up to 2015. EF uses a PageRank-based approach to measure the overall impact of a journal on scholarly literature[3], giving more weight to journals that are cited more often by influential journals. The influence of a journal is distributed amongst its citations to correct the citation differences across disciplines and to account for journals with high citation trends. That is, if a journal A cites an article from another journal B, then[3],

$$\text{Weight of citation} = \frac{\text{Influence of journal A}}{\text{\# citations appearing in journal A}}$$

A citation of a review article that cites many articles weighs less than a citation from a research article. EF value uses a one-year census period. It uses the five previous years for the citation window. That is, the EF score ensures that the disciplines that are slow to accrue the citations are not at a disadvantage[53]. Computation of EF[54] removes self-citations and therefore avoids an over-inflated measure value for the journals with high self-citations[55]. EF score can be applied to journals, conferences, authors, institutions, and articles. EF scores are scaled such that the sum of the EF scores for all the journals in JCR is 100. The value of the EF score for journals shows a high correlation to the total number of citations received by the journal[56].

4.2.3 SCImago Journal Rank

SCImago Journal Rank (SJR) was developed in 2007 by the SCImago research group[4] at the University of Granada in collaboration with Elsevier. SJR values are calculated yearly for journals indexed in Elsevier's Scopus citation database and are accessible free of charge. The SJR algorithm calculates the metric value of a journal, say J, through an iterative process of transferring the prestige from all the other journals included in the citation network. The amount of prestige of a journal (say K) transferred to another journal (say J) depends on the percentage of citations during the past three years, of the journal K, to the articles of journal J published in the past three years.

In the SJR computation, the denominator includes all the articles. Since article types such as correspondence articles, letters to the editor, commentaries, perspectives, news, obituaries, editorials, interviews, and tributes are primarily insignificant in terms of the number of citations received, including them in the denominator may underestimate the quality of interesting/good journals that publish a large number of such articles[57]. As SJR weighs citations depending on the prestige of the citing journal, the SJR index accounts for both the quantity and quality of citations.

Guerrero-Bote and Moya-Anegón[58] proposed the SJR2 metric as an improvement over the SJR metric. SJR2 weighs the citations based on the journal's prestige and the thematic closeness of the cited journal. The closeness of journals is measured using the co-citation count of the journals, ensuring that prestige transfer between the citing journal and the cited journal is more significant when the journals are closer thematically. Recently, SJR scores have been made available for conference proceedings also.

4.3 Evaluation of Conferences

Conference proceedings have been organized periodically for many decades, with the oldest founded in the late 1960s, endorsed by established international scientific associations like the Association for Computing Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), and Association for the Advancement of Artificial Intelligence (AAAI)[59].

In specific disciplines, like Computer Science and Information Technology, the rate of innovation is high, and the researchers prefer to report their results promptly. In these domains, conferences are considered a more suitable form of publication than journals which typically have a longer turnaround time for article publication[60]. Conference articles in Computer Science and Information Technology are usually submitted as full papers and undergo a comprehensive peer-review evaluation. Many leading conferences have a high rejection rate, and the published articles capture the attention of the research community[60], despite the accepted conference submissions having the associated costs of registering, often requiring participation in the conference. Further, a conference article must adhere to the limit on the number of pages specified by the conference[61]. In other disciplines, conference articles are usually extended abstracts that are not peer-reviewed and do not attract much critical attention from the research community[60]. Despite these differences, during an assessment of researchers from multiple disciplines, conference articles may be excluded, putting researchers in the fields of Computer Science and Information Technology at a disadvantage relative to their peers in other disciplines[60].

Additionally, many conference articles are cited in top-quality journals. Eckmann et al.[61] considered high-quality journals and conferences in the Computer Vision sub-field of Computer Science. They found that 30% of the articles in the top three Computer Vision journals based their work on top three conference articles by the same authors[61]. Eckmann et al.[61] called these conference articles as “priors”. The authors[61] found that the journal articles based on priors were significantly more cited than the other articles.

It is interesting to note that the two leading database conferences— ACM Special Interest Group on Management of Data (SIGMOD) and Very Large Data Bases (VLDB) conference, have a substantially higher citation impact than the three prominent Database journals— ACM Transactions on Database Systems (TODS), The VLDB Journal (VLDBJ), and ACM Special Interest Group on Management of Data of the Association for Computing Machinery (Sigmod Record), in terms of the total number of citations and also for the two-year and five-year citation impact[62]. Chen and Konstan[63] concluded that conferences are an essential archival venue and that the conferences with acceptance rates of 30% or less can be considered to have an impact comparable to the journals. Therefore, the essence of the conferences and journals is different. Conferences should not be compared with journals merely based on the acceptance rate or the number of citations[64]. Indeed, objectively assessing the performance and impact of conferences is vital.

4.4 Metrics to Evaluate Conferences

The popular criterion used in evaluating the quality of conferences includes analysing the impact of articles through citation count, submission and acceptance rates, article quality, and other impact measures like the number of highly cited articles, sponsorship, the age of the conference, and the characteristics of the program committee members. H-index (Section 4.4.1) is a popular bibliometric quality indicator for conferences.

Other metrics used for evaluating the quality of conferences include II index (Section 3.1.1), CORE ranking[48], Aminer ranking (Section 3.5), and Microsoft Academic rankings (Section 3.4). SJR (Section 4.2.3), a PageRank-based measure, has been recently introduced as a conference ranking and evaluation measure.

4.4.1 H-index

Hirsch's index (H-index)[2] is a popular citation metric that can be used to measure the impact of an author, conference, or journal. H-index was proposed in 2005 by Jorge Hirsch, a physicist at the University of California. Calculation of the H-index requires sorting the publications for an author/venue in decreasing order of citations. H-index value is h if the publication at rank h has at least h citations and publications with rank greater than h have less than h citations[2]. Thus, the computation of the H-index gives equal weight to the top h papers. The total number of citations for the author/venue will normally be much larger than h^2. Also, the H-index value has an upper limit as the number of published articles[42].

Since the total number of citations earned by an author/venue cannot decrease with time, the H-index value can never decrease. Thus, young researchers with fewer published articles but with a high number of citations for each article are at a disadvantage with respect to their H-index compared to the older researchers. Computation of the H-index value ignores the individual contribution of the authors giving equal credit to all the authors of an article. Hirsch suggested that a large variation in the number of co-authors can be circumvented by normalizing the H-index value by the average number of co-authors[65]. H-index score may be inflated due to self-citations. Further, since research output and citation patterns vary from one discipline to another, the H-index cannot be used to compare researchers across disciplines.

4.4.2 PageRank-based Metrics for Evaluating Conferences

PageRank-based metrics like SJR and EF have proven successful in ranking journals. While the H-index remains a popular measure for evaluating conferences, the PageRank-based metric, SJR (Section 4.2.3), has also become available to evaluate conferences.

We do not seek to conduct a user study here since the goodness of venues is subjective. Instead, we test if EF and SJR can produce ranking results comparable to some known methods.

To test the strength of PageRank-based metrics for conference evaluation, we ran EF[53] and SJR2[58] algorithms on the citation dataset (source: AMiner[46]) for the year 2014 containing 2,244,021 articles and 4,354,534 citations. Each article is associated with an index number, abstract, authors, year, venue, and citations. Each publication venue is assigned a unique ID. Noise in the form of differing names for the same venue was removed. For example, conference AAAI was mentioned as AAAI (1) and AAAI (2). Such venues received the same venue ID. Data clean-up was followed by the extraction of references, year, and publication venue information for each article. Next, a citation network of conferences in the dataset was created. The conferences are ranked using EF, SJR2, Google scholar $H5$-index, Microsoft (MS) Academic (earlier known as MS Field Rating), and ArnetMiner (2014) scores (Table 2).

Ranks assigned to the top data mining conferences by PageRank-based measures (EF, SJR) are compared against other metrics using Spearman rank correlation coefficient at 1% significance level, and their positive rank order relationship is seen in five out of six cases (Table 3).

It is noted that the top seven rankings generated by EF values are the same as that of MS Field Rating. WWW, SIGKDD, SIGIR, and VLDB conferences are among the top five in most rankings. Indeed, most of the top 20 conferences are included in all the rankings, although with differing ranks.

It can be concluded that the evaluation of conferences (in the field of data mining) using the EF and SJR metrics is commensurable with some of the well known citation metrics.

In the present work, we focused on conferences in the field of Data Mining for two reasons. First, this is a mature and active area of Computer Science research. Second, the author's familiarity with the area has been valuable when selecting conferences and independently verifying the results. The list of top 20 conferences includes conferences like SIGKDD and VLDB, where Data Mining results are heavily published.

Table 2. Ranks of Data Mining conferences based on different citation metrics (2014 snapshot). EF and SJR2 values are calculated using the citation dataset (source: AMiner[46]) for the year 2014

Metric / Rank	Eigenfactor (EF)	SCImago Journal Rank (SJR2)	Arnet Miner	Google Scholar H-5 Index	MS Field Rating
1	Very Large Data Bases (VLDB)	PODS	WWW	WWW	VLDB
2	Special Interest Group in Information Retrieval (SIGIR)	VLDB	SIGKDD	VLDB	SIGIR
3	Special Interest Group on Knowledge Discovery and Data Mining (SIGKDD)	DMKD	WSDM	SIGKDD	SIGKDD
4	World Wide Web (WWW)	ICDT	SIGIR	WSDM	WWW
5	International Conference on Data Engineering (ICDE)	SIGIR	ICDE	SIGIR	ICDE
6	Symposium on Principles of Database Systems (PODS)	Data Warehousing and OLAP (DOLAP)	CIKM	ICDE	PODS
7	Conference on Information and Knowledge Management (CIKM)	ICDE	ICDM	CIKM	CIKM
8	Symposium On Applied Computing (SAC)	SSDBM	EDBT	ICDM	EDBT
9	International Conference on Data Mining (ICDM)	SSTD	SIAM International Conference on Data Mining (SDM)	SAC	ICDT
10	Data Mining and Knowledge Discovery (DMKD)	SIGKDD	ECIR	Extended Semantic Web Conference (ESWC)	ER
11	Intelligent Data Engineering and Automated Learning (IDEAL)	IDEAL	PODS	SDM	ECML/PKDD
12	Extending Database Technology (EDBT)	Discovery Science (DS)	Conference on Innovative Data Systems Research (CIDR)	EDBT	SDM
13	Database and Expert Systems Applications (DEXA)	WWW	ISWC	DMKD	ISWC
14	International Conference on Database Theory (ICDT)	ICDM	ESWC	CIDR	SAC
15	International Semantic Web Conference (ISWC)	Data Warehousing and Knowledge Discovery (DaWaK)	ICDT	Advances in Social Network Analysis and Mining (ASONAM)	DEXA
16	Scientific and Statistical Database Management (SSDBM)	ISMIS	ER	Mobile Data Management (MDM)	SSDBM
17	ER: Conceptual Modeling (ER)	SAC	MDM	ICDT	PAKDD
18	Web Search and Data Mining (WSDM)	CIKM	SSDBM	PAKDD	CIDR
19	Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD)	ISWC	Asia-Pacific Web Conference (APWeb)	ER	DMKD
20	International Symposium on Methodologies for Intelligent Systems (ISMIS)	European Conference on Information Retrieval (ECIR)	SSTD	Database Systems for Advanced Applications (DASFAA)	ISMIS

Table 3. Spearman coefficient values/p-values for the ranks in Table 2

Citation Metric	Eigenfactor (EF)	Scimago Journal Rank (SJR 2)
Arnet Miner	0.5248/0.002	0.1733/0.3511
Google Scholar H-5 Index	0.6746/2.3E-05	0.5094/0.0034
MS Field Rating	0.5976/0.0003	0.4211/0.0183

5 Proposed Normalized Immediacy Index

In this article, we propose a Normalized Immediacy Index (II_{norm}), taking into account a month-based citation window that applies to a publication venue (journal or conference). The citations are counted for the articles published by a venue within a year after publication.

5.1 Motivation for the Proposal

The computation of the II index (Section 3.1.1) for a journal/conference tends to be biased towards the venues that publish early during the year. Compared to the venues publishing later in the same year, venues publishing earlier in the year get more time to be cited. Also, while an annual journal may be published in January, another journal may be published quarterly. For example, while Connection Science Journal is published annually in January, the Big Data Research Journal is usually published quarterly in March, July, September, and December. While the International Conference on Data Mining (ICDM) is held annually in November, the International Conference on Mobile Data Management (MDM) is held in June. Let us consider a hypothetical example for ease of calculations. If a venue, say A, published 20 articles in January 2020 and received 30 citations in the year, its II value is 1.5. For another venue, say B, that published 20 articles in November 2020 and received 4 citations in the year, its II is 0.2. In this example, although the II values indicate that the articles published by venue A have greater immediate relevance than those published by venue B, the difference may be due to differing citation accumulation duration. Venue A accumulates citations for almost the entire year, while venue B has only two months in the year to earn citations.

Since different months of publications in the same year may have systematically different citation distributions[66], as opposed to the conventional year-based citation windows, we propose a Normalized Immediacy Index (II_{norm}) based on month-based citation window. By counting the number of citations to publications within 12 months after publication, the proposed metric obviates the bias (introduced by the month of publication of an article) that plagues the II index while also allowing comparison of venues irrespective of their publication timeline. The proposed index can provide a useful perspective for comparing journals/conferences specializing in cutting-edge research. Because it is a per-article average, like the II, the proposed II_{norm} tends to discount the advantage of large venues over small ones. However, unlike the II index, frequently issued journals and venues published early in the year do not have an advantage.

Table 4. Computed values for the proposed II_{norm}, H-index, and II (rounded off to 2 decimal places) for conferences under consideration. For n^m articles published by a conference in month m of a year, C^m is the number of citations in the same year and C^m_{norm} is the number of citations in 12 months subsequent to month m.

SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
1	Congress on Evolutionary Computation (CEC)	IEEE	70 [67]	2014 (7)	438	8	90	0.02	0.21
				2015 (5)	452	41	93	0.09	0.21
				2016 (7)	702	34	147	0.05	0.21
				2017 (6)	359	24	77	0.07	0.21
				2018 (7)	343	15	75	0.04	0.22
				2019 (6)	443	26	92	0.06	0.21
				2020 (7)	423	18	130	0.04	0.31
2	International Conference on Information and Knowledge Management (CIKM)	ACM	127 [68]	2014 (11)	270	13	252	0.05	0.93
				2015 (10)	243	11	232	0.05	0.95
				2016 (10)	327	29	251	0.09	0.77
				2017 (11)	350	13	374	0.04	1.07
				2018 (10)	313	12	265	0.04	0.85
				2019 (11)	394	20	435	0.05	1.1
				2020 (10)	494	36	648	0.07	1.31
3	Extended Semantic Web Conference (ESWC)	Springer	31 [67]	2014 (5)	142	0	0	0	0
				2015 (5)	113	0	0	0	0
				2016 (5)	115	0	1	0	0.01
				2017 (5)	108	1	1	0.01	0.01
				2018 (6)	111	1	2	0.01	0.02
				2019 (6)	89	0	0	0	0
				2020 (5)	88	0	0	0	0

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SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
4	Genetic and Evolutionary Computation Conference (GECCO)	ACM	38 [67]	2014 (7)	409	34	244	0.08	0.6
				2015 (7)	414	69	271	0.17	0.65
				2016 (7)	375	59	280	0.16	0.75
				2017 (7)	497	60	357	0.12	0.72
				2018 (7)	503	71	345	0.14	0.69
				2019 (7)	545	81	365	0.15	0.67
				2020 (7)	435	80	360	0.18	0.83
5	International Conference on Data Engineering (ICDE)	IEEE	148 [68]	2014 (4)	135	38	53	0.28	0.39
				2015 (4)	164	83	116	0.51	0.71
				2016 (5)	212	55	128	0.26	0.6
				2017 (4)	233	68	103	0.29	0.44
				2018 (4)	263	56	89	0.21	0.34
				2019 (4)	268	78	118	0.29	0.44
				2020 (4)	241	82	152	0.34	0.63
6	International Conference on Data Mining (ICDM)	IEEE	126 [68]	2014(12)	159	0	97	0	0.61
				2015 (11)	165	1	84	0.01	0.51
				2016 (12)	211	0	138	0	0.65
				2017 (11)	182	1	112	0.01	0.62
				2018 (11)	220	2	131	0.01	0.6
				2019 (11)	196	9	95	0.05	0.48
				2020 (11)	310	4	98	0.01	0.32
7	International Conference on Tools with Artificial Intelligence (ICTAI)	IEEE	42 [68]	2014 (11)	144	0	31	0	0.22
				2015 (11)	147	0	30	0	0.2
				2016 (11)	155	2	46	0.01	0.3

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SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2017 (11)	187	0	30	0	0.16
				2018 (11)	151	0	34	0	0.23
				2019 (11)	265	1	45	0	0.17
				2020 (11)	188	2	20	0.01	0.11
8	International Semantic Web Conference (ISWC)	Springer	37[67]	2014 (10)	105	2	17	0.02	0.16
				2015 (10)	104	5	66	0.05	0.63
				2016 (10)	111	2	68	0.02	0.61
				2017 (10)	126	5	64	0.04	0.51
				2018 (10)	80	0	0	0	0
				2019 (10)	74	0	0	0	0
				2020 (11)	102	2	26	0.02	0.25
9	International Conference on Mobile Data Management (MDM)	IEEE	45[68]	2014 (7)	69	4	10	0.06	0.14
				2015 (6)	76	8	18	0.11	0.24
				2016 (6)	75	10	23	0.13	0.31
				2017 (5)	60	2	4	0.03	0.07
				2018 (6)	45	9	21	0.2	0.47
				2019 (6)	104	6	15	0.06	0.14
				2020 (6)	61	6	17	0.1	0.28
10	Symposium on Principles of Database Systems (PODS)	ACM	82[68]	2014 (6)	36	8	27	0.22	0.75
				2015 (5)	53	23	28	0.43	0.53
				2016 (6)	54	18	51	0.33	0.94
				2017 (5)	63	28	71	0.44	1.13
				2018 (6)	64	17	25	0.27	0.39
				2019 (6)	62	3	27	0.05	0.44

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SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2020 (6)	49	18	41	0.37	0.84
11	Symposium on Applied Computing (SAC)	ACM	70[68]	2014 (3)	317	25	30	0.08	0.09
				2015 (4)	367	51	99	0.14	0.27
				2016 (4)	383	70	106	0.18	0.28
				2017 (4)	302	70	111	0.23	0.37
				2018 (4)	308	82	138	0.27	0.45
				2019 (4)	351	73	120	0.21	0.34
				2020 (3)	303	61	84	0.2	0.28
12	SIAM International Conference on Data Mining (SDM)	SIAM	33[67]	2014 (4)	120	17	27	0.14	0.22
				2015 (4)	110	24	51	0.22	0.46
				2016 (5)	98	18	65	0.18	0.66
				2017 (4)	95	33	58	0.35	0.61
				2018 (5)	86	26	58	0.3	0.67
				2019 (5)	90	26	54	0.29	0.6
				2020 (5)	75	27	41	0.36	0.55
13	Special Interest Group in Information Retrieval (SIGIR)	ACM	106[68]	2014 (7)	229	38	129	0.17	0.56
				2015 (8)	201	42	245	0.21	1.22
				2016 (7)	233	76	195	0.33	0.84
				2017 (8)	255	113	450	0.44	1.76
				2018 (7)	251	100	270	0.4	1.08
				2019 (7)	262	67	472	0.26	1.8
				2020 (7)	382	101	780	0.26	2.04
14	International Conference on Knowledge Discovery and Data	ACM	185[68]	2014 (8)	220	21	326	0.1	1.48
				2015 (8)	253	40	259	0.16	1.02

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SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
	Mining (SIGKDD)			2016 (8)	235	42	387	0.18	1.65
				2017 (8)	232	41	378	0.18	1.63
				2018 (8)	310	76	560	0.25	1.81
				2019 (8)	374	86	609	0.23	1.63
				2020 (8)	421	90	481	0.21	1.14
15	Scientific and Statistical Database Management (SSDBM)	ACM	33[68]	2014 (7)	48	3	25	0.06	0.52
				2015 (6)	39	21	36	0.54	0.92
				2016 (7)	28	6	16	0.21	0.57
				2017 (6)	42	5	13	0.12	0.31
				2018 (7)	33	0	8	0	0.24
				2019 (7)	27	2	7	0.07	0.26
				2020 (7)	32	3	5	0.09	0.16
16	International Conference on Web Search and Data Mining (WSDM)	ACM	54[67]	2014 (2)	80	34	51	0.42	0.64
				2015 (2)	64	73	90	1.14	1.41
				2016 (2)	94	80	100	0.85	1.06
				2017 (2)	104	143	180	1.38	1.73
				2018 (2)	115	161	223	1.4	1.94
				2019 (2)	121	125	170	1.03	1.4
				2020 (2)	130	142	154	1.09	1.18
17	International World Wide Web Conference (WWW)	ACM	80[67]	2014 (4)	87	37	88	0.43	1.01
				2015 (5)	130	83	181	0.64	1.39
				2016 (4)	126	108	182	0.86	1.44
				2017 (4)	168	200	290	1.19	1.73
				2018 (4)	192	159	263	0.83	1.37

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SN	Conference	Publisher	H-index	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2019 (5)	392	201	443	0.51	1.13
				2020 (4)	321	215	327	0.67	1.02

Table 5. Computed values for the proposed II_{norm}, IF, II (rounded off to 2 decimal places) for journals under consideration. The definitions of m, n^m, C^m, and C^m_{norm} are as given in Table 4.

SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
1	Applied Soft Computing (ASOC)	Elsevier	8.26[69]	2014 (1-12)	497	136	395	0.27	0.79
				2015 (1-12)	654	265	701	0.41	1.07
				2016 (1-12)	596	288	782	0.48	1.31
				2017 (1-12)	620	351	1136	0.57	1.83
				2018 (1-12)	712	529	1427	0.74	2
				2019 (1-12)	696	505	1363	0.73	1.96
				2020 (1-12)	834	875	2734	1.05	3.28
2	Big Data Research (BDR)	Elsevier	3.74[70]	2014 (8)	28	2	10	0.07	0.36
				2015 (3,6,9,12)	42	12	44	0.29	1.05
				2016 (4,6,9,12)	44	1	32	0.02	0.73
				2017 (3,7,9,12)	56	2	40	0.04	0.71
				2018 (3,7,9,12)	50	9	57	0.18	1.14
				2019 (3,7,9,12)	26	1	25	0.04	0.96
				2020 (3,9,12)	92	0	61	0	0.66
3	Big Data	Mary	4.43[71]	2014 (3,6,9,12)	64	4	12	0.06	0.19

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SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
		Ann Liebert		2015 (3,6,9,12)	56	2	23	0.04	0.41
				2016 (3,6,9,12)	56	6	13	0.11	0.23
				2017 (3,6,9,12)	56	4	32	0.07	0.57
				2018 (3,6,9,12)	52	5	17	0.1	0.33
				2019 (3,6,9,12)	54	6	36	0.11	0.67
				2020 (3,6,9,12)	68	1	49	0.01	0.72
4	Computational Intelligence and Neuroscience (CIN)	Hindawi	3.12[72]	2014 (1)	186	0	18	0	0.1
				2015 (1)	332	10	75	0.03	0.23
				2016 (1)	336	4	135	0.01	0.4
				2017 (1)	270	4	100	0.01	0.37
				2018 (1)	294	12	207	0.04	0.7
				2019 (1)	312	10	229	0.03	0.73
				2020 (1)	838	15	265	0.02	0.32
5	Connection Science	Taylor & Francis	NA	2014 (1)	36	6	12	0.17	0.33
				2015 (1)	16	0	6	0	0.38
				2016 (1)	27	4	8	0.15	0.3
				2017 (1)	40	10	23	0.25	0.58
				2018 (1)	18	4	7	0.22	0.39
				2019 (1)	25	2	8	0.08	0.32
				2020 (1)	40	14	68	0.35	1.7
6	Data Science Journal (DSJ)	Ubiquity Press	NA	2014 (1)	34	1	7	0.03	0.21
				2015 (5)	34	1	7	0.03	0.21
				2016 (1)	62	6	29	0.1	0.47
				2017 (1)	81	4	25	0.05	0.31
				2018 (1)	81	5	19	0.06	0.23

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SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2019 (1)	105	4	47	0.04	0.45
				2020 (1)	65	2	67	0.03	1.03
7	Intelligent Data Analysis (IDA)	IOS Press	1.32[73]	2014 (1,2,4,6,7,10,12)	164	3	12	0.02	0.07
				2015 (1,4,6,7,10,12)	170	11	37	0.06	0.22
				2016 (1,2,4,6,7,10,12)	170	15	28	0.09	0.16
				2017 (1,3,4,6,8,10,11)	158	5	17	0.03	0.11
				2018 (2,3,5,6,9,12)	154	6	16	0.04	0.1
				2019 (2,4,6,9-11)	162	7	31	0.04	0.19
				2020 (2,3,5,7,9,12)	164	12	26	0.07	0.16
8	International Journal of Data Mining and Bioinformatics (IJDMB)	Inderscienc	0.34[74]	2014 (2,3,6,8,9,12)	128	3	4	0.02	0.03
				2015 (1-3,5,6,9,10,12)	124	1	2	0.01	0.02
				2016 (2,4-6,8,10,12)	122	4	4	0.03	0.03
				2017 (2,4,5,7,8-12)	114	0	0	0	0
				2018 (1,4,6,8-11)	74	0	0	0	0
				2019 (2-5,7,8)	66	2	2	0.03	0.03
				2020 (2,5-9,11)	41	0	2	0	0.05
9	International Journal of Data Warehousing and Mining (IJDWM)	IGI Global	0.62[75]	2014 (1)	28	0	0	0	0
				2015 (1)	32	4	4	0.12	0.12
				2016 (1)	30	9	9	0.3	0.3
				2017 (1)	32	1	1	0.03	0.03
				2018 (1)	32	1	1	0.03	0.03
				2019 (1)	42	0	0	0	0
				2020 (1)	40	9	12	0.22	0.3
10	International Journal of High Performance	Sage	2.82[76]	2014 (2,5,8,11)	28	4	12	0.14	0.43
				2015 (2,5,8,11)	35	8	15	0.23	0.43

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SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
	Computing Applications (IJHPCA)			2016 (2,5,8,11)	45	7	19	0.16	0.42
				2017 (1,3,5,7,9,11)	35	8	14	0.23	0.4
				2018 (1,3,5)	29	10	15	0.34	0.52
				2019 (1,3,5,7,9,11)	59	16	31	0.27	0.53
				2020 (1,3,5,7,9,11)	41	7	18	0.17	0.44
11	Information Systems Journal (ISJ)	Wiley	7.77[77]	2014 (1,4,6,7,8,12)	20	9	25	0.45	1.25
				2015 (3,5,7,9,11,12)	40	21	40	0.52	1
				2016 (3,5,7,9,11)	29	9	19	0.31	0.66
				2017 (3,5,7,9,11)	34	3	30	0.09	0.88
				2018 (1,3,5,7,9,11)	52	38	66	0.73	1.27
				2019 (1,3,5,7,9,11)	37	26	60	0.7	1.62
				2020 (1,3,5,7,9,11)	36	35	83	0.97	2.31
12	Journal of Artificial Intelligence and Soft Research (JAISCR)	Sciendio	2.67[78]	2014 (1,4,7,10)	5	0	3	0	0.6
				2015 (1,4,7,10)	20	1	79	0.05	3.95
				2016 (1,4,7,10)	25	41	95	1.64	3.8
				2017 (1,4,7,10)	25	3	41	0.12	1.64
				2018 (1,4,7,10)	20	5	25	0.25	1.25
				2019 (1,4,7,10)	15	3	43	0.2	2.87
				2020 (1,4,7,10)	20	15	37	0.75	1.85
13	Journal of Big Data (JBD)	Springer	10.84[7]	2014 (1)	8	0	3	0	0.38
				2015 (1)	25	7	36	0.28	1.44
				2016 (1)	26	7	27	0.27	1.04
				2017 (1)	49	8	35	0.16	0.71
				2018 (1)	53	12	68	0.23	1.28
				2019 (1)	113	85	302	0.75	2.67

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SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2020 (1)	111	64	228	0.58	2.05
14	Journal of Information Science (JIS)	Sage	2.46[80]	2014 (2,4,6,8,10,12)	63	6	30	0.1	0.48
				2015 (2,4,6,8,10,12)	67	7	41	0.1	0.61
				2016 (2,4,6,8,10,12)	87	31	54	0.36	0.62
				2017 (2,4,6,8,10,12)	36	7	13	0.19	0.36
				2018 (2,4,6,8,10,12)	58	2	17	0.03	0.29
				2019 (2,4,6,8,10,12)	54	7	11	0.13	0.2
				2020 (2,4,6,8,10,12)	26	6	15	0.23	0.58
15	Journal of Knowledge Management (JKM)	Emerald Publishing	8.69[81]	2014 (2,4,5,7,9,10)	134	2	12	0.01	0.09
				2015 (2,4,5,7,9,10)	140	4	34	0.03	0.24
				2016 (2,4,5,7,9,10)	154	9	40	0.06	0.26
				2017 (2,4,5,7,9,10)	96	33	170	0.34	1.77
				2018 (1,3-7,9,10)	180	39	98	0.22	0.54
				2019 (1,4-6,8,9,11,12)	185	65	270	0.35	1.46
				2020 (1,3,5,6,8,9,11)	180	146	560	0.81	3.11
16	Journal of Management Information Systems (JMIS)	Taylor & Francis	7.58[82]	2014 (12)	71	27	167	0.38	2.35
				2015 (3,4,7,8,12)	58	7	28	0.12	0.48
				2016 (4,6,10,12)	44	5	41	0.11	0.93
				2017 (2,4,8,11)	47	35	63	0.74	1.34
				2018 (1,3,5,10,12)	56	29	85	0.52	1.52
				2019 (3,6,8,10)	47	14	57	0.3	1.21
				2020 (3,6,11,12)	46	16	87	0.35	1.89
17	Social Network Analysis and Mining (SNAM)	Springer	3.87[83]	2014 (12)	86	5	24	0.06	0.28
				2015 (12)	73	11	25	0.15	0.34
				2016 (12)	107	11	41	0.1	0.38

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SN	Journal	Publisher	IF	Publication Year (month)	$\sum_{m=1}^{12} n^m$	$\sum_{m=1}^{12} C^m$	$\sum_{m=1}^{12} C^m_{norm}$	II	II_{norm}
				2017 (12)	60	10	33	0.17	0.55
				2018 (12)	65	26	49	0.4	0.75
				2019 (12)	70	10	101	0.14	1.44
				2020 (12)	87	42	103	0.48	1.18
18	Transactions on Intelligent Systems and Technology (TIST)	ACM	4.65[84]	2014 (4,9,12)	116	19	58	0.16	0.5
				2015 (3,5,8,10)	138	27	64	0.2	0.46
				2016 (1,4,7,10)	150	30	82	0.2	0.55
				2017 (1,4,7,9,10)	140	41	74	0.29	0.53
				2018 (1,2,7,11,12)	130	20	48	0.15	0.37
				2019 (1,2,5,8,11,12)	144	29	89	0.2	0.62
				2020 (2,3,5,7,9,11)	154	21	69	0.14	0.45
19	VLDB Journal (VLDB)	Springer	4.24[85]	2014 (2,4,6,8,10,12)	26	6	18	0.23	0.69
				2015 (2,4,6,8,10,12)	43	6	21	0.14	0.49
				2016 (2,4,6,8,10,12)	35	11	17	0.31	0.49
				2017 (2,4,6,8,10,12)	40	11	41	0.28	1.02
				2018 (2,4,6,8,10,12)	41	9	17	0.22	0.41
				2019 (2,4,6,8,10,12)	59	15	68	0.25	1.15
				2020 (1,5,7,9,11)	39	7	23	0.18	0.59
20	Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery (WIDM)	Wiley	7.56[86]	2014 (1,3,5,7,9,11)	20	6	11	0.3	0.55
				2015 (1,3,5,7,9,11)	22	8	19	0.36	0.86
				2016 (1,3,5,7,9,11)	14	1	7	0.07	0.5
				2017 (1,3,5,7,9,11)	33	7	22	0.21	0.67
				2018 (1,3,5,7,9,11)	52	29	55	0.56	1.06
				2019 (1,3,5,7,9,11)	44	37	81	0.84	1.84
				2020 (1,3,5,7,9,11)	41	21	56	0.51	1.37

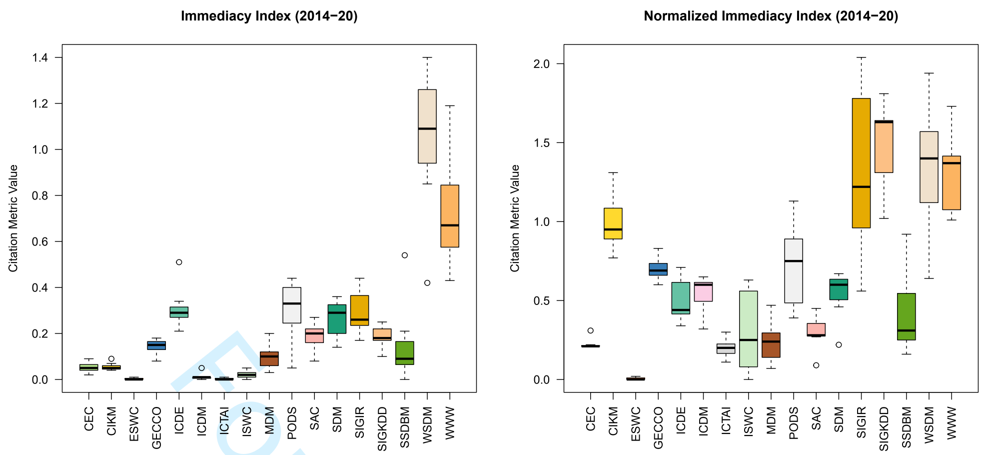

Figure 1. Box plot to compare Immediacy Index (II) and the proposed Normalized Immediacy Index (II_{norm}) values over the years 2014-2020 for conferences. Relative merit and the immediate relevance of the venues are better appreciated using the proposed II_{norm}.

5.2 Definition

Let C^{m}_{norm} be the number of citations in subsequent 12 months for articles published by a venue (say A) in month $\mathtt{m}$ of a year. Let $\mathtt{n}^{\mathtt{m}}$ be the number of articles published by the venue A in the month $\mathtt{m}$. If a venue does not publish an issue in a month $\mathtt{i}$, $\mathtt{n}^{\mathtt{i}}=0$, and $\mathtt{C}^{\mathtt{i}}_{\mathtt{norm}}=0$. The proposed II_{norm} for the venue A is computed as,

$$II_{norm}(A) = \frac{\sum_{\mathtt{m}=1}^{12} \mathtt{C}^{\mathtt{m}}_{\mathtt{norm}}}{\sum_{\mathtt{m}=1}^{12} \mathtt{n}^{\mathtt{m}}}$$

5.3 Immediacy Index vs. Normalized Immediacy Index

To compare the standard Immediacy Index with the proposed Normalised Immediacy Index, we extracted Bibliographic information of each venue for the period 2014 to 2020 from DBLP—an open online database for bibliographic information, on four Computer Science domains, namely, Data Mining, Big Data, Databases, and Evolutionary Computation. The authors' experience in the chosen domains has been an asset when selecting the venues and assessing the results.

Venues with varying publication schedules (publication month and frequency) were included for a wide range of publishers. All the venues included in this study continued to be active after 2020. We included only those venues which published regularly and included bibliographic/DOI information consistently.

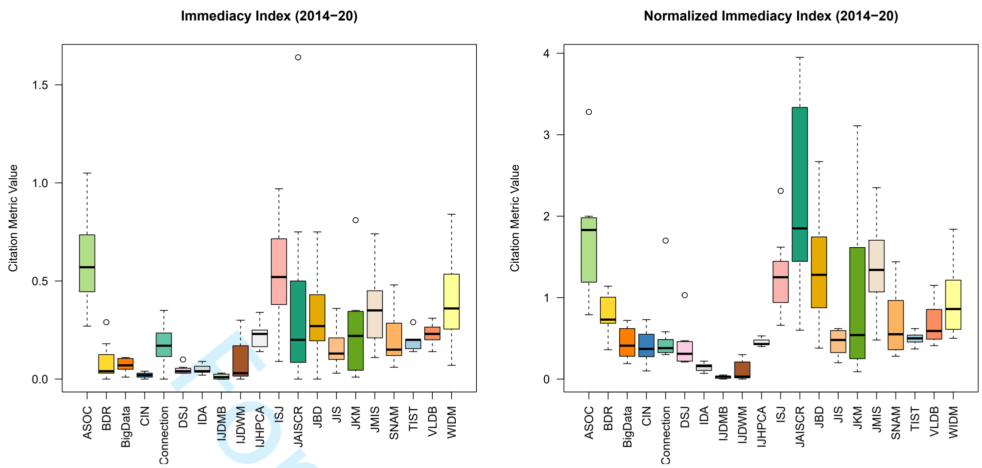

Figure 2. Box plot to compare Immediacy Index (II) and the proposed Normalized Immediacy Index (II_{norm}) values over the years 2014-2020 for journals. Relative merit and the immediate relevance of the venues are better appreciated using the proposed II_{norm}.

A list of 17 conferences (Table 4) and 20 journals (Table 5) was finalized for analysis. We extracted the citations of an article since it became available online.

While the proposed II_{norm} metric is an indicator of the immediate relevance of a venue, traditional metrics like the H-index, IF, and SJR indicate the overall achievement of the venue. The computed values of II and the proposed II_{norm} for the considered conferences and journals along with the values for traditional metrics are shown in Tables 4 and 5 and graphically represented in Figures 1 and 2. Note that whereas the II values favour the venues that publish articles early in the year and frequently issued journals, the proposed II_{norm} values do not show any such trend. Let us illustrate with examples.

CIKM (a conference that releases its proceedings in the month of October) shows a more substantial immediacy relevance as compared to the CEC conference (published in July) when evaluated using the proposed II_{norm} index. The respective H-index values corroborate this observation. However, CIKM and CEC conferences evaluate a similar relative merit according to their II index values. Similar trends are observed for other pairs of venues, such as ICDM and MDM conferences published in November and June respectively, SIGKDD and WSDM conferences published in August and February respectively, and BDR journal that usually publishes its first issue in March and Connection Science journal that is published in January. It is also observed that the WIDM journal (SJR:2.9) publishes more frequently than the JMIS journal (SJR:4.37) and receives a higher II value. However, in tandem with the respective SJR and IF values, II_{norm} assigns a higher immediate relevance to JMIS journal articles.

Table 6. Spearman coefficient values/p-values for the ranks of venues (17 conferences and 20 journals) in Tables 4 and 5

Venue/Citation Metric	II	II_{norm}
Conference/H-index	0.2922/0.2551	0.6685/0.0033
Journal/IF	0.5491/0.0122	0.6476/0.002

A similar observation can be made concerning the ISJ journal, which publishes more frequently than the JBD journal.

We also ranked the venues by the proposed II_{norm} values, and compared the II_{norm} ranking with other rankings such as II, H-index (for conferences), and IF (for journals). We computed Spearman's rank correlation coefficient and carried out the statistical significance test at the 1% level (see Table 6)). Table 6 shows that II_{norm} has a stronger relationship with the well-established H-index (for conferences)/IF (for journals) as compared to II index.
From the above results, it can be seen that the proposed standardized instantaneous year indicator fairly reflects the immediacy relevance. Further, as opposed to II, the proposed II_{norm} shows a strong, positive monotonic correlation with the traditional metrics.

6 Summary and Conclusions

The concept of citations has traditionally linked related articles. Metrics based on citation count have gained considerable prominence for evaluating the quality/impact of a research article, conference, or journal. They also grant the researchers tenure, incentives, and rewards. Using citation metrics to weigh the quality of an article does not rely on a particular expert, removing bias from the process. However, it raises the question of whether one formula for evaluating articles and venues (conferences, journals) fits all.

Since the proposal for measuring the journal impact using the IF, a metric introduced in 1955, many popularity measuring citation metrics like Cited Half-life, Citing Half-life, II, SNIP, and ABDC ranking have become available to evaluate and rank journals. In the last decade, prestige measuring metrics for citation analysis like EF and SJR have become increasingly popular for evaluating journals.

In rapidly growing fields such as Computer Science and Electrical Engineering, peer-reviewed conferences are essential channels for the fast dissemination of research results since their publication process is typically shorter than for journals. Not surprisingly, the last decade has seen a rise in the development of metrics for evaluating the impact of conferences. Many popularity measuring indicators for evaluating conferences include acceptance rate, H-index, CORE ranking, Aminer ranking, and Microsoft Academic rankings. In recent years, the research community has realized the possibility of prestige measuring metrics for evaluating conferences. We find merit in using PageRank-based citation measures to evaluate conferences and find a positive correlation in the prevalent citation-based and PageRank-based metrics— SJR, EF when used for evaluating conferences in Data Mining.

We have reviewed the prevalent citation metrics used to evaluate publication venues (journals, conferences), articles, and researchers. Well known databases and indexes used for citation analysis, along with the bibliometric quality indicators, are outlined.

We propose a Normalized Immediacy Index (II_{norm}), a standardized variant of the II index, to evaluate the immediacy relevance of articles published by a journal/conference. Whereas the II index is computed using the citations earned in the year of publication, the proposed II_{norm} index proposes to count the citations earned by an article for one year by the time of publication as the starting point. Unlike the II index, frequently issued journals and venues published early in the year do not have an advantage. That is, the proposed II_{norm} index indicates how quickly articles published in a venue are cited and can be used for immediacy relevance comparison irrespective of the publication schedule of the articles. The proposed metric can provide a valuable perspective for comparing the venues specializing in cutting-edge research.

It is vital to consider the issues related to the emergence of new publication venues. The prevalent popularity-based metrics such as H-index, IF, and prestige-based metrics such as SJR accumulate the metric score over time and are not the best methods to evaluate a new venue. On the other hand, the immediacy relevance metrics give comparable scores for older and newer venues alike. Since the proposed standardized instantaneous year indicator fairly reflects the immediacy relevance of a venue, we propose that it be applied to evaluate the strength of new publication venues.

Currently, the citation metrics do not consider the sentiment of a citation— whether a paper is cited neutrally, affirms the research, or criticizes it for evaluating an article's impact or popularity. In the future, we propose to work towards sentiment-recognizing citation metrics.

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