Journal of Informetrics 13 (2019) 419–433

Contents lists available at ScienceDirect

Journal of Informetrics

journal homepage: www.elsevier.com/locate/joi

Regular article

Using Scopus's CiteScore for assessing the quality of computer science conferences

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ARTICLE INFO

Article history:
Received 15 October 2018
Received in revised form 5 February 2019
Accepted 10 February 2019

Keywords:
Bibliometrics
Citation analysis
CiteScore
Conference publications
Conference ratings
Conference rankings
Google Scholar Metrics
Impact factor
Microsoft Academic
Publishing
Research assessment
Research evaluation
Scopus

ABSTRACT

Publication, hiring, promotion, tenure, and funding decisions in computer science often depend on an accurate assessment of the quality of conferences. This study reviews relevant literature and tests Scopus's CiteScore database and method for evaluating the quality of 395 conferences in the field.

The study identifies 154 conferences that match the CiteScore ranges of the top quartile journals. These 154 conferences make up 30% of all 515 top quartile publication venues in computer science, confirming the notion that publishing in conference proceedings—especially top rated ones—are as important and influential as publishing in top journals. The CiteScore method as implemented here shows that it is highly effective as a benchmark to evaluate and compare publication venues in computer science. Scopus, however, needs to enhance several of its indexing practices before the CiteScore database and method can become standard tools for conference quality assessment.

1. Introduction

According to the Scopus database—the largest abstract and citation database in the world—more than 60% of computer science papers are published in conference proceedings, compared to 2%, 2.5%, and 9% in health, life, and social sciences, respectively. The review process of major conferences in the field of computer science is rigorous and the work presented in these venues enjoy high visibility and attract large numbers of citations, with the advantage of disseminating ideas and research results more quickly than could be done through journals (Almendra et al., 2015). The fundamental role of conferences in computer science is emphasized in the Best Practices Memo for evaluating computer scientists and engineers for promotion and tenure published in 1999 by the U.S. Computing Research Association.[1] These facts make determining the quality of conferences in which computer scientists publish their work essential because it can help in manuscript submission decisions, as well as decisions related to distribution of funds, evaluation of research proposals, faculty hiring, promotion, and tenure, among others (Freyne, Coyle, Smyth, & Cunningham, 2010; Vrettas & Sanderson, 2015). This task is also important because there is no widely accepted empirical method for evaluating conferences (Almendra et al., 2015).

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[1] https://cra.org/resources/best-practice-memos/.

https://doi.org/10.1016/j.joi.2019.02.006
1751-1577/

Previous attempts at assessing the quality of conferences have relied on two main methods: consultation with subject specialists and application of citation-based metrics. The first method involves collecting and analyzing the opinions of experts in a given field. These exercises generally result in good quality assessments, especially when the number of experts consulted is significant. The experts' domain knowledge and experience provide informed opinions about the quality of conference venues in their fields. Examples of projects that employ this method in computer science, the subject matter of this study, are:

1 CORE (http://www.core.edu.au/), a rating system first developed in 2006 and last updated in 2018 (7th edition) by the Computing Research and Education Association of Australasia where 1505 conferences are classified into A*, A, B, and C; and
2 CCF (http://history.ccf.org.cn/paiming.jsp.htm), a rating system for conferences and journals developed in 2010 and last updated in 2015 (3rd edition) by the China Computer Federation, dividing the venues into 10 subfields and classifying them into three categories: A, B, and C. CCF covers 338 conferences.

One problem with these ratings is that they tend to favor conferences that are more popular among local computer researchers (Li, Rong, Shi, Tang, & Xiong, 2018). In the dynamic field of computer science, new venues are created or cease to exist on a regular basis and the quality of some venues may change frequently, further complicating this method (Martins, Gonçalves, Laender, & Ziviani, 2010). The cost and effort associated with consulting and collecting the opinions of a large number of subject specialists are high (Martins et al., 2010). Finally, such ratings are largely influenced by the manuscript acceptance rate—a good predictor for identifying some but not all top-tier conferences, given that the indicator is hard to obtain or is unreliable for many conferences (Küngas et al., 2013) and is influenced by many variables (Freyne et al., 2010). These aforementioned problems with expert-based rating systems may explain why CCF and CORE omit dozens of top-tier conferences as shown below.

In citation-based methods, researchers have applied various metrics and strategies to measure the quality of conferences. For example, Rahm and Thor (2005) analyzed the citation frequencies in Google Scholar of two main conferences (SIGMOD and VLDB) and three journals (Sigmod Record, ACM Transactions on Database Systems, and VLDB Journal) over a period of 10 years. They found that conference papers had a larger average number of citations than journal papers. Freyne et al. (2010) conducted an analysis of Google Scholar citations of 3258 conference papers and 5506 journal articles from 15 conferences and 15 journals in artificial intelligence and machine learning. They concluded that the impact of papers in top-ranked computer science conferences matches that of papers in middle-ranking journals and is only slightly above the impact of papers in journals in the bottom half of the *Journal Impact Factor* rankings. In contrast, Franceschet (2010) used Web of Science (including the Conference Proceedings Citation Indexes) and found that in computer science the impact of journal publications is significantly higher than that of conference papers. Vrettas and Sanderson (2015) analyzed Google Scholar citations of over 195,000 conference papers and 108,000 computer science journal articles. They found that A* conferences obtained a significantly higher average citation rate than A* journals, while conferences and journals graded A showed no statistical difference, and journals graded B and C had a significantly higher citation impact than conferences with the same rating. In an analysis of over 68,000 software engineering papers covered in Scopus up to year 2014, Garousi and Fernandes (2017) found that on average a journal article in the field is cited 12.6 times and review articles 18.5 times whereas conference papers on average attract only 3.6 citations. Results in these citation-based studies differed greatly due to different methods of analyses and different sources of data (Meho & Rogers, 2008; Meho & Yang, 2007).

In other types of citation-based studies, Zhuang, Elmacioglu, Lee, and Giles (2007) proposed using program committee members' citation characteristics as a proxy for estimating the quality of a conference. In another study, Yan and Lee (2007) considered that in each field there is a set of recognizable papers of good quality (the seeds) and that these highly cited papers can be used to determine the quality of a conference. Martins et al. (2010) used the sum of Conference Impact Factor, the Conference Citation Impact, the Conference Size and the Conference Longevity to compute what they called the Combined Conference Factor. Loizides and Koutsakis (2017) proposed a conference classification approach based on its papers' impact and their authors' h-indexes. All of these proposals have merit but none seems to be universally adopted by the scientific community.

Commercial companies, too, have used citation data to rank conferences. In 2014, Google Scholar introduced its Metrics service, which enables the comparison of journal and conference citation performances.[2] However, the service uses a measure, the h5 index, that is significantly influenced by the size of the venue (Vrettas & Sanderson, 2015), a limitation that also applies to conference rankings provided by Microsoft Academic, which was relaunched in 2016.[3] To conclude, the scientific community still lacks an evaluation tool or method that is as standardized, influential, popular, and easy to use as the Impact Factor is for journals.

In December 2016, Elsevier announced the development of CiteScore, a database and method meant to be used as alternatives to the over-40-year-old Journal Citation Reports database and the Journal Impact Factor method.[4] CiteScore measures

[2] https://scholar.google.com/citations?view_op=top_venues&hl=en.
[3] https://academic.microsoft.com/.
[4] https://www.elsevier.com/editors-update/story/journal-metrics/citescore-a-new-metric-to-help-you-choose-the-right-journal.

Table 1
Main differences between CiteScore database and Journal Citation Reports.

	CiteScore database	Journal Citation Reports
Publishing history	Elsevier, 2016-	Institute for Scientific Information, 1975-1992; Thomson, 1992-2008; Thomson-Reuters, 2008-2017; Clarivate Analytics, 2017-
Publication frequency and venue	Annually (June) + CiteScore Tracker, a monthly release of a provisional calculation via CiteScore list in Scopus	Annually (June-July) via Journal Citation Reports
Data source	Scopus	Journal Citation Reports database which is extracted from Web of Science
Materials covered (2017 edition)	22,337 journals, 551 book series, 292 trade journals, and 180 conferences indexed in Scopus database	11,655 journals indexed in Web of Science database. Does not cover conferences
Materials omitted from 2017 editions of CiteScore and JIF although covered in Scopus and Web of Science	595 journals, 52 book series, 10 trade journals, 2365 conference proceedings indexed individually, and hundreds of conference proceedings published in book series, such as the Lecture Notes in Computer Science	1,345 journals and all conference proceedings indexed individually or within book series, such as the Lecture Notes in Computer Science
Calculation method for each publication venue (using 2017 as an example)	Citations received in 2017 to **ALL** items published in previous three years divided by **ALL** items published in previous three years	Citations received in 2017 to **ALL** items published in previous two years divided by "**citable items**" published in previous two years
Access type	Free	Stand-alone subscription
Number of fields used to classify materials	334	252

the citation impact of journals, conferences, book series, and trade journals covered in the Scopus database (Colledge, James, Azoulay, Meester, & Plume, 2017). The result is a list of publication venues with a CiteScore value for each (we call this the CiteScore database). Table 1 provides a summary of the main differences between the CiteScore database and Journal Citation Reports, which publishes the Journal Impact Factor. For more details on these differences, see Fernandez-Llimos (2018).

This study explores whether CiteScore provides the kind of tool or method the scientific community has been seeking for evaluating the quality of computer science conferences. More specifically, this study addresses three questions:

1 How effective is CiteScore as a tool or method for assessing the quality of computer science conferences? How many and which conferences does CiteScore identify as top-tier and how do they compare with journals in the field?
2 How do CiteScore results for conferences compare with those of expert-based ratings and citation-based rankings?
3 Why do expert-based ratings and citation-based rankings such as Google Scholar Metrics and Microsoft Academic give low grades or do not rate/rank certain top quartile conference venues?

2. Method

Although Scopus indexes thousands of conferences, it provides CiteScore values for only 180 conferences in all subject categories together. This is because Scopus generates CiteScore values for conferences only if the proceedings are indexed, similar to journals, under a single standardized source name. To illustrate, Scopus does not generate a 2017 CiteScore for *ACM SIGCOMM Conference* because the proceedings are indexed in Scopus under different titles (e.g., SIGCOMM 2014 Proceedings of the 2014 ACM Conference on Special Interest Group on Data Communication, SIGCOMM 2015 Proceedings of the. . ., and SIGCOMM 2016 Proceedings of the. . .). Scopus would have automatically generated a CiteScore value for this conference if the proceedings were indexed, for example, under the single name of *Proceedings of the ACM SIGCOMM Conference*. Moreover, Scopus does not provide CiteScore values for hundreds of conferences published in book series, such as the *Lecture Notes in Computer Science*.

Because of the small number of conferences covered by the CiteScore database, it was decided to use as an alternative the CiteScore formula or method (see Table 1) to calculate CiteScore values manually for computer science conferences and assess their relative quality. The 395 computer science conferences examined in this study are:

A The 291 conferences commonly listed on the expert-based rating systems CCF and CORE;
B The 73 "very top" conferences selected by CSRankings[5] in consultation with faculty across a range of institutions (including via community surveys), to rank universities according to their productivity in these "most prestigious" venues. Of these 73 conferences, three were not among those found through method A;

[5] http://csrankings.org/faq.html.

C The 83 top-tier conferences selected by faculty of the Computer Science Department at the Rochester Institute of Technology (RIT hereafter) to "provide guidance to PhD students regarding the unarguably highest quality publication venues."[6] Of these 83 conferences, 7 were not among those found through methods A and B;
D The 149 conferences listed by Google Scholar Metrics among the top 20 publication venues in 22 computer science subfields.[7] Of these 149 conferences, 42 were not among those found through methods A to C;
E The top 100 "computer science" conferences by "h-index" in the latest five-year window, according to Microsoft Academic. Of these 100 conferences, 11 were not among those found through methods A to D; and
F The 151 conferences that each included, according to Scopus, more than one paper among the 2000 most cited in 2014–2016 (out of 620,000 computer science conference papers published in these three years).[8] Of these 151 conferences, 41 were not among those found through methods A to E.

These 395 conference venues include 273 conferences, 87 symposia, and 25 workshops (all referred to hereafter as conferences). To calculate the CiteScore of a conference for the year 2017, the CiteScore formula stipulates that the search is limited to publication years 2014–2016. I, however, extended some of the searches to the year 2013 to account for biennial conferences held in odd-numbered years, and to the year 2017 for those conferences held in 2016 but had their proceedings published in 2017. For biennial conferences, the formula uses the papers of 2013 and 2015 to calculate and report the 2016 CiteScore, and the papers of 2014 and 2016 to calculate and report the 2017 CiteScore.

In October 2018, I carried out individual searches for all 395 conferences in the Source Title and Conference fields of Scopus database. Of these conferences, Scopus either partially covers or does not cover at all the proceedings of 45 conferences. For these 45 venues, I calculated the CiteScore values by identifying the number of papers published in 2014–2016 (via the dblp: computer science bibliography[9] and where necessary through the conferences' websites) and the number of times these papers were cited in 2017 (via Scopus's Secondary Documents database)[10] and then applying the CiteScore formula. For over a dozen highly cited conferences and workshops (e.g., BMVC, CADE, CHES, EMNLP, ICCV, ICCVW, IJCAI, NAACL, RSS, and SOSP), I calculated the 2016 rather than the 2017 CiteScore because these conferences were held in 2013 and 2015 or because the papers of the year 2014 were not covered by the Scopus database. Finally, this work classifies the 395 conferences into 18 subfields, based on categories used by Wainer, Eckmann, Goldenstein, and Rocha (2013) and CSRankings with some minor modifications. For example, instead of keeping them separate, I combined artificial intelligence with machine learning and programming languages with software engineering. I also added categories for computer science education and educational technology.

3. Results and discussion

Vrettas and Sanderson (2015) claim that around 50 computer science conferences are so highly regarded that having a paper accepted is a notable mark of academic success. CCF classifies 49 conferences as top-tier (grade A), CORE includes 67 (grade A*), and, as mentioned earlier, CSRankings considers 73 as very distinguished and RIT lists 83 as top-tier. The four lists together classify as top-tier a total of 117 conferences. These claims and ratings were operationalized in this study as conferences that, if their CiteScores were calculated, would fall into the top quartile venues within their respective subfields.

To identify top quartile computer science conferences through the CiteScore method, I compared the CiteScore of each of the 395 conferences examined in this study with the CiteScore ranges of the 361 top quartile computer science journals covered in the CiteScore database.[11] The results show that the CiteScores of 154 conferences are comparable to those of journals ranked among the top quartile within their respective subfields and 67 are comparable to the top 10% (see Appendix for ranking, rating, and CiteScore information of all conferences).

With 361 computer science journals ranked in the top quartile in the CiteScore database, the 154 top quartile conferences would then constitute 30% of all 515 top publication venues in the field (and the 67 top 10% conferences would make up 32% of all 207 top 10% publication venues). It is noteworthy that the 154 top quartile conferences have slightly higher mean and median CiteScores than those of the 361 top quartile journals (4.45 vs. 4.23 and 3.60 vs. 3.49, respectively). These findings

[6] http://phd.gccis.rit.edu/policies/Top-tier%20Conference%20List.pdf. This is the only official, academic, up-to-date rating list that I was able to find online.
[7] The Google Scholar Metrics subfields used here include: Artificial Intelligence, Bioinformatics & Computational Biology, Computational Linguistics, Computer Graphics, Computer Hardware Design, Computer Networks & Wireless Communication, Computer Security & Cryptography, Computer Vision & Pattern Recognition, Computing Systems, Data Mining & Analysis, Databases & Information Systems, Educational Technology, Human-Computer Interaction, Information Retrieval, Machine Learning, Medical Informatics, Multimedia, Programming Languages, Robotics, Signal Processing, Software Systems, and Theoretical Computer Science.
[8] I limited the number to top 2,000 because that is the maximum number of papers that one can download at a time in Scopus with detailed bibliographic information.
[9] https://dblp.uni-trier.de/.
[10] https://service.elsevier.com/app/answers/detail/a_id/11239/supporthub/scopus/.
[11] Journals included are those listed in Scopus and CiteScore databases under the following 14 sub-subject categories: Artificial Intelligence, Computational Theory and Mathematics, Computer Graphics and Computer-Aided Design, Computer Networks and Communications, Computer Science (miscellaneous), Computer Science Applications, Computer Vision and Pattern Recognition, General Computer Science, Hardware and Architecture, Human-Computer Interaction, Information Systems, Signal Processing, Software, and Theoretical Computer Science.

Table 2
Percent of expert-designated top-tier conferences rated top quartile by CiteScore.

Expert-based rating list	Top-tier conferences on list	% rated among top quartile by CiteScore
CCF (all A conferences)	49	100%
CORE (all A* conferences)	67	82%
CSRankings (all conferences on list)	73	92%
RIT (all conferences on list)	83	84%

Table 3
Extent of agreement between expert-based ratings and CiteScore.

Category	Number of conferences	% rated among top quartile by CiteScore
Top-tier conferences appearing on at least one expert-based list	117	78%
Top-tier conferences appearing on at least two expert-based lists	69	93%
Top-tier conferences appearing on at least three expert-based lists	47	98%
Top-tier conferences appearing on all four expert-based lists	37	100%

confirm that publications in top-tier computer science conferences are as important and highly influential as publications in top-ranked journals. As Freyne et al. (2010) argue, when computer scientists have significant research results to report to the larger scientific community they do so primarily via conferences. Freyne et al. also contend that the role of conferences in computer science is different from that of other disciplines. In computer science, conference papers are usually full papers that go through rigorous peer review processes and in many cases form the only or the main archival publication; in other fields, journal articles fulfill that role. With respect to low impact computer science conferences, Vrettas and Sanderson (2015) suggest that such "venues should be viewed like conferences in any other academic field of study: valuable meeting places for interaction and exchange of ideas" (p. 2683).

The results of this study additionally show that top conferences in certain computer science subfields, such as computer vision and pattern recognition, tend to have higher CiteScores than conferences in other subfields, such as theoretical computer science, with CiteScore medians of around 4.50 vs. 2.50, respectively, among top quartile venues. Accordingly, as in journals, CiteScores of conferences should be compared to one another within the same subfield and not across subfields. For more on the differences in citation rates per paper among various computer science subfields, see Qian, Rong, Jiang, Tang, and Xiong (2017).

To verify whether CiteScore can be considered a valid and reliable conference assessment method, I compared the CiteScore ratings with those of CCF, CORE, CSRankings, and RIT expert-based ratings and where necessary with Google Scholar Metrics and Microsoft Academic. The results show that CiteScore rates among the top quartile 82%–100% of the conferences rated top-tier by experts (see Table 2). Moreover, CiteScore rates among the top quartile 93% of the 69 conferences rated top-tier by two or more expert-based lists and 98% of the 47 conferences rated top-tier by at least three expert-based lists. The percentage increases to 100% when examining the 37 conferences commonly appearing on all four expert lists (see Table 3). In short, CiteScore increasingly corresponds with expert ratings as agreement among the latter increases.

Data gathered for this study showed a number of advantages of the CiteScore method. First, CiteScore unambiguously separates conferences that belong to the top 10% from others within the larger population of top quartile conferences. Such information may be valuable or necessary in publication, hiring, promotion, and tenure decisions. In contrast, CSRankings, RIT, Google Scholar Metrics, and Microsoft Academic list all top-tier conferences together without differentiation between top 10% and top 25%, and CCF and CORE classify conferences into different grades that are not very clear how to translate, operationalize into a standardized measure, or even compare with each other.

Second, CiteScore employs a method that allows it to assess the quality of new conferences, an attribute that expert-based ratings do not offer. This is evidenced by the fact that the average age of the 117 conferences rated top-tier by CCF, CORE, CSRankings and RIT is 31 years (and median age is 30) whereas the average age of the 58 conferences rated top quartile by CiteSore but not rated top-tier by experts is 20 years and the median age is 18. The average age of the 20 conferences rated top-quartile by CiteScore and are not rated at all by experts is 11 years and the median age is 10. In addition, of the 117 conferences rated top-tier by experts, only one is less than 10 years old and seven are less than 15 years old. In contrast, CiteScore rates among the top quartile eight conferences that are less than 10 years old and 30 conferences that are less than 15 years old. In short, CiteScore fills a major gap or weakness in expert-based ratings in providing a method that effectively assesses the quality of new conferences.

Third, CiteScore does not penalize workshops and small conferences as Google Scholar Metrics and Microsoft Academic do (Vrettas & Sanderson, 2015). As shown in Table 4, CiteScore rates among the top quartile 88 of the 149 conferences ranked top by Google Scholar Metrics and 75 of the 100 conferences ranked top by Microsoft Academic. According to Scopus, the

Table 4
Average size of venue per rating/ranking source in terms of published papers.

Conferences rated by	Number of conferences rated top quartile by CiteScore	Average number of papers published in 2014-2016 per venue
Google Scholar Metrics (GSM)	88	472
Microsoft Academic (MSA)	75	499
Expert-based ratings—CCF, CORE, CSRankings, and RIT	117	424
CiteScore	154	328
CiteScore (excluding those rated by CCF, CORE, CSRankings, RIT)	63	179
CiteScore (excluding those rated by GSM & MSA)	53	136

Table 5
Percent of conferences rated/ranked top by type of venue.

Venue type	% rated top-tier by CCF, CORE, CSRankings, and RIT	% ranked top by GSM and MSA	% rated top quartile by CiteScore
Conferences	73%	78%	69%
Symposia	27%	21%	26%
Workshops	0%	1%	5%
Total number of venues	117	112	154

average number of papers published in these 88 and 75 conference venues in 2014–2016 is 472 and 499, respectively, per venue. In contrast, the average number of papers published in conferences rated among the top quartile by CiteScore and are not ranked by Google Scholar Metrics or Microsoft Academic is 136. Similarly, the average number of papers published in 2014–2016 in the 117 conferences rated top-tier by CCF, CORE, CSRankings and RIT is 424 per venue whereas the average number of papers in conferences rated among top quartile by CiteScore and are not rated top-tier by these four expert-based ratings is 179. In short, while expert- and citation-based ratings and rankings of conferences significantly favor large venues, CiteScore, on the other hand, provides equal opportunity for all conferences, symposia, and workshops to feature among the top quartile regardless of their size, presenting the scientific community with a more comprehensive list of highly rated conference venues.

Fourth, related to size, CiteScore gives better opportunities for workshops to feature among the top quartile conference venues. Of the 395 conference venues covered in this study, 25 were workshops—venues that are smaller than both conferences and symposia. None of these 25 workshops were top-rated by any of the expert-based lists and only CVPRW was rated among the top by Google Scholar Metrics. CiteScore, however, identifies eight workshops as belonging to the top quartile (see Table 5).

Fifth, CiteScore can be used to support claims regarding conferences that experts largely agree that they do not belong to top-tier. For example, CCF, CORE, CSRankings, and RIT list 26 top-tier conferences that CiteScore rated below top quartile. When examining these 26 conferences, results show that at least three of the four ranking systems agree with CiteScore that 22 (or 85%) of these 26 venues do not belong to top-tier. These results corroborate the findings of earlier studies that some publication venues are overrated due to the subjective opinions of the judges (Li et al., 2018).

Sixth, the CiteScore method is relatively simple and transparent as it uses an internationally known and straightforward calculation method, fairly similar to that of the Journal Impact Factor. Despite all the criticism, the Journal Impact Factor remains the most popular method for assessing and ranking the quality of journals (Teixeira da Silva & Memon, 2017); there is no reason to suggest that the CiteScore method will not have similar success for conferences. Here it should be emphasized that the Journal Impact Factor method itself might work quite well for conferences as it does with journals, but this is left for future studies.

Seventh, studies based on CiteScore are easy to replicate because the method utilizes readily available data (via Scopus in this case). The process of manually identifying a conference's papers and calculating its CiteScore is simple for individuals with experience in bibliographic and citation searching and with knowledge of citation databases. Periodic quality assessment of conferences is necessary for keeping the CiteScore information up-to-date and for assessing new conferences, especially in the absence of an annual conference assessment tool similar to that of the Journal Citation Reports for journals.

4. Limitations

CiteScore does not take into consideration that different conferences publish different types of documents (e.g., keynote speeches, invited talks, full papers, short papers, extended abstracts, panels, demos, posters, tutorials, doctoral presentations, industry talks, reports, videos, short abstracts) and, therefore, in some cases CiteScore may not be assessing conferences on similar grounds. Conferences that publish too many types of documents that attract few citations (e.g., non-extended abstracts and short demos and posters) and include these documents in the same proceedings' volume with long papers will be at a disadvantage compared to venues that do not publish many of these document types (Ke, Lin, Tsai, & Hu, 2014) if included in the CiteScore calculation. To explore the impact of these different publishing practices among conferences, I used the dblp: computer science bibliography to examine the 2014–2016 tables of contents of the proceedings of all 117 conferences rated top-tier by CCF, CORE, CSRankings, and RIT. Of these 117 venues, seven conferences (ASSETS, HRI, IEEE VR, ICMI, PPoPP, and RE) had their short posters, demos, panels, and tutorials, among others, published in the same proceedings' volumes with the long research-type of papers, all indexed in the Scopus database. These seven conferences would not have been rated top quartile by CiteScore had the CiteScore formula counted these documents. Another limitation of this study is that CCF rates 338 computer science conferences and workshops and CORE does so for 1505 venues. Microsoft Academic covers over 4350 conferences in its database and dblp: computer science bibliography over 5500. This study examined only 395 conferences; however, I believe the various methods used to select these conferences were sufficient to identify and examine the most visible ones.

5. Conclusion

This study explored whether Scopus's CiteScore provides the kind of tool or method the scientific community has been seeking for assessing the quality of computer science conferences. I validated this by comparing CiteScore results with those of expert-based ratings, Google Scholar Metrics, and Microsoft Academic for 395 highly visible conferences. Nearly 78% of the 117 conferences rated top-tier in the four expert-based rating lists were rated top quartile by CiteScore. CiteScore, however, has the added advantage of being able to both identify a significantly larger number of top-rated conferences than listed in expert-based ratings, as well as differentiate between top 10% and top 25% conference venues. The 154 conferences that CiteScore identified as belonging to the top-quartile constitute 30% of all publication venues classified as such, according to the CiteScore database. Moreover, many conference venues are missed or graded/ranked low by expert—based lists and by Google Scholar Metrics and Microsoft Academic because the venues are either relatively young in age or are small in size. In contrast, CiteScore provides equal opportunity for all conferences, symposia, and workshops to feature among the top-tier regardless of their size or age (as long as they are at least four years old). Finally, CiteScore uses simple, transparent, and internationally known calculation methods, and studies based on this new method are very easy to replicate. In short, all indicators analyzed in this study show that Scopus's CiteScore can be considered an effective method for evaluating the quality of conferences in computer science.

In addition to being able to address a few of the limitations of various existing conference assessment tools and techniques, the CiteScore method provides evidence that top conferences are as good as or have as high research impact as top journals in the field. While the computer science community realizes this fact, the broader scientific community may not realize that there are this high number of quality conferences. For emphasis, the most comprehensive expert-based rating list used in this study included 83 top-tier conference venues and all four expert-based rating lists used here together included only 117 venues. Through CiteScore, I was able to identify 67 conferences that had CiteScore values equivalent to those of the top 10% journals in the field and 154 conferences equivalent to the top quartile journals. At the minimum, the results of this study will initiate discussion among computer scientists about the validity of the CiteScore method in assessing the quality of conferences in the field and about extending their coverage of top-tier conferences without disproportionate effort, which is the case when it comes to expert-based ratings. The results of this study will also raise questions about publishing practices among conference sponsors who publish their research and non-research types of papers in the same volume which may lead to lower CiteScore values in comparison to conferences that do not mix these two types of papers together in the same volume.

Given that CiteScore is based on citations and reduces quality of a publication venue to a single figure, it is up to the academic community to decide whether to adopt CiteScore as a method to assess the quality of conference venues and use its results as a tool to make more informed publication, hiring, promotion, tenure, and funding decisions. Despite all of its advantages and strengths, CiteScore does not replace expert-based ratings, but it can serve as an effective complementary method to support expert-based judgment.

Manually generating CiteScore values for conferences can be time-consuming. For the CiteScore database and method to be embraced as standard complementary sources for assessing the quality of conferences in computer science and other similar fields, Scopus, which covers thousands of conferences, has to make several enhancements on its platform:

1) Index each conference venue under its own single, standardized name rather than splitting it into separate entries for each year the conference took place. (The current approach confounds the software that generates the CiteScores and each conference is ignored as a one-off publication.)
2) Develop a mechanism to allow identifying and calculating the CiteScores of conferences published in journal special issues and book series, such as the *Lecture Notes in Computer Science, Advances in Intelligent Systems and Computing, ACM International Conference Proceeding Series, Lecture Notes in Electrical Engineering,* and *Procedia Computer Science*. If not done, the CiteScore database will overlook hundreds of conferences.
3) Provide complete and consistent coverage of conference proceedings to allow uninterrupted updates of CiteScore values for these important publication venues.
4) Add conference frequency information in the Scopus and CiteScore databases to distinguish between annual and biennial conferences.
5) Use more categories in describing the many different types of documents published in proceedings. Currently, Scopus uses "editorial" for indexing keynote speeches and/or invited talks, "conference review" for indexing the preface and

editor's summary of the proceedings, and "conference paper" for indexing all of the following document types and more: full papers, short papers, extended abstracts, panels, demos, posters, tutorials, doctoral symposia, and industry talks. The current Scopus indexing method penalizes those conferences that publish many document types that attract little or no citations.

Finally, future studies may investigate whether results would be different if the Impact Factor formula in Web of Science was used, instead of CiteScore, in assessing the quality of computer science conferences. Future studies may also consider evaluating conferences, symposia, and workshops in other fields, such as electrical and computer engineering.

Author contributions

Lokman I. Meho: Conceived and designed the analysis, Collected the data, Contributed data or analysis tools, Performed the analysis, Wrote the paper, Other contribution.

Acknowledgement

The author would like to thank the editor, the anonymous reviewers, Debora Shaw, and Kiduk Yang for their valuable comments and suggestions.

Appendix A

CiteScores of the top 10% and top 25% computer science conferences by subfield

Included in this table are all 49 conferences rated A by CCF and the 67 rated A* by CORE, as well as all 73 and 83 conferences included on CSRankings and RIT lists, respectively. GSM = Google Scholar Metrics (ranking in subfield as recorded in November 2018). MSA = Microsoft Academic (ranking in computer science as recorded in November 2018).

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
Artificial Intelligence and Machine Learning. 2017 CiteScore range for Q1 journals in subfield: 2.62-14.83										
International Conference on Learning Representations	ICLR	2013						6	13.25	Top 10%
Conference on Neural Information Processing Systems	NeurIPS	1987	A	A*	Y	Y	1	3	10.30	Top 10%
International Conference on Machine Learning	ICML	1980	A	A*	Y	Y	2	5	7.19	Top 10%
Conference on Learning Theory	COLT	1988	B	A*			18		3.37	Q1
AAAI Conference on Artificial Intelligence	AAAI	1980	A	A*	Y	Y	11	19	3.31	Q1
International Joint Conference on Artificial Intelligence	IJCAI	1969	A	A*	Y	Y	12	56	2.84	Q1
International Conference on Artificial Intelligence and Statistics	AISTATS	1985	C	A		Y	19		2.80	Q1
International Joint Conference on Autonomous Agents and Multiagent Systems	AAMAS	1994	B	A*		Y		89	2.25	<Q1
International Conference on Automated Planning and Scheduling	ICAPS	1990	B	A*					2.24	<Q1
International Conference on the Principles of Knowledge Representation and Reasoning	KR	1989	B	A*					1.97	<Q1
International Conference on Uncertainty in Artificial Intelligence	UAI	1985	B	A*					1.48	<Q1
Bioinformatics and Computational Biology. 2017 CiteScore range for Q1 journals in subfield: 2.42-6.60										
Conference on Intelligent Systems for Molecular Biology	ISMB	1993	B	A	Y				4.51	Top 10%
International Conference on Information Processing in Medical Imaging	IPMI	1972				Y			2.77	Q1
International Conference on Medical Image Computing and Computer-Assisted Intervention	MICCAI	1998		A		Y		69	2.12	<Q1
International Conference on Research in Computational Molecular Biology	RECOMB	1997	B	B	Y		15		2.06	<Q1
Computational Linguistics/Natural Language Processing. 2017 CiteScore range for Q1 journals in subfield: 2.62-14.83										
Meeting of the Association for Computational Linguistics	ACL	1963	A	A*	Y	Y	1	9	5.46	Top 10%
Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies	NAACL-HLT	1986	C	A	Y	Y	3	23	5.27	Top 10%
Conference on Empirical Methods in Natural Language Processing	EMNLP	1996	B	A	Y	Y	2	12	5.10	Top 10%
IEEE Workshop on Automatic Speech Recognition and Understanding	ASRU	1997							4.37	Top 10%
International Joint Conference on Natural Language Processing	IJCNLP	2004		B			17	46	3.77	Q1
Conference of the European Chapter of the Association for Computational Linguistics	EACL	1983		A		Y	10		3.01	Q1
Conference on Natural Language Learning	CoNLL	1997	C	A		Y	11		2.92	Q1
International Conference on Computational Linguistics	COLING	1966	B	A		Y	9	60	1.95	<Q1
Data Compression Conference	DCC	1991	B	A*					1.91	<Q1
Computer Architecture and Design Automation. 2017 CiteScore range for Q1 journals in subfield: 2.45-10.53										
ACM/IEEE Annual International Symposium on Computer Architecture	ISCA	1973	A	A*	Y	Y	4	29	9.76	Top 10%
IEEE International Symposium on High Performance Computer Architecture	HPCA	1995	A	A*	Y	Y	6	44	6.78	Top 10%
ACM International Conference on Architectural Support for Programming Languages and Operating Systems	ASPLOS	1982	A	A*	Y	Y	5	39	6.25	Top 10%
IEEE International Solid-State Circuits Conference	ISSCC	1959		A			3	40	5.60	Top 10%
ACM/SIGDA International Symposium on Field-Programmable Gate Arrays	FPGA	1993	B				17		5.53	Top 10%
IEEE/ACM International Symposium on Microarchitecture	MICRO	1968	A	A	Y		8	63	5.43	Top 10%
Annual Design Automation Conference	DAC	1964	B	A	Y	Y	5	57	3.67	Q1

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
IEEE International Symposium on Workload Characterization	IISWC	2006							2.75	Q1
International Conference on Parallel Architectures and Compilation Techniques	PACT	1992	B	A					2.72	Q1
International Symposium on Physical Design	ISPD	1987	C	C					2.70	Q1
IEEE Symposium on VLSI Circuits	VLSIC	1992		A			20		2.62	Q1
IEEE/ACM International Conference on Computer-Aided Design	ICCAD	1988	B	A	Y		14		2.53	Q1
Design, Automation & Test in Europe Conference & Exhibition	DATE	1994	B	B		Y	7	72	2.43	Q1
Computer Communications, Mobile Computing, and Wireless Networks. 2017 CiteScore range for Q1 journals in subfield: 2.48-11.06										
USENIX Symposium on Networked Systems Design and Implementation	NSDI	2004	B	B	Y	Y	3	26	12.96	Top 10%
Conference of the ACM Special Interest Group on Data Communication	SIGCOMM	1975	A	A*	Y	Y	9	7	7.81	Top 10%
International Conference on Mobile Computing and Networking	MobiCom	1995	A	A*	Y	Y	19	49	6.30	Top 10%
International Conference on Mobile Systems, Applications, and Services	MobiSys	2003	B	B	Y	Y		55	5.53	Top 10%
IEEE Conference on Computer Communications	INFOCOM	1982	A	A*		Y	7	21	5.30	Top 10%
Internet Measurement Conference	IMC	2001	B	A	Y			64	5.14	Top 10%
International Conference on Emerging Networking Experiments and Technologies	CoNEXT	2005	B	A		Y		100	4.68	Top 10%
International Workshop on Mobile Computing Systems and Applications	HotMobile	1994		C					4.21	Top 10%
IEEE International Conference on Pervasive Computing and Communications	PerCom	2003	B	A*					3.98	Q1
ACM Workshop on Hot Topics in Networks	HotNets	2006	B	A					3.30	Q1
ACM Conference on Information-Centric Networking	ICN	2011							3.15	Q1
ACM International Symposium on Mobile Ad Hoc Networking and Computing	MobiHoc	2000	B	A		Y			3.14	Q1
ACM International Conference on Measurement and Modeling of Computer Systems	SIGMETRICS	1974	B	A*	Y	Y	12	78	2.83	Q1
ACM Conference on Embedded Networked Sensor Systems	SenSys	2003	B	A*	Y	Y			2.67	Q1
IEEE World Forum on Internet of Things	WF IOT	2014							2.60	Q1
ACM/IEEE International Conference on Information Processing in Sensor Networks	IPSN	2002	B	A*		Y			2.49	Q1
Computer Graphics and Visualization. 2017 CiteScore range for Q1 journals in subfield: 2.20-6.75										
Special Interest Group on Computer Graphics and Interactive Techniques Conference	SIGGRAPH	1974	A	A*	Y	Y	1	16	8.52	Top 10%
IEEE Information Visualization Conference	InfoVis	1995	A	A*	Y				5.15	Top 10%
IEEE International Symposium on Mixed and Augmented Reality	ISMAR	1998	C	A*					3.71	Q1
IEEE Conference on Virtual Reality and 3D User Interfaces	IEEE VR	1993	A	A	Y				3.11	Q1
Computer Science Education. 2017 CiteScore range for Q1 journals in subfield: 1.32-8.40										
ACM Conference on International Computing Education Research	ICER	2005		B		Y			2.23	Q1
ACM Technical Symposium on Computer Science Education	SIGCSE	1973		A		Y			2.01	Q1
Computer Security and Cryptography. 2017 CiteScore range for Q1 journals in subfield: 2.48-11.06										
IEEE Symposium on Security and Privacy	S&P	1980	A	A*	Y	Y	2	15	11.88	Top 10%
Network and Distributed System Security Symposium	NDSS	1994	B	A*	Y	Y		27	8.48	Top 10%
USENIX Security Symposium	USENIX Security	1988	A	A*	Y	Y		20	6.67	Top 10%

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
Annual International Conference on the Theory and Applications of Cryptographic Techniques	EUROCRYPT	1982	A	A*	Y	Y	7	62	5.89	Top 10%
Symposium On Usable Privacy and Security	SOUPS	2005					15		5.83	Top 10%
ACM SIGSAC Conference on Computer and Communications Security	CCS	1993	A	A*	Y	Y	1	10	5.76	Top 10%
Annual International Cryptology Conference	CRYPTO	1981	A	A*	Y	Y	5	28	5.76	Top 10%
International Conference on Cryptographic Hardware and Embedded Systems	CHES	1999	B	A			12	96	5.76	Top 10%
IEEE International Symposium on Hardware-Oriented Security and Trust	HOST	2008					19		3.86	Q1
International Conference on Practice and Theory in Public-Key Cryptography	PKC	1998	B	B			17		3.64	Q1
International Conference on the Theory and Application of Cryptology and Information Security	ASIACRYPT	1990	B	A		Y	11		3.59	Q1
International Conference on Theory of Cryptography	TCC	2004	B	A				97	3.58	Q1
ACM ASIA Conference on Computer and Communications Security	AsiaCCS	2006	C	B			13		3.27	Q1
International Conference on Financial Cryptography and Data Security	FC	1997	C	B			10	88	3.27	Q1
International Conference on Detection of Intrusions and Malware, and Vulnerability Assessment	DIMVA	2004	C	C					3.14	Q1
European Symposium on Research in Computer Security	ESORICS	1990	B	A					2.84	Q1
Annual Computer Security Applications Conference	ACSAC	1985	B	A					2.78	Q1
The Cryptographers' Track at the RSA Conference	CT-RSA	2001	C	B					2.74	Q1
International Conference on Fast Software Encryption	FSE	1993	B	B			19		2.68	Q1
ACM Conference on Data and Application Security and Privacy	CODASPY	2011							2.60	Q1
ACM Conference on Security & Privacy in Wireless and Mobile Networks	WiSec	2008	C						2.55	Q1
IEEE Computer Security Foundations Symposium	CSF	1988	B	A					2.52	Q1
ACM Workshop on Information Hiding and Multimedia Security	IH&MMSec	2013		C					2.51	Q1
Computer Vision and Pattern Recognition. 2017 CiteScore range for Q1 journals in subfield: 2.62-14.83										
IEEE Conference on Computer Vision and Pattern Recognition	CVPR	1983	A	A*	Y	Y	1	1	19.69	Top 10%
IEEE International Conference on Computer Vision	ICCV	2010	A	A*	Y	Y	2	2	9.65	Top 10%
European Conference on Computer Vision	ECCV	1990	B	A	Y	Y	4	4	9.33	Top 10%
British Machine Vision Conference	BMVC	1987	C				12	75	4.87	Top 10%
IEEE Conference on Computer Vision and Pattern Recognition Workshops	CVPRW	2003					10		4.70	Top 10%
IEEE International Conference on Computer Vision Workshops	ICCVW	2009							3.00	Q1
IEEE International Conference on Automatic Face & Gesture Recognition	FG	1994	C	C			16	95	2.86	Q1
IEEE International Conference on Biometrics Theory, Applications and Systems	BTAS	2007							2.76	Q1
IEEE Winter Conference on Applications of Computer Vision	WACV	1992		A			15	79	2.68	Q1
International Conference on Document Analysis and Recognition	ICDAR	1991	C	A		Y	19		1.62	<Q1
Computing, Embedded, Operating, and Real-Time Systems. 2017 CiteScore range for Q1 journals in subfield: 2.45-10.53										
Symposium on Operating Systems Principles	SOSP	1967	A	A*	Y	Y		65	11.48	Top 10%
USENIX Symposium on Operating Systems Design and Implementation	OSDI	1994	A	A*	Y	Y		81	10.00	Top 10%
European Conference on Computer Systems	EuroSys	2006	B	A	Y	Y	16	66	7.14	Top 10%

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
USENIX Conference on File and Storage Technologies	FAST	2002	A	A	Y			77	5.94	Top 10%
ACM Symposium on Cloud Computing	SoCC	2010	B						5.14	Top 10%
USENIX Annual Technical Conference	USENIX ATC	1983	A	A	Y			70	4.84	Top 10%
International Conference for High Performance Computing, Networking, Storage, and Analysis	SC	1988	A	A	Y	Y	13		4.21	Top 10%
Euromicro Conference on Real-Time Systems	ECRTS	1989		A					4.15	Top 10%
IEEE Real-Time and Embedded Technology and Applications Symposium	RTAS	1995	B	A	Y				3.60	Q1
ACM/IEEE International Conference on Cyber-Physical Systems	ICCPS	2010							3.25	Q1
ACM International Symposium on High-Performance Parallel and Distributed Computing	HPDC	1992	B	A	Y				3.21	Q1
Symposium on Mass Storage Systems and Technologies	MSST	1974	B	C					2.81	Q1
IEEE International Conference on Distributed Computing Systems	ICDCS	1980	B	A		Y		94	2.81	Q1
IEEE International Parallel and Distributed Processing Symposium	IPDPS	1987	B	A			9	68	2.80	Q1
IEEE Real-Time Systems Symposium	RTSS	1980	A	A*	Y				2.56	Q1
International Conference on Hybrid Systems: Computation and Control	HSCC	1991	B						2.50	Q1
International Conference on Supercomputing	ICS	1987	B	A	Y				1.86	<Q1
ACM Symposium on Parallelism in Algorithms and Architectures	SPAA	1989	B	A		Y			1.85	<Q1
ACM Symposium on Principles of Distributed Computing	PODC	1982	B	A*		Y			1.82	<Q1
ACM International Conference On Embedded Software	EMSOFT	2001	B	A	Y				1.74	<Q1
Data Mining, the Web, and Information Retrieval. 2017 CiteScore range for Q1 journals in subfield: 2.47-10.53										
ACM SIGKDD International Conference on Knowledge Discovery and Data Mining	KDD	1994	A	A*	Y	Y	1	11	7.10	Top 10%
The Web Conference	TheWebConf	1994	A	A*	Y	Y	2	14	6.67	Top 10%
ACM International Conference on Web Search and Data Mining	WSDM	2008	B	A*		Y	5	36	5.02	Top 10%
International Semantic Web Conference	ISWC	2001	B	A			11	71	4.66	Top 10%
ACM Conference on Recommender Systems	RecSys	2007		B			13	61	4.50	Top 10%
International ACM SIGIR Conference on Research & Development in Information Retrieval	SIGIR	1971	A	A*	Y	Y	8	33	3.61	Q1
International Conference on Multimedia Retrieval	ICMR	1995	B	B			8		2.71	Q1
ACM International Conference on Information and Knowledge Management	CIKM	1992	B	A		Y	9	48	2.65	Q1
ACM/IEEE Joint Conference on Digital Libraries	JCDL	1995		A*					1.87	<Q1
IEEE International Conference on Data Mining	ICDM	2001	B	A*		Y		93	1.85	<Q1
Databases and Management Information Systems. 2017 CiteScore range for Q1 journals in subfield: 2.47-10.53										
International Conference on Management of Data	SIGMOD	1965	A	A*	Y	Y	4	22	5.38	Top 10%
Very Large Data Bases Conference	VLDB	1975	A	A*	Y	Y	3	17	4.99	Top 10%
ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems	PODS	1982	B	A*	Y	Y			3.21	Q1
IEEE International Conference on Data Engineering	ICDE	1984	A	A*	Y	Y	7	38	3.17	Q1
International Conference on Information Systems	ICIS	1983		A*					0.45	<Q1
Educational Technology. 2017 CiteScore range for Q1 journals in subfield: 2.41-13.58										
International Conference on Learning Analytics and Knowledge	LAK	2011					7		3.07	Q1

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
ACM Conference on Learning at Scale	L@S	2014							2.53	Q1
Human-Computer Interaction. 2017 CiteScore range for Q1 journals in subfield: 2.91-10.90										
ACM Symposium on User Interface Software and Technology	UIST	1988	B	A	Y	Y	4	54	5.70	Top 10%
ACM International Joint Conference on Pervasive and Ubiquitous Computing	UbiComp	1999	A	A*	Y	Y	3	25	5.30	Top 10%
ACM/IEEE International Conference on Human-Robot Interaction	HRI	2006					8	82	5.30	Top 10%
International Conference on Web and Social Media	ICWSM	2007					6	50	3.80	Q1
International ACM SIGACCESS Conference on Computers and Accessibility	ASSETS	1994	C			Y			3.67	Q1
ACM Conference on Computer Supported Cooperative Work and Social Computing	CSCW	1986	A	A		Y	2	41	3.33	Q1
CHI Conference on Human Factors in Computing Systems	CHI	1989	A	A*	Y	Y	1	8	3.09	Q1
ACM International Conference on Multimodal Interaction	ICMI	1996	C	B			11		2.89	Q1
ACM International Symposium on Wearable Computers	ISWC	1997		A*					2.18	<Q1
International Conference on Intelligent User Interfaces	IUI	1993	B	A		Y	13		1.82	<Q1
ACM Symposium on Virtual Reality Software and Technology	VRST	1994	C	A		Y			1.76	<Q1
Web for All Conference	W4A	2004				Y			1.28	<Q1
Multimedia. 2017 CiteScore range for Q1 journals in subfield: 2.20-6.75										
ACM International Workshop on Audio/Visual Emotion Challenge	AVEC@MM	2011							6.55	Top 10%
ACM Conference on Multimedia	MM	1993	A	A*		Y	3	32	5.03	Top 10%
ACM Multimedia Systems Conference	MMSys	2010					12		3.15	Q1
ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video	NOSSDAV	1990	B	A					2.85	Q1
Programming Languages and Software Engineering. 2017 CiteScore range for Q1 journals in subfield: 2.71-18.18										
International Conference on Mining Software Repositories	MSR	2004	C	A			8	58	4.58	Top 10%
ACM SIGSOFT International Symposium on Software Testing and Analysis	ISSTA	1978	B	A	Y		14	92	4.26	Top 10%
ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming	PPoPP	1988	A	A				98	4.20	Top 10%
ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering	ESEC/SIGSOFT FSE	1997							4.19	Top 10%
ACM SIGPLAN Conference on Programming Language Design and Implementation	PLDI	1973	A	A*	Y	Y	5	47	4.18	Top 10%
International Symposium on Software Engineering for Adaptive and Self-Managing Systems	SEAMS	2006							4.14	Top 10%
ACM/IEEE International Conference on Software Engineering	ICSE	1975	A	A*	Y	Y	1	18	4.12	Top 10%

Conference Name	Acronyms	Year started	CCF rating	CORE rating	CSRankings list	RIT list	GSM ranking	MSA ranking	CiteScore value	CiteScore rating
ACM SIGSOFT International Symposium on Foundations of Software Engineering	FSE	1993	A	A*	Y	Y	4	51	3.92	Q1
IEEE International Symposium on Performance Analysis of Systems and Software	ISPASS	2000	C	B					3.42	Q1
International Conference on Tools and Algorithms for the Construction and Analysis of Systems	TACAS	1995		A			11		3.40	Q1
ACM/IEEE International Conference on Automated Software Engineering	ASE	1986	A	A	Y	Y	12	80	3.34	Q1
ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages	POPL	1973	A	A*	Y	Y	7	52	3.32	Q1
IEEE International Requirements Engineering Conference	RE	1993	B	A					3.16	Q1
International Conference on Evaluation and Assessment in Software Engineering	EASE	1997	C	A					3.08	Q1
International Symposium on Code Generation and Optimization	CGO	2003	B	A					2.79	Q1
ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications	OOPSLA	1986	A	A*	Y	Y	15		2.79	Q1
International Conference on Functional Programming	ICFP	1996	B	A*	Y	Y			2.27	<Q1
Robotics. 2017 CiteScore range for Q1 journals in subfield: 2.62-14.83										
Robotics: Science and Systems	RSS	2005		A*	Y		7	59	5.36	Top 10%
IEEE International Conference on Robotics and Automation	ICRA	1984	B	B	Y		1	43	2.88	Q1
International Conference on Intelligent Robots and Systems	IROS	1989	C	A	Y		4	30	2.00	<Q1
Theory. 2017 CiteScore range for Q1 journals in subfield: 1.98-13.67										
ACM SIGACT Symposium on Theory of Computing	STOC	1969	A	A*	Y	Y	1		5.67	Top 10%
IEEE Annual Symposium on Foundations of Computer Science	FOCS	1960	A	A*	Y	Y	2		4.55	Top 10%
International Conference on Computer Aided Verification	CAV	1989	A	A*	Y	Y	9	74	3.55	Q1
ACM-SIAM Symposium on Discrete Algorithms	SODA	1990	B	A*	Y	Y	3		3.19	Q1
ACM Conference on Economics and Computation / Electronic Commerce	ACM-EC	1999		A*	Y		3		2.62	Q1
International Conference on Theory and Applications of Satisfiability Testing	SAT	1996	C	A					2.57	Q1
ACM/SIGEVO Conference on Foundations of Genetic Algorithms	FOGA	1991		A*					2.42	Q1
Innovations in Theoretical Computer Science Conference	ITCS	2010		A			10		2.31	Q1
ACM/IEEE Symposium on Logic in Computer Science	LICS	1986	A	A*	Y	Y			2.20	Q1
International Conference on Automated Deduction	CADE	1974	B	A					2.14	Q1
International Joint Conference on Automated Reasoning	IJCAR	2001	B	A*					1.99	Q1
International Colloquium on Automata, Languages and Programming	ICALP	1973	B	A		Y	9		1.60	<Q1
ACM International Symposium on Symbolic and Algebraic Computation	ISSAC	1966		A*					1.24	<Q1
European Symposium on Algorithms	ESA	1993	B	A		Y	17		1.20	<Q1
Conference on Web and Internet Economics	WINE	2005			Y		19		0.81	<Q1

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