

# THEORETICAL COMPUTER ALGORITHMS CONFERENCES: ANALYZING THE PROGRAM COMMITTEE CHARACTERISTICS

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## ABSTRACT

Algorithm represents the computer-based road map for accomplishing a given, well-defined task. In general, computer algorithms form one of the core practical technologies of computer science. In principle, research in theoretical computer science focuses on the design and analysis of algorithms and data structures, as well as the study of fundamental barriers to efficient computation. The research community of this field has been significantly growing in the last decade. In general, in the computer science field, publishing research results is an integral part of a researcher's professional life. The preference for conference publications is motivated by many arguments such as the high dynamism of the field requiring shorter turnaround time between submissions; the prestige associated with publishing at highly-selective venues. With the main aim of retaining the high quality and the prestige of these conference, program committee members plays the major role of evaluating the submitted papers and deciding which submissions are to be included in the conference programs. In this article we assess the health of the computer algorithms research community by analyzing four top-tier and prestigious computer algorithm conferences (ESA, ICALP, SOCG and SODA) over the period between 2006 and 2015 based on different criteria. We study dynamics in the membership of the committees of the different editions of these conferences. Finally, we report about the major contributing scholars in the committees of these conferences as a mean of acknowledging their impact in the community. This knowledge can be used by prospective authors to decide in which conferences to publish and by conference steering committees or PC chairs to assess their selection process.

**Keywords:** *Program committee, Steering Committees, Computer Algorithms conferences, Research Communities, committee membership*

## 1. INTRODUCTION

The term algorithm is universally used in computer science to describe problem-solving methods suitable for implementation as computer programs. The design and analysis of algorithms forms one of the core areas within computer science. In general, research in theoretical computer science focuses on the design and analysis of algorithms and data structures, as well as the study of fundamental barriers to efficient computation. The research community of this field has been significantly growing in the last decade. In general, the dissemination of research results and findings is an integral part of the research process and the career in academia. Computer scientists consider top-tier and prestigious conferences as their favorite tools for presenting original research work in contrast to the general case of many other scientific

disciplines where journal papers are routinely considered to be superior than those of conference papers [1] [2]. In practice, the general culture in the computer science community is that journal papers are used to present deeper versions of papers that already have been presented at conferences [1] [3]. One of the main reasons behind this is that the review process of journal papers is usually very long. The turnaround time (the interval between the submission date of a manuscript and the date of having the editorial decision) for conferences is often less than a third of that of journals [4]. Since the field of computer science research tends to be fast-paced, conferences provide a great chance for timestamping the latest research findings earlier which allows the knowledge to be publicly shared more rapidly. A lot of efforts in evaluating the quality of these research contributions is exerted [5]

In general, the quality of a conference depends on its program committee members. This has inspired us to study the problem from a novel perspective to assess the health of the computer algorithm community. This knowledge can be used by conference steering committees and program committee chairs to assess composition of the program committee members and adherence to conference charters. In practice, the program committee members of any conference play a vital role of judging whether research submitted is technically sound, provides a contribution to the field, and has novelty with respect to previous work. Therefore, their decisions play the main role of retaining the high quality and the prestige of these conferences. On the other hand, these decisions reward the research scholars of the accepted papers such that they gain good publicity of their research contributions [6]. Thus, membership of the program committee of the top-tier conferences is considered as one of the main factors for judging the impact of the scholars in the research community.

Authors in [7] analyzed the characteristics and the dynamics of the program committees of four top-tier and prestigious database conferences (SIGMOD, VLDB, ICDE, EDBT) over the period between 2001 - 2010. This study has reveal some interesting insights about the health and growth of the database research community In. this paper, we shift the focus on the computer algorithms research community by studying the characteristics of the program committees of four main computer algorithms conferences: European Symposia on Algorithms (ESA), International Colloquium on Automata, Languages, and Programming (ICALP), ACM-SIAM Symposium on Discrete Algorithms (SODA) and Symposium on Computational Geometry (SOCG). The four conferences are long standing conferences. In 2015, the ICALP conference had its 42 edition, the SOCG had its 31 edition, the SODA conference had its 26 edition and the ESA conference had its 23 edition. In this study, we provide details statistics about the program committees of these conferences over the period between 2006 and 2015. In addition, we provide a comparative analysis and study between the computer algorithms and data management research communities [7] based on analyzing the characteristics of the program committees of the top conferences of both communities. In particular, we summarize the main contributions of this paper as follows:

- We analyze the growth rate on the size of the program committees of the major core algorithms conferences in comparison to the size of contributing members in the core algorithms research community and the number of core algorithm research publications of these conferences in the last decade

- We spot on the diversity of the influencing community members, we analyze the overlap in the membership of the program committee of the different editions of the same conference in addition to the overlap in the membership of the program committee of the different conferences in the same years.

- We report about the scholars with the highest number of membership in the committee of the major core algorithm technology conferences separately and when combined

- We compare the dynamics of the computer algorithms and data management research communities based on the analysis of the characteristics of the program committee of the top conferences of both communities.

The input data of this study has been manually collected, cleaned and verified from the official conferences' pages<sup>1</sup>.

## 2. Statistics on Conferences

The members of the program committee of any conference are the key group of people who are responsible for objectively and thoroughly reviewing all submissions, and for submitting timely, informative reviews that provide authors with feedback about their submissions. Hence, they play the main role of retaining the high quality and the prestige of the top-tier conferences [9]. In this study, we focus on analyzing the membership of the program committees of the four major core computer algorithm conferences (ESA, ICALP, SOCG, SODA) over the last decade (2006 - 2015).

- Figure 1 illustrates the yearly numbers of the program committee members of the major conferences in the computer algorithms research field over the last decade. The results show that for the ICALP conference, the number of program committee members in 2015 has increased by 26% over the number of program committee in 2006. For the ESA conference, the number has been increased by about 40% while it has been increased by about

<sup>1</sup> A set of Python scripts has been prepared to help achieving this task

60% for the SODA conference. The number of program committee members for SOCG conference has been slightly fluctuating around 25 members per year.

– Table 1 shows the number of distinct scholars that have been participating in each of the major algorithms conferences separately and when combined over the last decade.

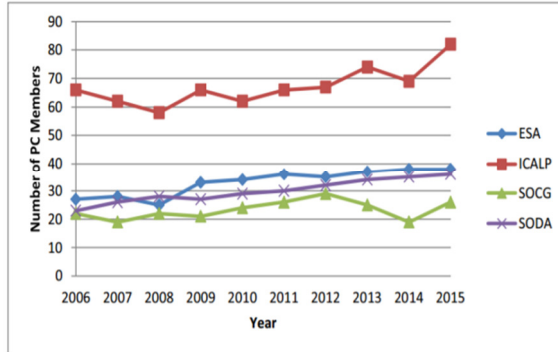


Fig. 1. Number of program committee members of the major core computer algorithm conferences over the last decade

The numbers show that the ICALP conference had the largest community membership with 503 scholars and the SOCG conference had the smallest program committee community with 164 members. However, it should be noted that ICALP conference has three tracks (Algorithms, Complexity and Games - Logic, Semantics, Automata and Theory of Programming - Foundations of Networked Computation: Models, Algorithms and Information Management) while ESA (Design and Analysis Track - Engineering and Application Track) and SOCG conferences (Main Track - Multimedia Track) has only two tracks. SODA conference has only one track. When combined, 948 distinct scholars have participated in the program committee of the major core Computer algorithm conferences over the last decade. This number gives an indication on the reasonably big size of the contributing scholars in the computer algorithms research community over the last decade.

– In general, it is quite unhealthy to have a fixed or slightly different list of members in the program committees for the different venues (different editions of the same conference or different conferences) of a research community [10]. Having large numbers of the same scholars as frequent members in the program committees of different venues may have intended or unintended negative effects in the fairness of evaluating the research

contributions or in the quality and variability of the conference programs.

Table 1. Total Numbers of Distinct PC Members in The Major Algorithm Conferences In The Last Decade

	ESA	ICALP	SOCG	SODA	Combined
Total Distinct PC Members	290	503	164	256	948

For example, a specific scholar might be not convinced with the importance of a specific research idea or with the quality of work of a specific research group. This scholar might abandon the visibility of this research idea or the work of this group in all the venues where he is involved in the program committee while other scholars in the same research community may have different views in the evaluation of that research idea or the work of that group [11] [12] [13]. Therefore, it is quite healthy for any conference to have a dynamic membership for the program committees of its different editions. It is also quite healthy for any research community to have a large pool of trustable scholars from which the members of the program committees of the top-tier conferences can be recruited. This large pool of candidates serves the key role of easing the job of the chairs and organizers of these conferences in forming the committee that can achieve the goals of such prestigious conferences. Figure 2 illustrates the percentage of overlap between the different editions of the major core computer algorithm conferences over the last decade. The X-axis and the Y-axis represent the editions of the conference. The percentage of overlap between two editions of a conference is computed by dividing the total count of the common scholars in the program committees of these two editions over the total count of the distinct scholars in the program committees of the same two editions. On average, the percentage of overlap between the different editions of the ESA conference is 2%, of the ICALP conference is 4%, of the SOCG conference is 5% and of the SODA conference is 2%. The highest percentage of overlap between two different editions of the ESA conference is 9% (2006 and 2011), of the ICALP conference is 7% (2012 and 2015), of the SOCG conference is 15% (2007 and 2013) and of the SODA conference is 11% (2010 and 2013). The percentage of overlap between the two years 2006 (beginning of the decade) and 2015 (end of the decade) of the ESA conference is 3%, of the ICALP conference is 1%, of the SOCG conference is 2% and of the SODA conference is 2%. These results show that the program committee membership of the computer algorithms major

conferences is quite dynamic and there is significance changes in the members of the program committee of the top conferences from one year to another which reflect big variety and quite healthy status of the community.

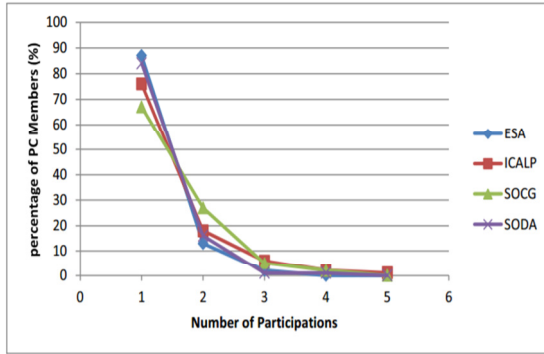


Fig. 3. The total frequency of participation in the program committees of the major algorithm conferences over the last decade

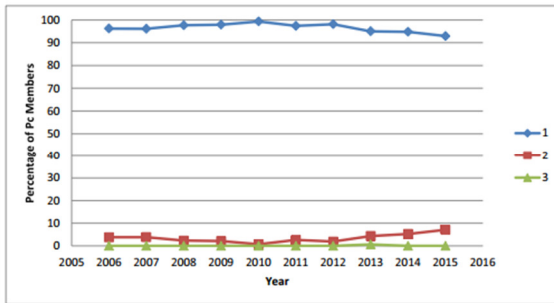


Fig. 4. The yearly frequency of participation in the program committees of the major conferences over the last decade

– Figure 3 illustrates the percentages for the frequency of scholars’ participation in the program committees of the major core computer algorithms conferences. Out of the ten editions of the ESA, ICALP, SOCG and SODA conferences in the last decade, the percentages of the program committee members who have participated only once are 87%, 76%, 67% and 84% respectively. For the ESA conference, 35 has participated twice in the program committees with a percentage of participation (13%). In addition, three scholars have participated three times (2%). For the ICALP conference, 18 scholars have participated twice with a percentage of participation (18%) while 27 scholars have participated three times (6%) and 7

scholars have participated four times (2%). For the SOCG conference, 44 has participated in twice program committees (27%), eight have participated three times (5%). For the SODA conference, 16 scholars have participated twice (16%) while one scholar has participated three times (1%).

– Table 2 shows the yearly number of distinct scholars that have been participating in all of the PCs of the Computer algorithms conferences in combined. The numbers show that the computer algorithms conference had 133 distinct scholar in their committees in the 2006 editions. This number had been gradually increasing from year 2008 to reach its maximum of 170 by end of the decade (28% increase). Figure 4 illustrates the percentages for the yearly frequency of scholars’ participation in the program committees of the major core Computer Algorithms conferences. In 2006, 96% of the total distinct program committee members (133 in Table 1) have participated in only one of the major computer algorithms conference while the 2015 editions had 93% of the total distinct program committee members participating only once. The 2006 editions of the major core computer algorithms conferences had 4% of the the total distinct program committee members participating in two different conference while the corresponding percentage of 2015 has increased to 7%. In 2013, Konstantinos Panagiotou has been participating in three editions of the major computer algorithms (ICALP, SODA and ESA) conferences of the year.

Table 2. Yearly Number of Distinct PC Members in the Major Computer Algorithms Conferences In The Last Decade

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Distinct PC Members	133	130	130	144	148	154	160	161	153	170

There is no incident that one scholar has participated in the program committee of the four conferences in one year. The results of Figure 4 reflect the high volatility and dynamics in the yearly constitution of the program committees of the computer algorithms conferences. On average, 97% of the program committee members participate in one conference per year, 3% participate in two conferences per year.

### 3. STATISTICS ON SCHOLARS

Research is a competitive endeavor. Research scholars usually have multiple goals to achieve and it is therefore reasonable that their impact must be judged by multiple criteria. For example, one way of measuring the impact of

research scholars in the community is their number of publications in top-tier research venues and the number of citations they receive, i.e. how frequently their publications are referenced by other publications (e.g. h-index1 [14], g-index2 [15]. Rahm et al in [6] presented a study where they considered ranking the scholars based on their citation counts. Sakr et al. [7] presented a study focused on measuring the number of publications in top-tier publication venues as one of the main indicators to evaluate the impact of a research scholar in the community and the quality of his research production. In this work, we focus on measuring the participation on the program committees of the top-tier conferences as another important factor in measuring the impact of research scholars in the community. Figure 5 illustrates the top participating scholars in the program committees for the major core computer algorithms conferences over the last decade: ESA 5(a), ICALP 5(b), SOCG 5(c) and SODA 5(d). The results of these figures show that there is no scholar appears more than once in the top participating scholars of the program committees of the major computer algorithm conferences. The top participating scholars of the program committees of ESA conference have participated three times and are namely: Irene Finocchi Leah Epstein, Dan Halperin. While the top participating scholars of the program committees of ICALP conference have participated five times and are namely: Pierre Fraigniaud Christian Scheideler. The top participating scholars of the program committees of SOCG and SODA conference have participated four times and are namely: Monique Teillaud Joe Mitchell, and Sandor Fekete (SOCG) and Yuval Rabani (SODA).

Table 3 shows an aggregate list of scholars with the highest number of participation in the program committees of the major core computer algorithms over the last decade. The record of each scholar represents his h-index<sup>2</sup> and the current affiliation. Sandor Fekete comes alone on the top of this list with a total of 8 memberships out of a total of 40 venues (20%) in the program committees of the major core computer algorithms conferences over the last decade. David Eppstein, Pankaj Agarwal, Christian Scheideler, and Lars Arge had 6 memberships (15%). The reported affiliations in Table 3 show that 22% (5 out of 23) of the scholars with the highest number of memberships in the

program committees of the major core computer algorithm conferences are Germany-based scholars. Also the figures shows that 74 % (17 out of 23) of the scholars with the highest number of memberships in the program committees of the major core computer algorithm conferences are European-based scholars.

#### 4. COMPARISON WITH THE DATABASE RESEARCH COMMUNITY

In [8] authors analyzed the characteristics and the dynamics of the program committees of four top-tier and prestigious database conferences (SIGMOD, VLDB, ICDE, EDBT) over a decade. In this section, we compare between the computer algorithms and database research communities based on the analysis of the characteristics of the program committee of the top conferences in both communities. Some interesting insights from this comparison are summarized as follows:

- The size of the database research community is significantly larger than the computer algorithms research community. The total number of distinct program committee members in the major computer algorithms and database conferences over a decade is 1308 and 948 members respectively. That means the number of scholars who are participating in the program committees of the major database conference is about 38% larger than the size of program committees of the major computer algorithms conference. The database conference with the largest number of the members is the ICDE conference had 845 member while the largest computer algorithms conference is the ICALP conference with 503 conference. The database conference with the smallest number of the members is the EDBT conference with 349 members while the smallest computer algorithms conference is SOCG with 164 scholars.

- The percentage of overlap in the database research community is much higher than the computer algorithms community. For, for the database conferences, on average, the VLDB conference had the highest percentage of overlap between the different editions with 14% while the SIGMOD conference had the lowest with 9% while for the computer algorithms conference, the SOCG conference had the highest average percentage of overlap with is 5% while SODA and ESA had the lowest with 2%. In addition, for the database conferences, the EDBT conference had the highest percentage of overlap between two different editions of 2008 and 2009 with 30% while for the computer algorithms conference, the SOCG

<sup>2</sup> The reported h-index information is based on the Google Scholar Service and the Publish or Perish software (<http://www.harzing.com/pop.htm>)

conference had the highest percentage of overlap between two different editions of 2007 and 2013 with 15%. Furthermore, for the database conference, the VLDB conference had the highest percentage of overlap between the 2 years of the beginning of the decade and end of the decade with 8% while for the computer algorithms conference, the ESA conference had the highest percentage of overlap between the 2 years of the beginning of the decade and end of the decade with 3%. This comparison shows that the program committees of the major computer algorithms conference are much more dynamic with much less overlap and more frequent fresh blood with new scholars.

– For the database conferences, the EDBT conference had the highest percentage of the scholars who had participating only once in the program committee over a decade with 70% while the VLDB had the lowest percentage with 40%. For the computer algorithms conferences, the ESA conference had the highest percentage with 87% while the SOCG conference had the lowest percentage with 67%. In addition, the database conferences had each year a number of scholars who are participating in the program committee of the four major database conference while the computer algorithms conferences had no single case in any year. These results are compatible with the observation that the program committees of the major computer algorithms conference are more dynamic than the program committees of the database conferences.

– For the database conferences, the scholars S. Sudarshan had the highest number of participation on the program committees of the VLDB conferences with 9 participations. The scholars Christian Jensen, Goetz Graefe, Sunil Prabhakar and Kevin Chang had the highest number of participation on the program committees of the ICDE conferences with 8 participations. Minos Garofalakis had the highest number of participation on the program committees of the SIGMOD conference with 7 participation. Finally, Tore Risch had the highest number of participation on the program committees of the EDBT conference with 6 participation. While for the computer algorithms conferences, the scholars with the highest number of participation in the program committees of the ICALP, SOCG, SODA and ESA had 5, 4, 4 and 3 participations respectively. – Jiawei Han has the highest h-index, 133, in the list of scholars with the highest number of participations in the program committees of the major core database technology conferences while Pankaj Agarwal has the highest h-index, 62, in the list of scholars with the highest

number of participations in the program committees of the major computer algorithms conferences. This comparison indicate that the rate of productivity and impact of the scholars in the database research community is higher than scholars of the computer algorithms community.

## 5. CONCLUSIONS

The goal of this article was to assess how the characteristics and the health status of four core computer algorithms conferences spanning over a decade of time and with respect to a variety of criteria. In general, healthy conferences should strive for an open, dynamic and fair community where the program committee turnover should be high enough introducing enough fresh blood in order to avoid inbreeding or establishing a centralized authority. In this study, we presented a range of analyses that can be useful for steering committees, prospective authors and researchers in various ways. We studied the representativeness of the program committees of four major core computer algorithms conferences (ESA, ICALP, SOCG, SODA) over the last decade. The results has revealed some interesting insights including – The computer algorithms research community size has significantly increased through the last decade. – The program committees of the major computer algorithms technology conferences are quite dynamic and healthy.

– The yearly number of distinct scholars who are participating in the program committees of all the major computer algorithms conferences is reasonably large.

– The percentages of overlap between the program committees of the top venues are considerably very low which shows that the program committee membership is quite dynamic with always fresh bloods.

– The percentages of scholars with very frequent memberships in the program committees are also very low. Therefore, it seems that there is no controlling authority in the community.

The results of this study show that the number of scholars participating in the program committees of the major database conference is considerably larger than the number of program committee members participating in the major computer algorithms conference. In addition, the program committees of the major computer algorithms conference are much more dynamic than major database conferences. Indeed, the quality of a conference is strongly correlated with the quality

and diversity of its program committee member. Therefore, the smaller the overlap the more scholars to serve as members of the program committees and play an effective role in retaining the high quality and the prestige of these conferences.

As a future work, we plan to further study the computer algorithms research community over the last decade from other two different angles: analyzing the collaboration patterns between the research institutes and their impact [16] in addition to analyzing the trend of the most contributing institutes and countries in the research community. Also we plan to study the relation between the quality of the program committee and the h-index of the conferences studied in this paper. In addition we can include other types of publication venues, top tier computer algorithms journals. We will continue our work to analyze the program committee members in the top tier conferences in different research area in order to eventually recommend particular venues based on the social distance and similarity in interests between the user and the program committee members.

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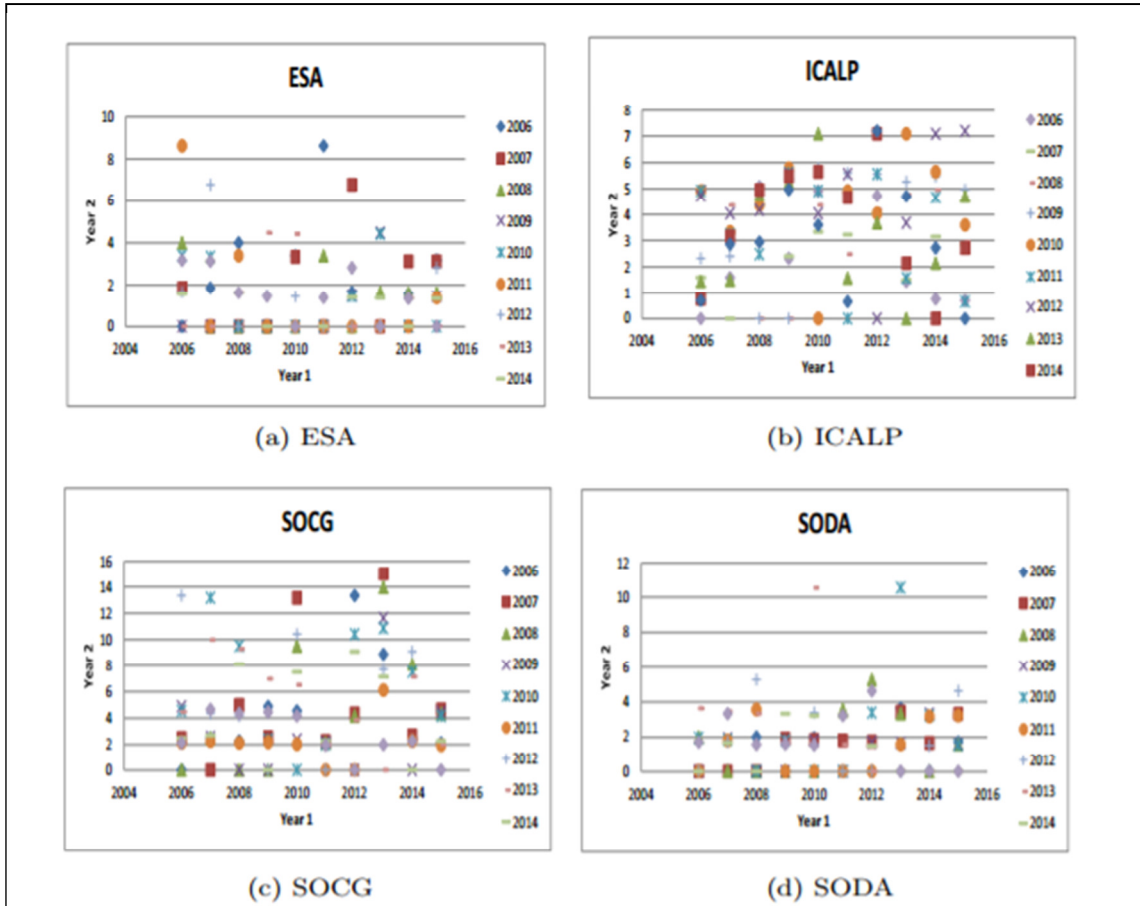


Fig. 2. Percentage of overlap between the different editions of the major algorithm conferences

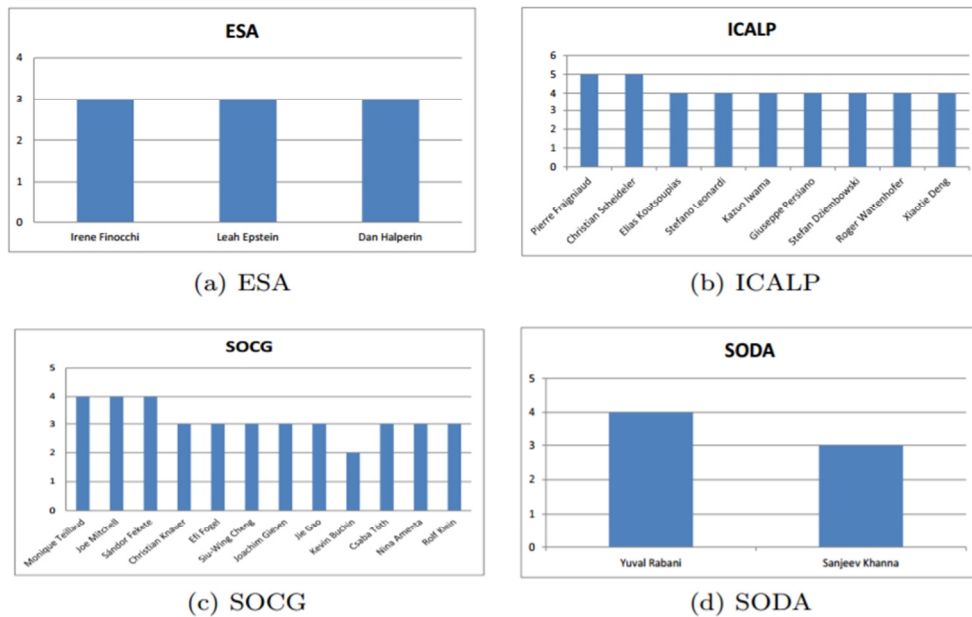


Fig. 5. Top Participating Scholars In The Program Committees For Each Of Major Computer Algorithms Conferences Over The Last Decade



Table 3. List of scholars with the highest number of participation in the program committees of the major core computer algorithms conferences

Scholar	PC Memberships	h-index.	Current Affiliation
Sándor Fekete	8	36	Technical University of Braunschweig, Germany
David Eppstein	6	25	University of California, Irvine, USA
Pankaj Agarwal	6	62	Duke University, USA
Christian Scheideler	6	31	Universität Paderborn, Germany
Lars Arge	6	40	University of Aarhus, Denmark
Suresh Venkatasubramanian	5	41	University of Toronto, Canada
Dorothea Wagner	5	44	Karlsruhe Institute of Technology, Germany
Nikhil Bansal	5	35	Eindhoven University of Technology, Netherlands
Sariel Har-Peled	5	40	University of Illinois at Urbana-Champaign, USA
Piotr Sankowski	5	16	University of Warsaw, Poland
Christian Knauer	5	17	Universitt Bayreuth, Germany
Xiaotie Deng	5	43	Shanghai Jiao Tong University, China
Gerth Brodal	5	32	Aarhus University, Denmark
Magns Halldrsson	5	36	Reykjavik University, Iceland
Dan Halperin	5	34	Tel Aviv University, Israel
Irene Finocchi	5	19	Sapienza University of Rome, Italy
Monique Teillaud	5	23	INRIA Sophia Antipolis, France
Monika Henzinger	5	50	University of Vienna, Austria
Bettina Speckmann	5	21	TU Eindhoven, Netherlands
Pierre Fraigniaud	5	41	CNRS and University Paris Diderot, France
Giuseppe Italiano	5	34	Universit di Roma "Tor Vergata", Italy
Christian Sohler	5	25	TU Dortmund University, Germany
Stefano Leonardi	5	40	Sapienza University of Rome, Italy