Sixteen Years of Sound and Music Computing: A Look Into the History and Trends of the Conference and Community

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ABSTRACT

This contribution provides an overview of the Sound and Music Computing conference and community over the course of its sixteen years. As a sequel to a previous corresponding contribution investigating the community ten years ago, here we analyze the proceedings of the past editions, as well as the changes in the organization of the conference itself. The analysis reveals the growth of the SMC community in terms of attendees and countries represented at the conference, highlights the changes in trends and topics, and provides insights on the directions of the conference. A reflection is made with regards to the SMC roadmap originally conceived in 2004. Motivated by similar initiatives in "sister" communities, this resource is made available to the community at http://smc.lim.di.unimi.it/.

1. INTRODUCTION

"Sound and Music Computing (SMC) research approaches the whole sound and music communication chain from a multidisciplinary point of view. By combining scientific, technological and artistic methodologies, it aims at understanding, modelling and generating sound and music through computational approaches" [1].

This is a deliberately broad definition, which is aimed at encompassing a wide range of topics. The name Sound and Music Computing was in fact coined by a group of scholars in the second half of the 1990's [2–4], in an effort to identify and promote the research field. One of the main achievements of this effort was the inclusion of SMC in the ACM Computing Classification System (1998). [1] By choosing this name, the proponents intended to go beyond the term "computer music", which was interpreted primarily from a musical perspective, and to define a discipline in Computer Science.

[1] H. Information Systems → H.5 Information Interfaces and Presentation (e.g., HCI) → H.5.5 Sound and Music Computing. See https://www.acm.org/publications/computing-classification-system/1998

Since its first edition in 2004, the Sound and Music Computing Conference and Summer School (hereafter SMC Conference for brevity) was meant to embody this vision. The main goal of this paper is to analyze the data available from the previous 16 editions of the event, and to reflect on how the field evolved in the course of the years. Even though the event is comprised of three complementary programs (the Summer School, the Music Program, and the Scientific Program), here we focus exclusively on the latter.

Similar contributions have been published in recent years for various conferences related to SMC, including the International Symposium on Music Information Retrieval (ISMIR) [5–8], the International Conference on Digital Audio Effects (DAFX) [9, 10], and the International Conference on New Interfaces for Musical Expression (NIME) [11, 12]. One previous contribution was also focused on SMC [13], but examined a limited time-span (2004-2009). Ten years later, it seems appropriate to provide a more up-to-date picture.

2. HISTORY AND TIMELINE

The SMC Conference was born as a joint initiative of the AIMI [2] (Associazione Italiana di Informatica Musicale) and the AFIM [3] (Association Française d'Informatique Musicale). It was originally intended to replace the respective national conferences organized by the two associations, the CIM (Colloquium on Musical Informatics) and the JIM (Journées d'Informatique Musicale), although these were later rescheduled as independent events. The stated goal was to achieve an international dimension for the joint conference.

In June 2004, the EU-funded project "Sound to Sense – Sense to Sound" ($S2S^2$) was started. The project consortium included some of the most active SMC research groups in Europe, and aimed at consolidating the research field. Among the outputs of the project, two major ones were an edited book that collected a wide account of state-of-the-art research in SMC [14], and a roadmap for SMC research [1] (later extended as a journal special issue [15])

[2] http://aimi-musica.org
[3] http://www.afim-asso.org/

Year	Location	Organizers	KI	O	P	OP	S	AR
2004	Paris	Institut de Recherche et Coordination Acoustique/Musique (IRCAM)	0(0)	47	0	47	N.A.	N.A.
2005	Salerno	University of Salerno	3(2)	30	0	30	N.A.	N.A.
2006	Marseille	Centre National de Création Musicale	0(0)	28	0	28	N.A.	N.A.
2007	Lefkada	University of Athens, Ionian University	2(2)	42	21	63	N.A.	N.A.
2008	Berlin	German Association of Electroacoustic Music, Technical University Berlin	1(0)	34	0	34	N.A.	N.A.
2009	Porto	INESC Porto, CITAR, Politechnic of Porto, Casa da Música, University of Porto	3(0)	26	37	63	165	38%
2010	Barcelona	University Pompeu Fabra, Phonos Foundation, ESMUC	1(0)	30	44	74	117	66%
2011	Padova	University of Padova, Conservatory of Padova	1(0)	35	44	79	136	58%
2012	Copenhagen	Aalborg University Copenhagen	3(0)	38	37	75	142	53%
2013	Stockholm	Royal Institute of Technology (KTH)	6(6)	48	65	113	130	87%
2014	Athens	University of Athens	12(12)	133	136	269	383	70%
2015	Maynooth	Maynooth University	3(0)	39	36	75	100	75%
2016	Hamburg	Hamburg University of Music and Theatre, Hamburg University of Applied Sciences, University of Hamburg, Leuphana University	4(0)	40	40	80	150	53%
2017	Espoo	Aalto University	3(0)	45	20	65	85	76%
2018	Limassol	Cyprus University of Technology	3(1)	45	31	76	N.A.	N.A.
2019	Málaga	University of Málaga	3(0)	41	58	99	123	76%

Table 1: Timeline of SMC editions and related figures for scientific contributions. **KI**: keynote/invited contributions (numbers in parentheses indicate those with a paper in the proceedings); **O**: accepted as oral presentations; **P**: accepted as posters; **OP**: oral+poster accepted; **S**: submissions; **AR**: acceptance rate (**OP**·100/**S**).

which provided a definition of the field, outlined its research, educational, industrial, and social/cultural contexts, identified a set of key research challenges for the field in the following ten to fifteen years, and proposed strategies for tackling them.

One further output of S2S[2] was the establishment of an annual Summer School for PhD students and young researchers in SMC. Starting in 2009, the summer school and the conference were merged. At this point the mission of the event was fully defined: a compact and selective conference, aiming at representing the whole spectrum of Sound and Music Computing research, with a focus on participation especially from young researchers, and based on an interdisciplinary dialogue between scientific and artistic research. Has this mission been fulfilled?

Table 1 provides a timeline for the conference editions, along with figures about scientific contributions.[4] Note that the 2013 and 2014 editions were organized in conjunction with other events (2013: Stockholm Music Acoustics Conference; 2014: International Computer Music Conference). In 2013 the two events were given separate tracks and proceedings, while in 2014 they were completely merged: this explains the unusually high numbers for 2014. Note also that the 2014 and 2019 editions included demo tracks with accepted demos (8 and 25, respectively) included in the conference proceedings. Correspondingly, Tab. 1 reports figures for posters+demos.

Having discussed these specific cases, it may be stated that starting from 2010 the scientific program maintained a relatively stable format in terms of oral and poster contributions (apart from the 2014 edition that was combined with another conference with a similar number of contributions). Schedule and duration have also remained similar in all editions after 2010, in accordance to the Guidelines for Organizers.[5] The Summer School normally lasts 4-5 days just before the Conference, which then runs for 3 days with no parallel sessions. Finally, Tab. 1 shows that the conference has only been held in Europe.

3. THE NEW REPOSITORY

As prescribed by the Guidelines for Organizers, the conference proceedings are freely available and published under a Creative Commons license (Attribution - Non Commercial - Share Alike 3.0 Unported License). The proceedings were hosted on a CMS (Content Management System) managed by the Music Technology Group at University Pompeu Fabra until 2017, and were then moved to Zenodo.[6]

For the analyses conducted in this paper a Relational Database has been built with the PostgreSQL platform. The corresponding Entity Relationship Diagram is shown in Fig. 1. It is worth underlining some aspects, such as the possibility to track variations in the affiliation of an author along his/her career (virtually also for different papers presented at the same edition) and to support multiple affiliations of a given author for a single paper.

Data were automatically retrieved from heterogeneous sources, including Zenodo, dedicated web pages of each edition, and the EasyChair submission system (for those editions employing such an editorial manager). Then, all the collected data were validated against published proceedings, considered as the authoritative information source. This allowed to find and fix some inconsistencies. The 2014 edition in particular had inconsistent information

[4] Figures for numbers of submissions were collected from introductory materials in conference proceedings whenever available, as well as from official notifications to authors and online submission systems.

[5] http://www.smcnetwork.org/guidelines.pdf

[6] https://zenodo.org/communities/smc

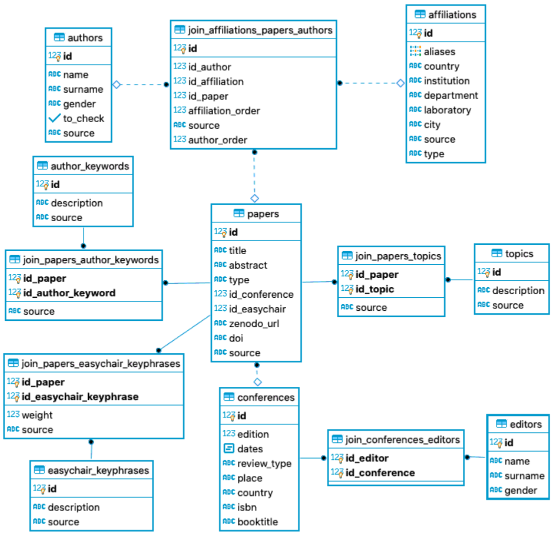


Figure 1: ER diagram of the SMC relational database.

Year	UA	A2	Ā	MA	1FA		UFA	
2004	83	7	1.98	5	7	14.9%	7	8.4%
2005	69	6	2.41	6	11	34.4%	13	18.8%
2006	50	8	2.10	5	9	32.1%	8	16.0%
2007	128	18	2.28	9	16	24.6%	18	14.1%
2008	69	6	2.26	14	6	17.7%	7	10.1%
2009	165	13	2.89	8	11	17.5%	12	7.3%
2010	173	17	2.64	7	13	17.6%	17	9.8%
2011	186	19	2.68	7	26	32.9%	30	16.1%
2012	162	15	2.41	7	16	21.3%	19	11.7%
2013	276	42	2.76	11	27	22.7%	30	10.9%
2014	587	106	2.60	9	66	23.5%	74	12.6%
2015	205	28	3.19	14	22	29.3%	28	13.7%
2016	197	20	2.78	9	22	27.5%	25	12.7%
2017	178	18	3.03	9	22	33.9%	22	12.3%
2018	186	30	2.99	8	25	32.5%	26	14.0%
2019	225	28	2.72	6	47	47.5%	45	20.0%
Total	1980	554	2.66	14	262	20.31%	281	14.09%

Table 2: Authorship data. **UA**: unique authors; **A2**: authors of 2 or more papers; **Ā**: average number of authors per paper; **MA**: maximum number of authors in a paper; **1FA**: papers with at least 1 female author, and percentage over total papers; **UFA**: unique female authors, and percentage over total authors.

across different online versions of the proceedings, as well as the conference program, and data "sanitization" required careful manual checking. In light of the heterogeneity of the employed data sources, all the tables of the database were assigned a "source" field in order to keep track of where data were collected from.

The database is accessible, browsable, and searchable at `http://smc.lim.di.unimi.it/`

4. AUTHORSHIP ANALYSIS

Table 2 provides various synthetic figures. We analyzed a total of 1923 papers. Among the 1980 unique authors involved in all editions, 1427 of them authored a single paper while 553 participated in more than one work. Returning authors across different editions were 452, namely the 22.8% of the total.

It is interesting to look at the presence of female authors, being SMC a sub-area of Computer Science, where gender gap is a relevant issue [16]. According to recent data on the enrollment, production, and employment of Ph.D.s in information, computer science and computer engineering in North America [17], in 2018 the percentage of females awarded with a Ph.D. in these areas was 21.3%, and newly hired faculty included 22.9% of females in a tenured track, 26.5% as teaching professors, 20.4% as researchers, and 18.2% as post-doc associates. At 2019 SMC conference, female authors have been about 20.0% of the total; in 2018 the percentage was 14.0%, in 2017 12.3%. This trend shows an increasing involvement of female scholars and experts in the field of SMC (see [18] for an analysis in other related conferences).

Figure 2 shows the quantity of papers as a function of the number of authors, with a peak on 2 authors, followed by 3 authors and 1 author respectively. Figure 3 reports frequency of publication by authors. It can be seen that the curve follows approximately the empirical Lotka's law [19], which states that the number of authors making x contri-

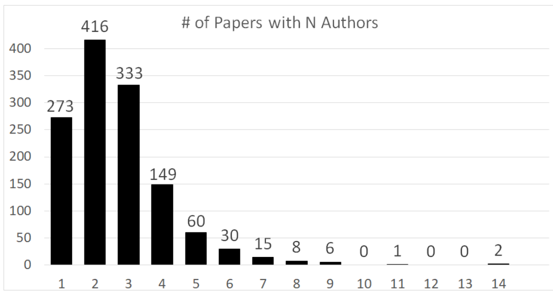


Figure 2: Number of authors per paper.

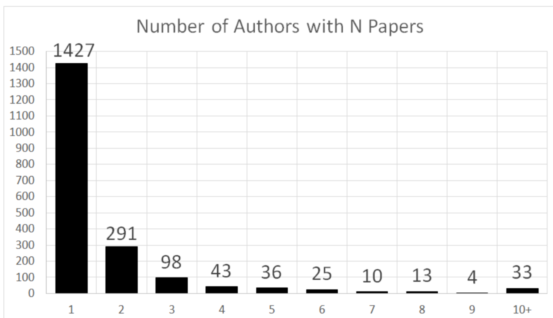


Figure 3: Frequency of publication by authors.

Author	Papers	Author	Coauthors	Author	Editions
Stefania Serafin	29	Stefania Serafin	54	Anastasia Georgaki	12
Sergio Canazza	19	Federico Avanzini	41	Federico Avanzini	11
Eduardo Reck Miranda	19	Sergio Canazza	38	Masataka Goto	10
Masataka Goto	17	Eduardo Reck Miranda	34	Stefania Serafin	10
Anastasia Georgaki	16	Antonio Rodà	31	Antonio Rodà	9
Marcelo Queiroz	16	Daniel Overholt	29	Tomoyasu Nakano	9
Antonio Rodà	16	Marcelo M. Wanderley	29	Myriam Desainte-Catherine	9
Marcelo M. Wanderley	16	Masataka Goto	26	Marcelo M. Wanderley	9
Gerhard Widmer	16	Anastasia Georgaki	25	Federico Fontana	9
Federico Avanzini	14	Federico Fontana	25	Luca Andrea Ludovico	9

Table 3: Top 10 contributing authors (left), top 10 authors with distinct coauthors (center), top 10 returning authors (right).

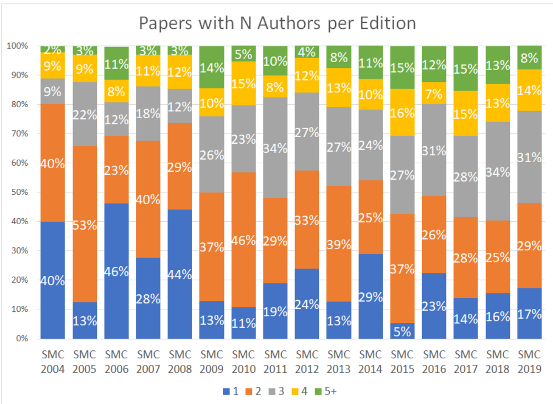


Figure 4: Papers with 1, 2, 3, 4, and 5+ authors.

Institution	Papers
IRCAM	50.04
Pompeu Fabra University (UPF)	39.65
Università di Padova	25.63
Queen Mary University of London	24.88
Aalborg University	23.83
KTH Royal Institute of Technology	22.02
Zurich University of the Arts (ZHdK)	20.23
Stanford University	20.22
Independent	19.37
Aalto University	18.77

Table 4: Top 10 contributing institutions.

Country	Papers
United Kingdom	159.19
France	151.73
United States	134.16
Italy	98.60
Japan	82.00
Spain	66.35
Canada	63.21
Germany	56.66
Austria	52.11
Greece	50.18

Table 5: Top 10 contributing countries.

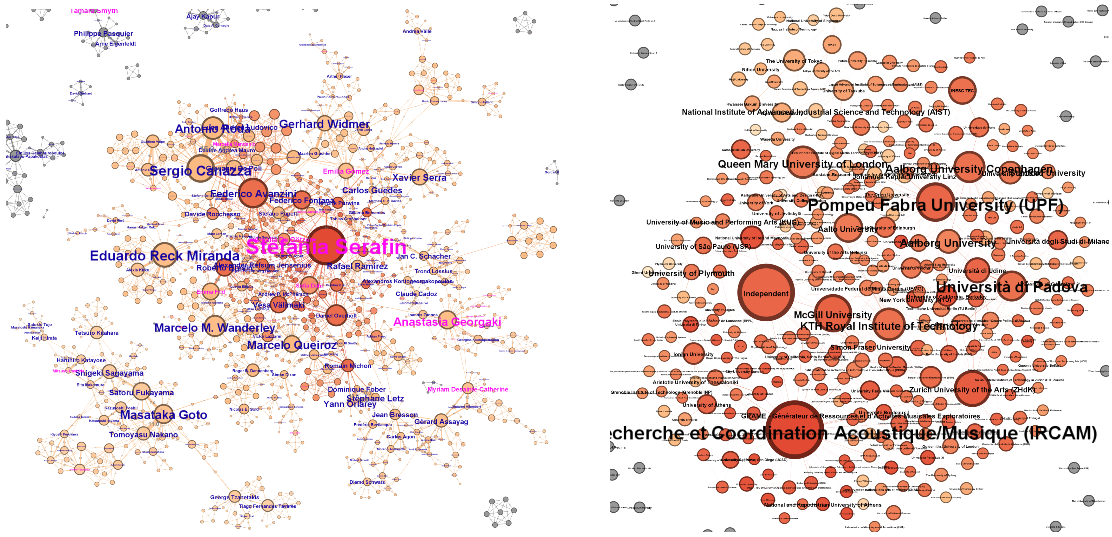
butions in a given period and in any given field is $1/x^a$ of those making a single contribution, with $a \sim 2$. Finally, Fig. 4 shows the number of papers with a given number of authors per edition. It can be seen that the coauthorships have increased over the years.

Table 3 shows the top 10 authors in terms of unique contributions, distinct co-authors, and participated editions (based on accepted papers rather than actual attendance). Altogether these figures suggest the establishment of a network of collaborations inside the SMC community, with many co-authors working together and a remarkable amount of returning authors. The connectivity graph of authors, particularly its largest connected component, can be seen in Fig. 5a.

We also analyzed authorship in terms of countries and affiliations represented. Represented countries are 51 in total, spanning over 5 continents. The trend is growing slowly but steadily: with the exception of the 2014 edition, SMC 2019 reached the top number of contributing countries (27), thus equalling the previous maximum gained in 2013. With regard to authors' affiliations, the whole series of SMC conferences has been attended by members from 585 unique institutions, including universities, music institutions (particularly conservatories), research centers, and private companies. In computing these figures, authors from different departments or laboratories belonging to the same institution have been clustered under a single element. Once again, the trend is ascending: in 2019 participants came from 94 institutions, reaching the highest value after 2014 and 2013 editions, respectively.

Tables 4 and 5 show the top 10 first level institution and countries. These values are weighted: i.e. a paper with 3 authors from 3 distinct institutions will count 1/3 for each institution/country represented. By doing so the overall total will sum up to the number of papers making comparisons possible.

Figure 6 shows the number of papers with a given number of affiliations per edition. On average, each paper has been written by authors from 1.44 different institutions, which reflects a good degree of cooperation on shared projects inside the SMC community. This aspect is particularly relevant, since one of the goals of the SMC conferences initiative is to create a network of scholars and experts. A visual representation is shown in Fig. 5b. An interactive graph view is available at the database website.



(a) Largest connected component of authors (961) centered on Stefania Serafin (highest number of coauthors). Node size represents degree of connectivity, edge thickness represents strength of the connection, font color represents gender, font size represents number of papers, node gradient represents distance from Stefania Serafin.

(b) Largest connected component of affiliations (319) centered on IRCAM. Node size represents degree of connectivity (number of occurrences), edge thickness represents strength of the connection, font size represents number of papers, node gradient represents distance from IRCAM.

Figure 5: Connectivity graphs between authors and affiliations.

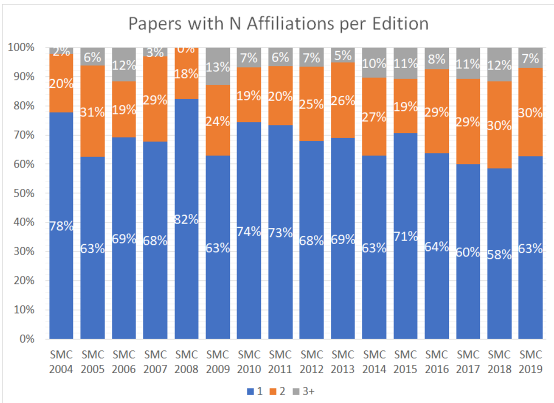


Figure 6: Papers with 1, 2, and 3+ affiliation.

Finally, affiliation types have been clustered into 5 groups: universities, other musical institutions, private companies, independent participants, and others. The percentage of papers coming from academia across various editions has always been over 90%, with a peak of 99.5% in 2010.

5. TOPICS

In this section we present an analysis of single terms and digrams (2-word phrases) extracted from titles and abstracts of SMC papers. Only title and abstract terms were considered, as these are assumed to provide concise and reliable summaries of the papers' contents. The analysis presented here largely follows the approach proposed by Lee *et al.* [5].

5.1 Words

As a first analysis, all the terms were extracted from titles and abstracts of each individual edition. Words were stemmed using an implementation of the Porter stemming algorithm provided by Stanford CoreNLP.[7] Stop-words were first removed using a publicly available list of common-usage English-language words, and additonal stop-words were removed through manual inspection of the resulting lists. Table 6 reports the top-15 stems for each edition, including ties.

The three stems *music, sound, perform* are often in the top-3 positions, and always in the top-5 positions, apart from the 2004 and 2005 editions (data in the first editions are generally noisy due to small numbers of contributions, and possibly also to a lack of a clear identity). These three stems fit well with the three broad research areas identified in Chapter 4 of the Roadmap [1], namely *sound*, *music*, and *interaction*. In this respect, it may be stated that, while SMC has grown and changed, it has remained true to the vision laid out in the Roadmap. The next most recurring stems are *interact, model* (all editions), *audio* (missing in 2007 only), *control* (missing in 2005, 2009, 2017-18). The four stems *instrument, algorithm, process, composit* are less frequent (10, 9, 9, and 8 occurrences respectively) but appear to be evenly represented over time, suggesting that they too can be considered to be amongst core SMC topics.

Despite being among the most frequently recurring terms, the two stems *synthesi* (2005-08, 2010, 2012, 2016, 2019) and *analysi* (2005-07, 2009-10, 2012, 2015) exhibit a decreasing trend over time, in terms of both occurrences and

[7] https://stanfordnlp.github.io/CoreNLP/

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
music	music	music	music	music	music	music	music	music	music	music	music	music	music	music	music
perform	*analysi*	sound	sound	sound	sound	sound	sound	sound	perform	sound	sound	sound	perform	perform	sound
~~control~~	model	model	model	~~*space*~~	perform	model	model	perform	sound	perform	model	perform	sound	sound	model
interact	interact	interact	perform	~~*spatial*~~	model	perform	perform	model	model	~~*composit*~~	perform	instrument	design	~~instrument~~	interact
~~pattern~~	perform	perform	~~interact~~	perform	audio	*control*	design	design	audio	model	instrument	model	model	model	perform
express	*synthesi*	~~*chant*~~	composit	model	~~instrument~~	audio	audio	~~*synthesi*~~	interact	interact	design	interact	*user*	audio	design
sound	*process*	*data*	control	~~composit~~	*design*	~~*pattern*~~	featur	~~instrument~~	user	design	~~user~~	audio	audio	interact	audio
model	sound	~~structur~~	instrument	~~*express*~~	*interact*	~~analysi~~	interact	interact	~~*data*~~	*process*	~~experi~~	~~*synthesi*~~	instrument	~~featur~~	*chord*
~~represent~~	~~audio~~	*control*	~~process~~	*algorithm*	~~*data*~~	~~user~~	*process*	audio	~~algorithm~~	control	audio	design	~~*musician*~~	design	*synthesi*
~~sequenc~~	~~piec~~	synthesi	~~analysi~~	~~synthesi~~	*analysi*	~~*synthesi*~~	control	~~*composit*~~	*experi*	*instrument*	~~process~~	~~control~~	*algorithm*	*process*	*control*
audio	~~*experi*~~	analysi	~~*voic*~~	*audio*	*user*	~~*time*~~	*instrument*	~~process~~	featur	~~*interfac*~~	~~*signal*~~	~~*composit*~~	~~*piano*~~	*learn*	learn
~~score~~	~~algorithm~~	process	~~*gestur*~~	*score*	~~score~~	featur	*algorithm*	algorithm	~~*listen*~~	audio	interact	~~*evalu*~~	*featur*	~~*record*~~	*data*
~~system~~	*structur*	~~*rhythmic*~~	synthesi	instrument	~~*object*~~	interact	~~*data*~~	featur	control	user	~~*song*~~	~~visual~~	~~*experi*~~	user	process
piec	~~*segment*~~	*instrument*	~~data~~	~~*system*~~	~~algorithm~~	design	~~*paramet*~~	~~*analysi*~~	design	experi	*visual*	~~*comput*~~	~~*data*~~	~~algorithm~~	user
algorithm	~~express~~	~~*time*~~	~~*tool*~~	~~control~~	*featur*	~~*composit*~~	~~*physic*~~	*user*	~~*paramet*~~	featur	~~*analysi*~~	~~*environ*~~	interact	~~*composit*~~	*network*
~~gestur~~		*composit*					~~*express*~~	control			~~featur~~				

Table 6: Top 15 title+abstract words (stemmed) w/ ties. Italics: new wrt previous edition; strikethrough: not anymore in next edition.

ranks. This suggests convergence towards an evolutionary plateau and a high level of maturity for these topics, with a corresponding decrease of contributions by the research community.

A definite trend can be observed for the stem *design*, which first appears in 2009 and ranks in the top positions from there onwards. This can be related to a corresponding boost in such research topics as Sound Design and Sonic Interaction Design [20]. More in general, the increasing trend for stems such as *user* and *experi* may suggest a growing interest for HCI-related research and human factors.

One second possible trend can be observed, albeit on a very short time-scale, for the stem *learn* (2018-19), which is associated with a boost in contributions using machine learning approaches in a variety of applications. The increasing trend for the stem *featur*, although slower and longer (2009-15, 2017-18), supports this view.

Some sporadically recurring terms can be linked to specificity of certain editions, in particular to their proposed general theme. A striking example is given by the 2008 edition, which invited contributions dealing with "sound and space": correspondingly, the stems *space, spatial* have unusually high ranks. Similar remarks hold for other editions, and suggest that the SMC research community responds well to dedicated calls on special topics.

5.2 Digrams

Since single terms provide a limited view of research topics (also as a side effect of stemming), as a second analysis we extracted digrams (2-word phrases) from titles and abstracts of each individual edition, with the goal of identifying more specific concepts. The number of digrams largely exceeds that of single terms, and their frequency is consequently much lower. Therefore, instead of examining digrams on a year-by-year basis we clustered them into four groups of four years in order to let dominant research topics emerge. Table 7 reports the top-10 digrams for four groups of four editions, including ties.

The 42 entries in the table are made up of 20 unique digrams. In particular, the digrams *sound synthesi, physic model, music composit, music perform, music instrument* occur in all four clusters, accounting for half of all the entries. Again, these fit very well with the three broad research areas *sound*, *music*, and *interaction*, identified in the Roadmap.

2004-2007	2008-2011	2012-2015	2016-2019
physic model	music instrument	comput music	sound synthesi
sound synthesi	music perform	music perform	music instrument
music instrument	comput music	music instrument	neural network
comput music	physic model	sound synthesi	music perform
gestur control	sound synthesi	electron music	music composit
sing voic	music composit	real time	physic model
music perform	sound object	interact music	music score
electroacoust music	music score	music composit	interact music
tone sequenc	audio signal	physic model	deep learn
music composit	concaten synthesi	electroacoust music	sing voic
music piec			signal process

Table 7: Top 10 title+abstract digrams w/ ties.

It is not easy to identify trends in time. The only clear trend is the rise of machine learning and deep learning methods in recent years, shown by the digrams *neural network, deep learn*. Instead, the previously discussed trend for sound design and sonic interaction design is less clearly identifiable, with related digrams being *sound object* (cluster 2) and *interact music* (3,4). Note that the latter is the only digram containing the stem *interact*.

6. DISCUSSION AND CONCLUSIONS

Due to space constraint the amount of data displayed in this paper is limited. More types of charts, graphs, and analysis can be found online.

In general, data about authorship show that the participation to the conference has widened over the years, in terms of unique authors, represented institutions, and represented countries. Participation by female authors is also increasing, and peaked in the last 2019 edition. The average number of authors per paper has increased, as well as the degree of connectivity of unique authors and institutions, suggesting the establishment of a research community that increasingly collaborates on joint papers and projects.

It must be noted that the acceptance rate in particular is far from the one of comparable top-tier computer science conferences. Although previous studies have questioned the use of acceptance rate as a good proxy for conference quality [21]. This can be interpreted as a warning that the conference attractiveness is not growing.

Possible reasons and countermeasures should be investigated. One point of discussion concerns the appeal of

SMC against related conferences mentioned before (ISMIR [5–8], DAFX [9,10], and NIME [11,12]. These are all events with a narrower and more specialized focus, which might attract more effectively researchers in related fields. We should thus interrogate ourselves on the effectiveness of the current aims, focus, and format of SMC, and find ways to promote them more incisively. Answering to these questions would also benefit from the availability of data regarding citations of SMC papers from Google Scholar or other sources. This is left for future work.

The analysis of topics confirms that one of the defining elements of the SMC is its wide focus, that spans a broad spectrum of research topics. This analysis is admittedly at a preliminary stage and needs to be refined through more advanced natural language processing approaches. We need to better understand what SMC research is today, and envision what it will be tomorrow, much like the authors of the SMC Roadmap [1] did almost fifteen years ago. A related relevant point is that the 2012 ACM Computing Classification Scheme, which replaced the 1998 CCS, moved SMC to the section "Applied Computing". [8] After twenty five years SMC is still struggling to find its place as a research field.

We encourage the SMC community to check the website and report to the authors about any discrepancy in the data. By adopting a "crowdsourced" approach the database can be improved in a relatively little time. As for future editions, if there is a general interest toward the platform there will be the need for a small overhead on the organizers. Automatic import functions have been built to interact with the EasyChair platform thus allowing a reasonably painless procedure. A few actions could also considerably improve the quality of the data, i.e. changing the LaTeX template for the conference. At the moment there is no structure for the authors/institution thus allowing an heterogeneous approach at presenting the information. By superimposing a more rigid structure most of the problems could be easily solved once again requiring just a minor effort from the authors. In particular a new template should support an explicit mapping of authors-institutions in order to make clear any multiple affiliation scenario for the authors. On top of that it would be beneficial to require more structured information for each author. For example some journals (e.g. Nature) are requiring unique identifiers (such as. ORCID) for each author. If we do not want to adopt an external service we could start by standardizing the authorship with tags (some optional) such as:

```
\firstnames{}\middlenames{}\lastnames{}
\gender{}
```

Authors with names written in non-Latin alphabet should be given the possibility to add those names as well. This will also mitigate the problems related to the non-uniqueness of transliterations and will allow for searches using any alphabet system. Similar requirements are needed for affiliations in order to organize that information and make it easier to understand:

```
\affiliation{}\department{}\laboratory{}
\city{}\country{}
```

Another requirement would then be to add to the submission process not only the PDF but also the source code used to generate it. This will allow automatic text mining in order to retrieve keywords, topics, and more in general the text for further analysis. More insights about the community could be gained by adding more information about the authors such as the age and their job description (particularly relevant for academia) at the time of publication. Determining how many new young students the community is able to attract can contribute to the understanding of how such a community can survive and thrive in the future. It is important to keep in mind that these constitute sensitive data and they have to be handled particularly carefully. Also it is not sure how many members of the community will be willing to share this information at all. As a future improvement to the connectivity graphs presented here and on the web we plan to add the possibility to navigate the timeline of SMC editions in order to see how clusters formed, evolved, and potentially extinguished over time.

[8] Applied Computing → Arts and Humanities → Sound and Music Computing. Previously H.5.5 H Information Systems → H.5 Information Interfaces and Presentation (e.g., HCI) See: https://dl.acm.org/ccs

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