BIBLIOMETRIC STUDY OF THE DAFX PROCEEDINGS 1998 – 2009

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ABSTRACT

In this paper we present a bibliometric study of the *Digital Audio Effects* (DAFx) conference proceedings from 1998 to 2009. Using the online DAFx proceedings, we constructed a DAFx database (LaTeX) to study its bibliometric statistics in terms of research topics, growth of literature, authorship distribution, citation patterns, and frequency distribution of scientific productivity. Results showed that the DAFx literature (with quasi-linear accumulative growth) now consists of 722 contributions (including key notes, papers and posters) from 767 unique authors, from which we identified the 20 top DAFx contributors. Using Google Scholar, we identified that the top 10 most cited DAFx papers (between 43 to 65 times) are in majority (8/10) dealing with sound and music analysis (e.g. extraction of sinusoids, musical genre classification, perceived intensity of music, and musical note onset detection). This study also confirmed that the DAFx literature conforms to the Lokta's law (n=2.0771 and C=0.6336) at 0.01 level of significance using the Kolmogorov-Smirnov test (KS-test) of goodness-of-fit. The DAFx database will serve as the basis for an Author Co-citation Analysis (ACA) and to create a DAFx conferences archive DVD.

1. INTRODUCTION

The *Digital Audio Effects* (DAFx) conference series started in 1998 as a workshop initiated by Daniel Arfib (Laboratoire de Mécanique et Acoustique (LMA), Centre National de la Recherche Scientifique (CNRS), France) and funded as a European research project for co-operation and scientific transfer (EU-COST-G6) during 1997 and 2001.

Although the first author has only attended the DAFx99 at which he presented his first research paper [1], great memories remain of the presentations covering both theoretical and practical issues with methods and systems for audio/music/sound analysis, processing and synthesis, and also excellent social activities. After more than a decade, it is timely to provide a status-check of the DAFx conferences in terms of scientometrics and bibliometrics. Results from this study should be useful for future comparisons with more DAFx conferences over many years to come.

Every year, the DAFx conference organizers create a web site[1] to disseminate, with free online access, the proceedings of the conference to the international music/audio research community. In this paper we thus aim to use this proceedings and try to quantify the impact of DAFx conferences using bibliometric measures (bibliometrics) from its DAFx literature records.

The rest of the paper is organized as follows. In Section 2, we briefly remind the chronology of the DAFx conferences since 1998. In Section 3 we focus on the DAFx publications with its bibliometrics on research topics, growth of literature, authorship distribution, citation patterns, and scientific productivity. Finally, in Section 4 we conclude the paper.

[1] See from www.dafx.de

Table 1: *Timeline of the DAFx conferences*

Year	Location	Organizers
1998	Barcelona, Spain	Pompeu Fabra University
1999	Trondheim, Norway	Norwegian University of Science & Technology
2000	Verona, Italy	University of Verona
2001	Limerick, Ireland	University of Limerick
2002	Hamburg, Germany	University of the German Federal Armed Forces
2003	London, U.K.	Queen Mary, University of London
2004	Naples, Italy	Federico II University of Naples
2005	Madrid, Spain	Universidad Politécnica de Madrid
2006	Montreal, Canada	Schulich School of Music, McGill University
2007	Bordeaux, France	SCRIME & LaBRI, University of Bordeaux I
2008	Espoo, Finland	Helsinki University of Technology
2009	Como, Italy	ISPG, Politecnico di Milano

2. DAFX CONFERENCES

The DAFx conference started in 1998 from an initial COST-G6 funding which ended in 2001 and this lead to the DAFx committee to decide to further continue the organization of the DAFx conferences. Since then the workshop was renamed international conference, having gained popularity and extended its research coverage to broader topics. Each conference consists of key notes from audio experts, sessions focused on a specific audio research field, and sessions in which researchers present their work using posters.

The chronology of the DAFx conferences since 1998 is shown in Table 1. Thanks to the support from its main organizers, the DAFx conferences will continue in the years to come with more planned until 2014. The Institute of Electronic Music and Acoustics (IEM) at Graz (Austria) will be hosting the DAFx in 2010, then subsequent DAFx conferences are already planned in Paris (France) for 2011, in York (U.K.) for 2012, in Maynooth (Ireland) for 2013, and Erlangen (Germany) for 2014.

3. DAFX PUBLICATIONS

3.1. DAFx research topics

DAFx conferences have primary session themes related to digital audio effects, but also extend its research topics to sound synthesis, physical models and virtual musical instruments, virtual

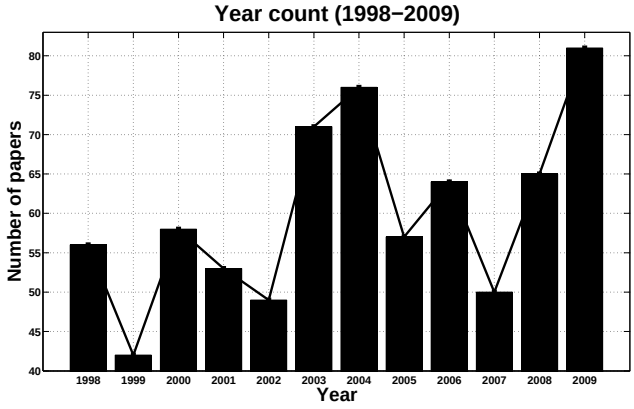

Figure 1: *DAFx papers per year*

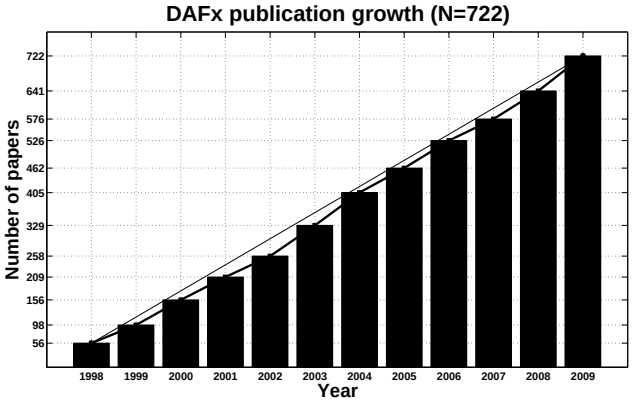

Figure 2: *DAFx literature growth*

analog models, sound representation and sound modeling, time-frequency and spectral processing, audio coding, audio analysis and feature extraction, synthesis, reproduction and perception of spatial sound, perception, cognition, and psychoacoustics, software and hardware implementations with Digital Signal Processing (DSP), PC-based plug-in developments, audio-based music information retrieval systems, automatic transcription and high-level features, space-time audio processing, networked audio and the internet, compositional issues, sound design and sonic interaction design, applications for mobile audio devices. The broad scope of topics/interests allow researchers from different background and expertise to exchange ideas and synergize audio research around the theme of *digital audio effects*.

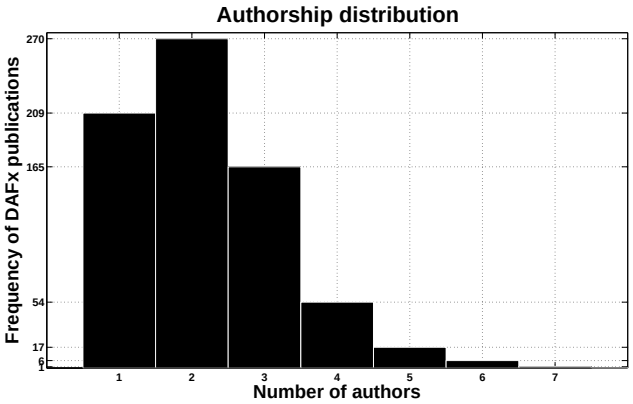

Figure 3: Authorship distribution

3.2. Growth of DAFx literature

The number of papers published at each DAFx conference, as shown in Figure 1, is rather constant, all summing up to 722 by 2009 with an average of 60.3 papers (std 11.43). The growth of DAFx literature is quasi-linear (See Figure 2), with DAFx conferences in 2003, 2004 and 2009 having the most contributions with, respectively, 71, 76 and 81 papers.

3.3. DAFx authorship distribution

The authorship distribution is shown in Figure 3 with the majority of papers written by one, two or three authors. In Figure 4, we also show the authorship profile for all DAFx conferences from 1998 to 2009, with a total of 767 unique authors having contributed to keynotes, papers or posters (in total 722 contributions from an accumulative count of 1588 authors). The accumulated count for each author revealed the top 20 contributors as Julius O. Smith (22), Mark Sandler (20), Joseph Timoney (18), Gianpaolo Evangelista (17), Victor Lazzarini (17), Sylvain Marchand (17), Udo Zölzer, Damian Murphy (15), Vesa Välimäki (15), Thomas Lysaght (13), Matti Karjalainen (12), Davide Rocchesso (12), Laurent Daudet (11), Jonathan Abel (10), Augusto Sarti (10), Stefania Serafin (10), Daniel Arfib (9), Federico Avanzini (9), José R. Beltran (9), and Stefan Bilbao (9).

3.4. DAFx most cited papers

One way to assess the outcome of the DAFx conference in bibliometric terms would be to look at its most cited papers. However, one can not expect the most recent papers to be cited as much as older paper. For each of the 722 DAFx contributions, we queried Using Google's advanced scholar search to obtain its citation count.

The most cited DAFx contribution is on a *survey on extraction of sinusoids in stationary sounds* by F. Keiler and S. Marchand [2] cited 65 times, followed by a DAFx03 poster by J. J. Burred and A. Lerch on *a hierarchical approach to automatic musical genre classification* [3] cited 63 times. We then find a poster on *musical mosaicing* by A. Zils and F. Pachet [4], cited 61 times, followed by a work on *a hybrid approach to musical note onset detection* by C. Duxbury, M. Sandler, and M. Davies [5], cited 59 times. Next on the same topic, with a *Complex domain onset detection for musical signals* [6] with J.P. Bello followed, collecting 54 citations. Following in the list is the work by E. Pampalk, S. Dixon and G. Widmer [7] titled *on the evaluation of perceptual similarity measures for music*, cited 53 times, then a paper by S. Dixon on *onset detection revisited* [8], with 51 citations. Cited 46 times, follows the work presented on *a new approach to transient processing in the phase vocoder* by A. Röbel [9], followed by the research on *modeling collision sounds: non-linear contact force*

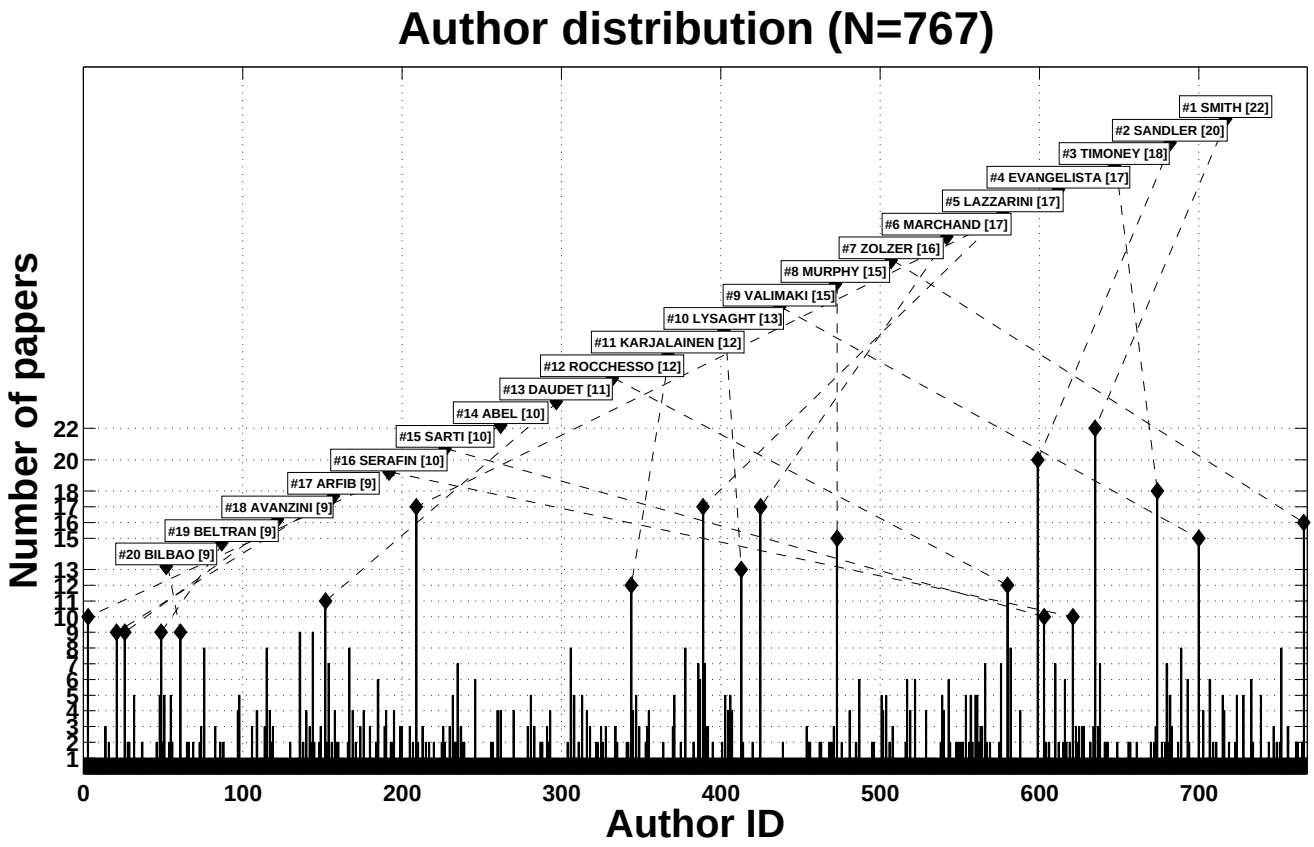

Figure 4: *Authorship distribution*

by F. Avanzini and D. Rocchesso [10], cited 45 times. Finally, the 10th most cited DAFx contribution is by C. Faller on *parametric coding of spatial audio* [11].

It would be interesting to organize, during future DAFx conferences, a survey for DAFx contributors to nominate the 5 top ever DAFx papers, and to comment on their rationale.

3.5. Lotka's law

Using the name of the 767 unique authors who contributed to the 722 publications of the DAFx literature, one can look at the frequency of publication by authors. As shown in Figure 5, a good majority of 500 (65.19%) authors contributed to only one publication, while 121 (15.78%) to 2 publications, and 45 (5.87%) have 3 publications. We used Lotka's law [12] to find authors' productivity patterns. It typically states that for every 100 authors contributing to one article, 25 will contribute 2, 11 will contribute 3, etc. (i.e. $1/n^2$), thus accordingly only 6% of the authors in the field will produce more than 10 articles (C=1 and n=2). The general form of Lotka's law is defined as:

$$y = C/x^n \tag{1}$$

where x is the number of contributing authors and y is the number of publications. The exponent n and constant C are estimated, respectively, by linear least square fitting and an approximation function [13]. For the DAFx literature, we found n=2.0771 and

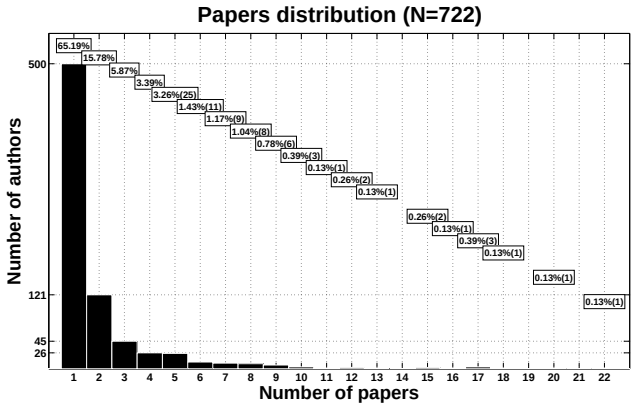

Figure 5: *Paper distribution*

C=0.6336, resulting in the Log-Log plot of the number of author and their corresponding number of publications, as shown in Figure 6. Furthermore, using the Kolmogorov-Smirnov test (KS-test) of goodness-of-fit, we found that the DAFx literature conforms to Lokta's law at 0.01 level of significance.

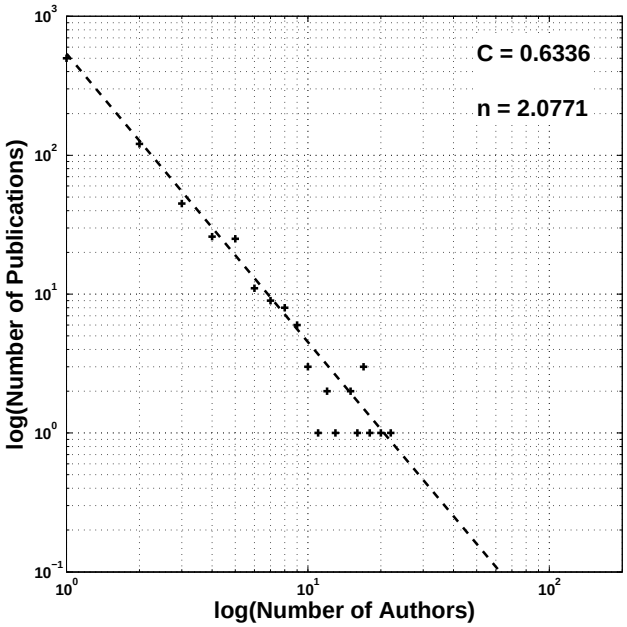

Figure 6: *LogLog-Plot showing Lotka's law*

4. CONCLUSION

In this paper an historical view was taken on the digital audio effects (DAFx) conferences and in particular details on the proceedings since DAFx creation in 1998. Such study was carried out to create the a list of DAFx conferences contributions (publications) and contributors (authors). From this comprehensive database, we extracted bibliometrics (e.g. number of papers, authors' count, number of citations and its patterns, scientific productivity, etc.) to create a timely picture of the DAFx literature.

A list of the most cited DAFx papers was created and indicated that the top ten most cited papers, between 43 to 65 times, all relate to sound / music analysis (e.g. extraction of sinusoids, musical genre classification, perceived intensity of music, and musical note onset detection). Results also indicate that although the DAFx has a major European organizing component, created from an initial European Cooperation in the Field of Scientific and Technical Research initiative (EU-COST-G6), over the years DAFx conferences have attracted more and more international researchers.

One outcome of this study is the creation of a LaTeX bibliography file with all DAFx paper references from all the DAFx conferences (See Appendix[2]). The creation of such files will facilitate future citation and provide (hopefully) error-free source for the Information Sciences Institute (ISI) World of Knowledge database. It could be maintained online, available from the official DAFx website, and serve to create an archive DVD with all the DAFx contributions for future reference.

Future work will be looking at visualizing the DAFx research space of the DAFx conferences proceedings with an Author Co-citation Analysis (ACA) [14]. For comparison purpose, bibliometric studies can be carried out on other audio conferences, for e.g. the Audio Engineering Society (AES) conventions and the International Computer Music Conference (ICMC).

[2]Complementary data available at
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5. REFERENCES

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