Analysis of VINCI 2009–2017 Proceedings

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ABSTRACT

Both the metadata and the textual contents of scientific publications can provide us with insights about the development and the current state of the corresponding scientific community. In this short paper, we take a look at the proceedings of VINCI from the previous years and conduct several types of analyses. We summarize the yearly statistics about different types of publications, identify the overall authorship statistics and the most prominent contributors, and analyze the current community structure with a co-authorship network. We also apply topic modeling to identify the most prominent topics discussed in the publications. We hope that the results of our work will provide insights for the visualization community and will also be used as an overview for researchers previously unfamiliar with VINCI.

CCS CONCEPTS

• **General and reference** → **Surveys and overviews**; • **Human-centered computing**; • **Computing methodologies** → *Topic modeling*;

KEYWORDS

meta-analysis, survey, overview, visualization, scientific literature, topic modeling

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1 INTRODUCTION

The VINCI symposium is going to take place for the 11th time in 2018, which means that the results of its previous decade can now be summarized and analyzed. The title of VINCI mentions concepts such as visual information communication and interaction, while the symposium description mentions further topics of interest such as visual analytics, human-computer interaction, visual arts and design, and computational aesthetics. This rather wide range of concepts and topics leads to the following question: what is the actual state of VINCI proceedings with regard to topics discussed in the publications? Furthermore, the statistics about the publications, their authors, and their interactions can also be beneficial for the scientific community. In this short paper, we present analyses of the existing VINCI symposium proceedings from 2009–2017 which provide insights about these questions. Our work can also be used as an overview for researchers previously unfamiliar with VINCI.

The rest of this paper is organized as follows: in the next section, we discuss the existing work on analyses of scientific publications, including the methods involving visualizations of topic models. We outline the main steps and methods of our analyses in Section 3, and then describe our results and findings in Section 4. Finally, we conclude the paper in Section 5 with several ideas for future work.

2 RELATED WORK

While survey articles, including some of our own previous work [18, 19], focus mostly on specific research problems or aspects, this paper is geared towards the analysis of scientific publications with a rather wide range of research topics. Quite relevant to our approach is the work by Plaisant et al. [29] on the data set for the InfoVis 2004 contest, which was based on metadata about the first 10 years of the InfoVis conference proceedings. The authors' description of the issues related to data collection, preprocessing, and cleaning fits our experience very well.

The information visualization community itself has produced a number of approaches for visual analysis of scientific literature, as described in the survey by Federico et al. [13]. For example, the SurVis approach for literature survey curation and analysis by Beck et al. [3] supports visualization of publication clustering results based on authorship and user-defined keywords. Other existing approaches use topics discovered in publications with topic modeling algorithms, as discussed in the recent survey by Zhang et al. [36] on visualization for scientific literature topics. Topic visualization approaches have also been applied to a variety of data domains besides scientific literature, including the tools such as Termite by Chuang et al. [9], TIARA by Liu et al. [24], Serendip by Alexander et al. [1], or Topics2Themes by Skeppstedt et al. [34]. In contrast to some of the more powerful and complex tools, pyLDAvis [26, 33] provides a simple interactive visualization for exploring the relations between extracted topics and corresponding terms. We were inspired by this tool when analyzing topic modeling results ourselves, but in contrast, our approach also involved analyzing the relations between topics and documents.

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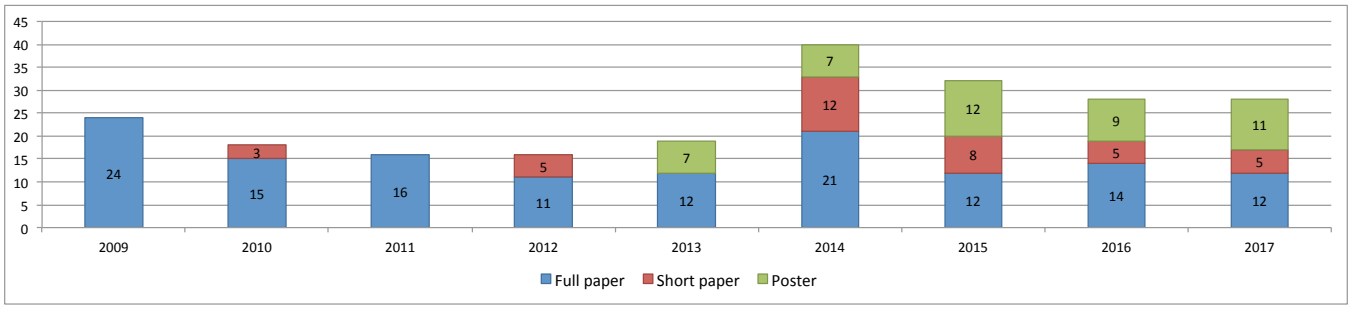

Figure 1: Yearly statistics for 221 publications included in VINCI 2009–2017 proceedings.

Table 1: Top authors (≥ 5 publications)

Kang Zhang	13
Mao Lin Huang	13
Quang Vinh Nguyen	9
Robert P. Biuk-Aghai	8
Guozhong Dai	7
Michael Burch	7
Takayuki Itoh	6
Zhifang Jiang	6
Changbo Wang	5
Hongan Wang	5
Jie Li	5
Xiaolong (Luke) Zhang	5
Yuhua Liu	5

Table 2: Publication count distribution

#publications	1	2	3	4	5	6	7	8	9	13
#authors	499	61	13	10	5	2	2	1	1	2

3 METHOD

In order to conduct analyses of VINCI symposium proceedings, we used the corresponding 221 publications in PDF format, publishers' metadata (when available), and symposium websites (when available). To the best of our knowledge, no proceedings were published for the first symposium in 2008. The proceedings of VINCI 2009 [16] are available only as a book published by Springer in 2010. We also used the symposium program from the VINCI 2009 webpage in order to establish the session titles for further analyses. Proceedings of VINCI 2010–2017 are available online from the ACM Digital Library [8, 11, 17, 23, 28, 30, 35, 37] alongside the metadata about the session titles. We also had to use the symposium webpages in several cases to confirm the requirements for the paper types, e.g., whether short papers were submitted in a separate track.

The further metadata preprocessing step involved extraction of authorship and co-authorship statistics. We had to manually normalize the names of some authors in the metadata, for instance, there are four different variations of the name of Mao Lin Huang in VINCI proceedings [20, 22, 38, 39]. After the author name normalization, we could proceed with computing statistics and constructing a co-authorship network, which was later analyzed in Gephi [2].

The final group of analyses involved a topic modeling approach [5]. In order to conduct such analyses, we extracted full text contents from publication PDFs. Due to various problems with PDF-to-text conversion (which are often encountered when analyzing scientific literature [10, 14]), we had to use several tools, including several PDF viewers to copy parts of the content manually and even an OCR approach to tackle several problematic files. Then, we manually cleaned the plain text files and edited them to remove the initial boilerplate messages, acknowledgments, and references in order to focus on the main publication contents. The resulting text files were used for topic modeling with LDA [6, 15], an algorithm that produces a set of topics, corresponding top terms, and their relationships to the documents. The implementation was carried out with Python using NLTK [4] and Gensim [31] for preprocessing and actual topic modeling stages, respectively. Inspired by pyLDAvis [26, 33], we also explored the relationships between documents, topics, and terms visually. This step involved computing a projection for documents based on corresponding related topics. Following the recommendations by Sedlmair et al. [32], we selected t-SNE [25] as the dimensionality reduction technique for this task. The results, including the documents projection and interactive bar charts for topics and terms, were then visualized with Bokeh [7].

4 RESULTS

In this section, we present and discuss the results of the conducted analyses, ranging from the metadata-related to the content-related ones.

4.1 Temporal publication statistics

Figure 1 presents the temporal statistics for several publication types: full papers, short papers, and posters. The short paper track was not formally introduced until 2014, but we included several papers from 2010 and 2012 into this category since their length did not exceed 5 pages, a limitation set for short papers in 2014. Also, while posters were displayed during the early years of the symposium, poster papers started to be included in the proceedings only in 2013. The same year an abstract about a demo presentation by Derksen et al. [12] was included in the proceedings, which is the only demo abstract in VINCI proceedings so far (it is included in the poster category in Figure 1). In general, these temporal statistics show a stable level of interest for the symposium in the last years after a peak in 2014.

Topic 1 *time & text vis*	**Topic 2** *user interface*	**Topic 3** *mobile devices*	**Topic 4** *interactions*	**Topic 5** *eye tracking*	**Topic 6** *general infovis*	**Topic 7** *geospatial data*	**Topic 8** *general infovis*	**Topic 9** *evaluation*	**Topic 10** *sentiment & networks*
topic	data	user	interaction	eye	data	map	data	task	sentiment
event	widget	map	device	visualization	time	user	user	participant	node
news	user	system	user	data	user	visualisation	information	information	edge
data	model	information	process	county	visualization	figure	visualization	visualization	data
time	container	phone	model	movement	information	information	visual	set	visualization
word	application	figure	two	eye_movement	figure	visualization	figure	study	algorithm
analysis	node	group	method	visual	node	like	system	group	tree
trend	end	interface	handed	design	system	data	interaction	user	view
visualization	visual	mobile	mobile	task	visual	task	web	question	analysis
system	figure	data	space	user	view	colour	example	result	point

Topic 11 *general infovis*	**Topic 12** *time vis*	**Topic 13** *image processing*	**Topic 14** *graph drawing*	**Topic 15** *clustering & graphs*	**Topic 16** *computer graphics*	**Topic 17** *applications*	**Topic 18** *applications*	**Topic 19** *graphs & networks*	**Topic 20** *parallel coordinates*
data	stock	image	graph	tag	color	data	document	graph	data
user	data	feature	model	rule	image	system	process	node	visualization
view	visualization	figure	drawing	cluster	object	user	policy	network	coordinate
task	figure	method	production	network	table	information	user	user	figure
visualization	pattern	region	two	user	method	visualization	graph	set	dimension
model	time	water	crossing	feature	texture	cluster	metaphor	layout	category
system	article	result	hand	node	figure	figure	edge	link	parallel
visual	editor	system	set	data	layout	power	visualization	edge	line
process	pen	point	algorithm	matrix	result	application	approach	visualization	number
information	market	model	grammar	visual	tile	patient	expert	dynamic	parallel_coordinate

Figure 2: Top terms for topics generated with LDA for VINCI proceedings. The suggested topic titles are displayed in italics.

4.2 Authorship and co-authorship statistics

After normalizing the author names and counting the number of their contributions, we discovered that the total number of authors in VINCI proceedings so far is 596. The sorted list of authors with largest numbers of publications is presented in Table 1. Besides the most prominent authors, we were also interested in the overall distribution of publication counts. This information is presented in Table 2, and it presents us with an insight that while the majority of authors have published at VINCI only once, there is still a large group of recurring authors with two or more publications.

We also used the metadata to create a co-authorship network and used Gephi [2] to analyze it (see the auxiliary material). 596 nodes representing authors are connected with 1,241 edges in total. The further analysis revealed that the network contains 101 connected components. The largest component includes 63 author nodes (10.57%), with several researchers from the top of Table 1 among them. The second and third largest components include 44 nodes (7.38%) and 21 nodes (3.52%), respectively. An interesting insight is that the first two components mostly include researchers who work or worked in China, and the third component includes multiple researchers from Stuttgart, Germany.

The final analysis conducted with the co-authorship network is related to network centralities [27]. The largest *betweenness* centrality [21] values in the network are associated with Mao Lin Huang, Kang Zhang, and Quang Vinh Nguyen. All these three authors belong to the largest network component and also have the largest numbers of publications in the data set.

4.3 Content analysis with topic modeling

The detailed information about the top 20 topics discovered in VINCI proceedings with LDA (computed with unigrams and bigrams) is provided in Figure 2. The interpretation of these results is facilitated by an interactive tool displayed in Figure 3, which offers an alternative view on the distribution of topics of the corpus. We employed the dimensionality reduction technique t-SNE [25] to create a two-dimensional layout of all the documents according to their topics. In other words, the features used are the topic distributions of each document—a 20-dimensional vector for each document—with a value of zero applied to topics which are entirely unrelated to the document. This 20-dimensional space is reduced to two dimensions using t-SNE, where two documents are positioned close to each other if their topic distributions are similar. The results, as can be seen in Figure 3(a), show the formation of clear clusters of documents related to similar topics.

In order to facilitate the analysis, we selected seven interesting topics corresponding to the clusters in Figure 3(a) and assigned a different categorical color for each of them (see Figure 3(b)). A document (a point in the scatterplot) was assigned one of the topic colors if that topic represents the highest probability in the document's 20-dimensional vector (i.e., it is the most related topic to the document, among the 20 possibilities). Transparency shows the confidence of this mapping; opaque documents are highly related to the assigned topic, while transparent ones are only marginally related (and are, thus, less informative). The colored rings around each of the 7 selected topic clusters were manually added later. Finally, the bars at the right-hand side (see Figure 3(c)) show the terms with the highest relevance among all the topics selected using the bar chart in Figure 3(b).

Some interesting insights can be gathered from this view. Topic 19 includes terms such as 'graph', 'node', and 'network', which means it is related to papers from the graph drawing community. The terms relevant to this topic take up 8 spots from the 20 most relevant terms shown in Figure 3(c), although the visually-detected cluster of documents contains only 7 documents. We conclude that the graph drawing community is relatively small among the VINCI authors, but is nonetheless a very tight group, with strongly related papers and easily identifiable topical terms. That is also the case, for example, with the image processing community (Topic 13), showing highly relevant topics such as 'image', 'feature', and 'region', and with papers related to parallel coordinates (Topic 20), a popular multidimensional visualization technique.

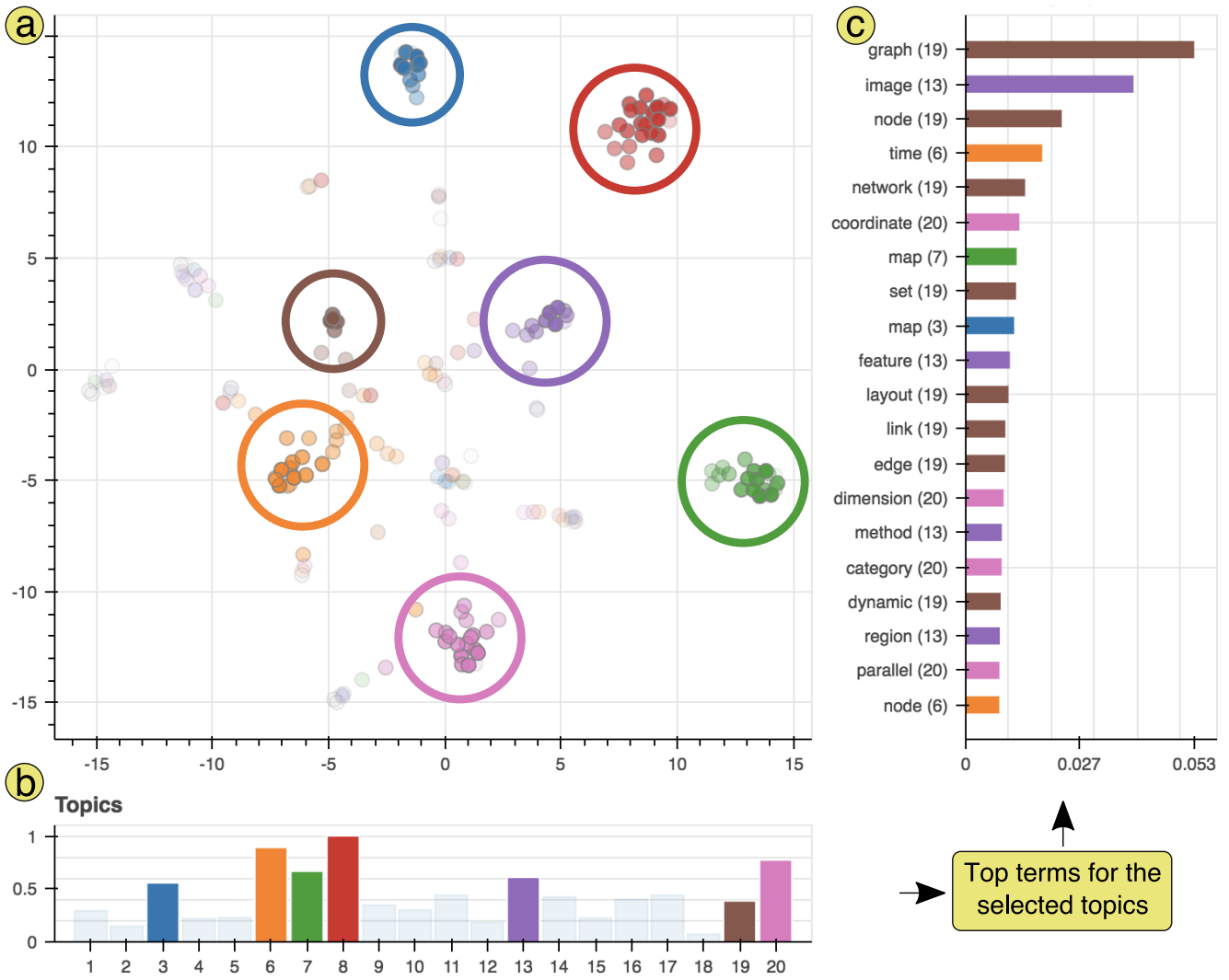

Figure 3: Interactive exploration of the topic model. (a) Representation of documents laid out with t-SNE based on the corresponding topics (clusters are manually annotated with colored rings). (b) The interactive bar chart of topics used for filtering. (c) The bar chart of top terms for the selected topics (topic numbers displayed in parentheses; please note that a term can be present in several topics).

On the other hand, while Topic 8 is the largest topic in the data set (with 23 documents in the shown cluster), it has no representative terms being shown among the 20 most relevant for the selected topics. An investigation of this individual cluster of papers shows terms such as 'data', 'information', and 'visualization' as being highly relevant for its formation, but with equivalent weights. These are very common terms that appear in many (if not most) papers in the data set, which makes it hard to identify clear topics for this group. Further preprocessing and analysis are required to address such issues.

5 CONCLUSIONS AND FUTURE WORK

In this paper, we described the results of several analyses conducted on the data set based on VINCI 2009–2017 proceedings, including publication, authorship, and co-authorship statistics as well as the topic analysis of the publication texts. These results provide insights about the stable interest for the symposium, a large community of contributors, and multiple topics of interest in the proceedings. We hope that our work will be useful for the visualization community.

There are several tasks to be addressed as part of our future work. First, we would like to extend our analyses by comparing the extracted document topics to the symposium sessions metadata in an attempt to match them. Second, it would interesting to add the author affiliation information to the metadata and use that for further co-authorship network analysis. Third, temporal development of topics in the proceedings [15] is also interesting to investigate. Finally, we aim to continue updating our data set and analyses with new VINCI proceedings annually.

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