BIBLIOMETRIC TOOLS FOR RESEARCH

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Abstract: *In this paper the tools for Bibliometrics is studied which are useful for researchers around the world.*

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Introduction:

Bibliometrics is a set of methods to quantitatively analyze academic literature. Citation analysis and content analysisare commonly used bibliometric methods. While bibliometric methods are most often used in the field of library and information science, Bibliometrics have wide applications in other areas. Many research fields use bibliometric methods to explore the impact of their field, the impact of a set of researchers, or the impact of a particular paper.

Usage

Historically bibliometric methods have been used to trace relationships amongst academic journal citations. Citation analysis, which involves examining an item's referring documents, is used in searching for materials and analyzing their merit. Citation indices, such as Institute for Scientific Information's Web of Science, allow users to search forward in time from a known article to more recent publications which cite the known item.

Data from citation indexes can be analyzed to determine the popularity and impact of specific articles, authors, and publications. Using citation analysis to gauge the importance of one's work, for example, is a significant part of the tenure review process. Information scientists also use citation analysis to quantitatively assess the core journal titles and watershed publications in particular disciplines; interrelationships between authors from different institutions and schools of thought; and related data about the sociology of academia. Some more pragmatic applications of this information includes the planning of retrospective bibliographies, "giving some indication both of the age of material used in a discipline, and of the extent to which more recent publications supersede the older ones;" indicating through high frequency of citation which documents should be archived; comparing the coverage of secondary services which can help publishers gauge their achievements and competition, and can aid librarians in evaluating "the effectiveness of their stock".There are also some limitations to the value of citation data. They are often incomplete or biased; data has been largely collected by hand (which is expensive), though citation indexes can also be used; incorrect citing of sources occurs continually; thus, further

investigation is required to truly understand the rationale behind citing to allow it to be confidently applied.

Bibliometrics are now used in quantitative research assessment exercises of academic output which is starting to threaten practice based research. The UK government is considering using bibliometrics as a possible auxiliary tool in its Research Excellence Framework, a process which will assess the quality of the research output of UK universities and on the basis of the assessment results, allocate research funding.

Other bibliometrics applications include: creating thesauri; measuring term frequencies; as metrics in scientometric analysis, exploring grammatical and syntactical structures of texts; measuring usage by readers.

History

The term bibliometrics was coined by Alan Pritchard in a paper published in 1969, titled *Statistical Bibliography or Bibliometrics?*[10] He defined the term as "the application of mathematics and statistical methods to books and other media of communication".

Although citation analysis is not new (the Science Citation Index began publication in 1961), before it could be calculated by computers it was done manually and so was time-consuming. Automated algorithms are making it much more useful, versatile, and widespread. This led to the creation of the new field of computational bibliometrics. The first such algorithm for automated citation extraction and indexing was by CiteSeer.

Google's PageRank is based on the principle of citation analysis. Patent citation maps are also based upon citation analysis (in this case, the citation of one patent by another).

Tools

The Tools are as follows

- Citation impact
- Citation index
- Altmetrics
- H-index or Hirsch number
- Impact factor
- Informetrics
- Webometrics

Citation impact

Citation impact can be measured in various ways. An obvious measure is citation count, which quantifies both the usage and impact of the cited work. This is called citation analysis or bibliometrics. Among the measures that have emerged from citation analysis are the citation counts for:

- An individual article (how often it was cited);
- An author (total citations, or average citation count per article);
- A journal (average citation count for the articles in the journal).

Citation index

A citation index is a kind of bibliographic database, an index of citations between publications, allowing the user to easily establish which later documents cite which earlier documents. A form of citation index is first found in 12th-century Hebrew religious literature. Legal citation indexes are found in the 18th century and were made popular by citators such as Shepard's Citations (1873). In 1960, Eugene Garfield's Institute for Scientific Information (ISI) introduced the first citation index for papers published in academic journals, first the *Science Citation Index* (SCI), and later the *Social Sciences Citation Index* (SSCI) and the *Arts and Humanities Citation Index* (AHCI). The first automated citation indexing was done by CiteSeer in 1997. Other sources for such data include Google Scholar.

Altmetrics

In scholarly and scientific publishing, altmetrics are non-traditional metrics proposed as an alternative to more traditional citation impact metrics, such as impact factor and h-index. The term altmetrics was proposed in 2010, as a generalization of article level metrics, and has its roots in the #altmetrics hashtag. Although altmetrics are often thought of as metrics about articles, they can be applied to people, journals, books, data sets, presentations, videos, source code repositories, web pages, etc. Altmetrics cover not just citation counts, but also

other aspects of the impact of a work, such as how many data and knowledge bases refer to it, article views, download, or mentions in social media and news media.

h-index

The *h*-index is an index that attempts to measure both the productivity and citation impact of the published body of work of a scientist or scholar. The index is based on the set of the scientist's most cited papers and the number of citations that they have received in other publications. The index can also be applied to the productivity and impact of a scholarly journal as well as a group of scientists, such as a department or university or country. The index was suggested in 2005 by Jorge E. Hirsch, a physicist at UCSD, as a tool for determining theoretical physicists' relative quality[3] and is sometimes called the *Hirsch index* or *Hirsch number*.

Impact factor

The impact factor (IF) of an academic journal is a measure reflecting the average number of citations to recent articles published in the journal. It is frequently used as a proxy for the relative importance of a journal within its field, with journals with higher impact factors deemed to be more important than those with lower ones. The impact factor was devised by Eugene Garfield, the founder of the Institute for Scientific Information. Impact factors are

calculated yearly starting from 1975 for those journals that are indexed in the *Journal Citation Reports*.

Informetrics

Informetrics is the study of quantitative aspects of information. This includes the production, dissemination, and use of all forms of information, regardless of its form or origin. Informetrics encompasses the following fields:

- Scientometrics, which studies quantitative aspects of science

- Webometrics, which studies quantitative aspects of the World Wide Web

- Cybermetrics, which is similar to webometrics, but broadens its definition to include electronic resources

- Bibliometrics, which studies quantitative aspects of *recorded* information

The term informetrics (French: *Informetrie*) was coined by Nacke in 1979.

In the western world, 20th century's Informetrics is mostly based on Lotka's law, named after Alfred J. Lotka, Zipf's law, named after George Kingsley Zipf,Bradford's law named after Samuel C. Bradford and on the work of Derek J. de Solla Price, Gerard Salton, Leo Egghe, Ronald Rousseau, Tibor Braun, Olle Persson, Peter Ingwersen, Manfred Bonitz, and Eugene Garfield.

Quantitative analysis of bibliographic data was pioneered by Robert K. Merton in an article called *Science, Technology, and Society in Seventeenth Century England* and originally published by Merton in 1938.

Webometrics

The science of webometrics (also cybermetrics) tries to measure the World Wide Web to get knowledge about the number and types of hyperlinks, structure of the World Wide Web and usage patterns. According to Björneborn and Ingwersen (2004), the definition of webometrics is "the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing on bibliometric and informetric approaches." The term *webometrics* was first coined by Almind and Ingwersen (1997). A second definition of webometrics has also been introduced, "the study of web-based content with primarily quantitative methods for social science research goals using techniques that are not specific to one field of study" (Thelwall, 2009), which emphasizes the development of applied methods for use in the wider social sciences. The purpose of this alternative definition was to help publicize appropriate methods outside of the information science discipline rather than to replace the original definition within information science.

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