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New journal classification methods based on the global h-index

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ABSTRACT

In this work we develop new journal classification methods based on the h-index. The introduction of the h-index for research evaluation has attracted much attention in the bibliometric study and research quality evaluation. The main purpose of using an h-index is to compare the index for different research units (e.g. researchers, journals, etc.) to differentiate their research performance. However the h-index is defined by only comparing citations counts of one's own publications, it is doubtful that the h index alone should be used for reliable comparisons among different research units, like researchers or journals. In this paper we propose a new global h-index (Gh-index), where the publications in the core are selected in comparison with all the publications of the units to be evaluated. Furthermore, we introduce some variants of the Gh-index to address the issue of discrimination power. We show that together with the original h-index, they can be used to evaluate and classify academic journals with some distinct advantages, in particular that they can produce an automatic classification into a number of categories without arbitrary cut-off points. We then carry out an empirical study for classification of operations research and management science (OR/MS) journals using this index, and compare it with other well-known journal ranking results such as the Association of Business Schools (ABS) Journal Quality Guide and the Committee of Professors in OR (COPIOR) ranking lists.

1. Introduction

Journal evaluation is a heated topic in bibliometrics. Previous studies have concentrated on journal evaluation approaches. Two major approaches have been studied theoretically and applied practically. The first approach is called peer review, whereby a survey or questionnaire is designed for collecting opinions from experts in bibliometrics (Chandy, Ganesh, & Henderson, 1991). A series of well-known journal ranking lists have been generated using this approach, such as the recently published COPIOR journal list (COPIOR, 2011), which was produced by the UK Committee of Professors in Operations Research. In total, 68 journals in operations research and management science (OR/MS) were categorized into 4 groups from rank 4 (the highest quality) to rank 1 (the lowest quality).

The second journal evaluation approach consists of bibliometric methods, also known as quantitative methods. Journal impact factor (JIF), the most well-known and commonly used indicator to rank scientific journals, was suggested by Garfield (1972). The JIF indicator calculates the average number of citations for certain papers (articles, reviews and letters) published in specified journals over a two-year evaluation window. The JIF indicator has attracted much attention

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(Glänzel & Moed, 2002; Whitehouse, 2001; Yu, Wang, & Yu, 2005), and the well-known online database Web of Science's (WoS) Journal Citation Report (JCR) employs the JIF indicator to select journals for input into the JCR database.

More recently, the h-index was introduced. Currently regarded as a milestone method of research evaluation, h-index applications extend across multiple levels, from the assessment of individual researchers to academic journals. In 2006, (Braun, Glanzel, & Schubert, 2006) suggested and defined the h-index for journal evaluation as follows:

> "*Retrieving all source items of a given journal from a given year and sorting them by the number of times cited, it is easy to find the highest rank number which is still lower than the corresponding 'Times Cited' value. This is exactly the h-index of the journals for the given year.*"
>
> [Braun et al., 2006]

In practice, the h-index is widely used for journal evaluation and is studied extensively in the literature (Harzing & van der Wal, 2009; Saad, 2006). Although an h-index can be computed by using one's own publications of a person or a journal quite easily, its interpretation is clearer by using the so called h-core which has been much investigated in the literature. According to Burrell (2007), *the h-index seeks to identify the most productive core of an author's output in terms of most received citations. This most productive set we refer to as the Hirsch core, or h-core*. In other words, h-core refers to all the publications whose citations are greater than or equal to the h-index.

Clearly the problem with this kind of definitions is that the size of an h-core (e.g., the number of publications in an h core) may be greater than its h-index. In this paper unless specifically stated otherwise, we adopt the second kind definition: *All publications ranked between rank 1 and rank h form the Hirsch core. If there are several publications with the same number of citations, one ranks the articles with the same number of citations in anti-chronological order so that more recent articles have a larger probability to belong to the Hirsch core than older ones* (Cabrerizo, Alonso, Herrera-Viedma, et al., 2010; Liu & Rousseau, 2009). Thus an h-core consists of exactly *h* elements if using this kind of definitions.

Using the h-core, we can further discuss some issues of the h-index. The main purpose of using an h-index is to compare the index for different research units (e.g. researchers, journals, etc.) to differentiate their research performance. However let us note that an h-index is defined by only making comparison among the citations counts of one's own publications. This naturally raises one question: can h-index be reliably used for comparisons among different research units, like researchers or journals? For example, if two researchers or journals have the same h-index, does that mean that they will in fact be "equal" in terms of research quality? Clearly the answer is negative: Take an extreme example, unlike the other indexes such as citation counts, the h-index of a publication is always one! To make an h-index work, it needs peers for comparisons: the more and the better! Although its discrimination power gradually increases as the number of publications in the units does, this inherited weakness remains in the index. In this context we shall have a close examination of the citation distribution within the h-core. Suppose h-indexes of Journal A and B are 4 and 6 respectively, and their h-core papers have citations of 4;4;4;4 and 6;6;6;6;6;6 respectively. In this case clearly journal B dominates Journal A. However their h core papers could also have citations of 12;12;12;12, and 6;6;6;6;6;6 instead. In the 2nd case it is unclear that Journal B should dominate Journal A. Clearly h-index itself could not tell which cases they are. However if we gather those ten papers together (we call it the global set) and re-compute the h-index (we call it the global h index) and rebuild the h-core (we call it the global h core), we notice that in the 1st case the papers in the global h core have citations of 6;6;6;6;6;6 (12;12;12;12;6;6 in the 2nd case), all from Journal B (two from Journal B and four from Journal A in the 2nd case). Thus we may conclude that in the 1st case the qualities of the Journal A's h-core papers are lower than those of the Journal B's h-core papers, while in the 2nd case the qualities of the Journal A's h-core papers are higher than those of Journals B's h-core's. It occurs to us that by comparing the number of papers within the global h core and its own h core, one can more reliably differentiate research performance among different research units (e.g. researchers, journals, etc.). This motivates us to introduce the global h-index and global h-core for research assessment, which will be discussed in details in the follows.

This paper is organized as follows: in the next section, we discuss the definition and theoretical basis of the Gh-index; next, we extend the definition of the Gh-index to improve its discrimination power on large samples; we then consider how the Gh-index can be used for evaluating the quality of journals and carry out an empirical study of OR/MS journals, comparing our results with those generated by peer review in the ABS and COPIOR ranking lists. In particular we show how we can develop an automatic way of classifying journals into groups without having to specify arbitrary cut-off points by comparing the Gh-index with the h-index. A discussion and conclusion are given in the final section.

2. Introduction of the Gh-index

As mentioned before, by building the global set and the global h index and global h core, we can have a clearer understanding on the individuals' performance. Our idea is simply to integrate all assessed items (researchers or journals) as a global set and undertake the comparisons between the global h core and the original h core.

In particular, we define the Gh-index as follows:

Assuming all compared outputs are collected together and arranged in descending citation order, the global h-index and global h-core (i.e., the GH-index and GH-core) are calculated in the usual way. The Gh-index of unit i (i.e., Gh^i) is then the number of unit i's items included in the GH-core.