**The h-index Paradox: Why your coauthors have higher h-index than you**

Fabrício Benevenuto, Bruno L. Alves, Alberto H. F. Laender

Department of Computer Science

Universidade Federal de Minas Gerais

Belo Horizonte, Brazil

H-index is a metric originally proposed to measure an individual’s scientific research output [1]. Its calculation is quite simple as it is based on the set of the researcher's most cited papers and the number of citations they have received. More specifically, a researcher has an h-index *h* if she published *h* papers that had received at least *h* citations. Thus, if a researcher has 10 papers with at least 10 citations, her h-index is 10.

Like any metric that attempts to summarize in a single number a complex and subjective evaluation, h-index has its limitations, including to be biased towards the authors scientific lifetime, do not account for the number of coauthors in the publications and disregard the distinct citation patterns across different areas. Nevertheless, it became popular as it provides a notion of both quality and quantity of a researcher’s scientific output in a simple and easy to compute metric.

Therefore, researchers are tempted to evaluate themselves based on h-index. Systems like Microsoft Academic Search[[1]](#footnote-1) and Google Scholar[[2]](#footnote-2) help researchers to track their publication impact and coauthors, as well as to maintain their profiles, where the h-index is stamped like a medals of Honor.

Thus, it is reasonable to suppose that researchers may use their coauthors h-indexes as a way to infer whether they, themselves, have an adequate h-index in their areas or within a department or university. For instance, if you search on Google Scholar for a piece of your email (e.g. dcc.ufmg.br) you can obtain a ranking of your department colleagues according to their citation numbers.

There is nothing wrong with this. It is actually fun to browse others profiles to get a sense of how we are in comparison with other colleagues, especially our coauthors. However, this article seeks to show that this kind of comparison may lead to a classical paradox of sociology. We show that if an individual compares her h-index with the h-index of her coauthors, she might feel below the average.

We name this phenomena as the “The h-index Paradox” and present empirical results and sociological theories to support our arguments. We show that the mean h-index of a reseracher’s coauthors is usually greater than her own h-index. We further explore the reasons behind this type of paradox. Next, first we briefly discuss how we measure the h-index for researchers from distinct computer science scientific communities. Then we provide our empirical results on the measurement of the h-index of those researcher’s and their co-authors.

**Estimating the h-index of researchers and their co-authors**

In order to measure the reserachers’ h-indexes and compare them with the h-indexes of their coauthors, we need to be able to (1) identify the coauthors of a large set of researchers and (2) estimate the h-index of these researchers and their coauthors.

To construct the coauthorship network of computer science researchers of different areas, we gathered data from DBLP[[3]](#footnote-3), as it offers its entire database in XML format for download. We gathered this data for those researchers who published in the flagship conferences of 24 ACM SIGs (Special Interest Groups) [2]. Here, however, we focus on analyzing the index of eight of them: SIGDOC, SIGCHI, SIGIR, KDD, SIGCOMM, SIGGRAPH, SIGMETRICS, POPL and SIGMOD.

There are multiple tools that measure the h-index of researchers, out of which Google Citations is today the most prominent one. However, to have a profile in this system, a researcher needs to sign up and explicitly create her research profile. In a preliminary collection of part of the profiles of the DBLP authors, we found that less than 30% of these authors had a profile at Google Citations [2]. Thus, this strategy would largely reduce our dataset.

To divert from this limitation, we used data from the SHINE (Simple HINdex Estimator) project[[4]](#footnote-4) to infer the researchers' h-index. SHINE provides a website that shows the h-index of almost two thousand Computer Science conferences. They crawled Google Scholar, searching for the title of papers published in these conferences, which allowed them to effectively estimate the h-index of the target conferences based on the citations computed by Google Scholar. Although SHINE only allows one to search for the h-index of conferences, the SHINE developers kindly allowed us to access their dataset to infer the h-index of researchers based on the conferences they crawled.

As SHINE does not track all existing Computer Science conferences, researchers' h-index might be underestimated when computed with this data. To investigate this issue, we compared the h-index of a set of researchers with a profile on Google Scholar with their estimated h-index based on the SHINE data. For this, we randomly selected 10 researchers for each of the eight SIG’s flagship conferences and extracted their h-indexes from their Google Scholar profiles. In comparison with the h-index we estimated from SHINE, the Google Scholar values are, on average, 50% higher, but they are highly correlated (Pearson's correlation coefficient is 0.85), which indicates that researchers have proportional h-index estimations in both systems.

**Comparing the h-index of a researcher with her coauthors**

Having accurately estimated the h-index of the authors from the eight ACM SIG conferences, we can compare one’s h-index with her coauthors.

Table 1 shows the fraction of authors with h-index smaller than the average of their coauthors. We can note that even focusing in authors that published in flagship conferences of ACM SIGs, the fraction of authors that might be below the average is quite high, varying from 60% to 80%. When we look at percentage of authors with at least one coauthor with higher h-index than hers, the numbers are higher than 90% for most of the conferences.

**Table 1:** Comparison results of one’s h-index with coauthors (tranformar em um gráfico)

|  |  |  |
| --- | --- | --- |
| Conference | Authors with h-index smaller than the average of their coauthors | Authors with at least one coauthor with higher h-index than herself |
| SIGDOC | 81% | 95% |
| SIGCHI | 78% | 94% |
| SIGIR | 74% | 92% |
| SIGKDD | 74% | 92% |
| SIGCOMM | 75% | 93% |
| SIGCSE | 70% | 87% |
| SIGGRAPH | 76% | 91% |
| SIGMETRICS | 71% | 91% |
| POPL | 69% | 87% |
| SIGMOD | 77% | 95% |

These results are quite related to a know phenomena in social networks, called the Friendship Paradox [3,4], which says that your friends in a social network have more friends than you in average. Although, coauthorship networks usually exhibit the same properties of many social networks [referências], including small-world properties and node degree distribution, this cannot explain alone the h-index paradox as the Pearson correlation coefficient of number of coauthors and an author’s h-index is 0.36, which is positive but not so high. Nevertheless, the important point here is not related to the reasons behind this paradox, but its consequences.

The easy comparison among peers that today’s systems offer might accentuate the existing pressure that exists for publication as one might tend to feel pressured by the sensation of being below coauthors. Humans are natural competitors, not only in research, but in several aspects of life. The problem here is just an instantiation of a sensation that occurs in different scenarios and even culminated in an expression that is common to different languages and cultures: “The neighbor’s grass is always greener on the other side”.

Competition in science can be good, but it also may lead to undesirable scenarios. First, it can lead researchers to do salami science, where research results are split in pieces of publication to increase publication count [5]. More alarming, researchers might be tempted to fraud or obscure experiments details to “sell” better their results. A recent work on the field of Medicine has evaluated 788 retracted articles [6] and focused on 180 of them, which involves experiments with patients. From these, 70 were retracted by fraud and 110 by mistakes. These articles received more than 5,000 citations and involved thousands of patients. On the computer science perspective, retractions are not so common, but it is not hard to accept that there might exist inaccurate reported results or even wrong code implementations that lead to publications in major computer science venues.

Despite all the pressure for results in science, there is still the pressure we do to ourselves to increase our output numbers with respect to our peers. Instead of criticize any current publish or perish system in which we are inserted today, we should first ask ourselves if we are not the main source of pressure for fast results. If increasing your h-index begins to be an important thing to you, do not forget that the most important thing for a scientist is to produce high quality research. Nothing else should drive our goals.

**References**

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