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

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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 attempt to summarize in a single number a complex and subjective evaluation, h-index has its limitations, including to be biased towards the author’s scientific lifetime, do not account the number of coauthors in papers of an author and do not account with the volume of papers and citations in different areas. Nevertheless, it became popular as it provides a notion of both quality and quantity of one’s scientific output in a simple and easy to compute metric.

Naturally, researchers are tempted to evaluate themselves based on h-index. Systems like Microsoft Academic and Google Scholar help researchers to track their publication impact, connect to coauthors, and maintain profiles, where h-indexes are stamped like medals of Honor.

It is reasonable to suppose that researchers may use the h-indexes that their co-authors have as a way to infer whether they, themselves, have an adequate h-index in their areas or within a department or university. If you search on Google scholar for a piece of your email (i.e. 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 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 compare her h-index with the h-index of co-authors, she might feel below the average.

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

**Estimating authors and their co-authors h-index**

In order to measure the h-indexes of authors and compare them with the h-indexes of one’s 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 authors and their co-authors.

To construct the coauthorship network of computer science researchers of different areas, we gathered data from DBLP[[1]](#footnote-1), as it offers its entire database in XML format for download. We focus on analyzing the index of those who published in the flagship conferences of eight important ACM SIGs (Special Interest Groups). Particularly, we chose 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 [6] 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. Thus, this strategy would largely reduce our dataset.

To divert from this limitation, we used data from the SHINE (Simple HINdex Estimator)[[2]](#footnote-2) project to infer the researchers' h-index. SHINE provides a website that shows the h-index of almost two thousands 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 Author’s and Coauthor’s h-index**

Having accurately obtained the h-index of computer science researchers and their coauthors, we can compare one’s h-index with her coauthors.

Next, 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

|  |  |  |
| --- | --- | --- |
| 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 is 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, the coauthorship network exhibits the same properties of many social networks, including small-world properties and node degree distribution, it 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 different systems offer might accentuate all 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 focus on 180 of them, which involves experiments with patients. From these, 70 were retracted by fraud 110 by mistakes. These papers 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 exists 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 related 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 produce high quality research. Nothing else should drive our goals.

**References**

[1] J. E. Hirsch. 2010. An index to quantify an individual's scientific research output that takes into account the effect of multiple coauthorship. Scientometrics 85, 3, 741-754.

[2] B. L. Alves, F. Benevenuto, and A. H. F. Laender. "The role of research leaders on the evolution of scientific communities. "*Int’l Conference on World Wide Web (companion volume)*. 2013.

[3] Hodas, Nathan O., Farshad Kooti, and Kristina Lerman. "Friendship Paradox Redux: Your Friends Are More Interesting Than You." *arXiv preprint arXiv:1304.3480* (2013).

[4] Feld, Scott L. "Why your friends have more friends than you do." *American Journal of Sociology* (1991): 1464-1477.

[5] Hoit, Jeannette D. "Salami science." *American Journal of Speech-Language Pathology* 16.2 (2007): 94.

[6] Steen, R. Grant. "Retractions in the medical literature: how many patients are put at risk by flawed research?." *Journal of medical ethics* 37.11 (2011): 688-692.

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