Gintropic limits and scaling for the Hirsch index

Tamas Biro[1,2,3], Andras Telcs[1], Mate Jozsa[1], **Zoltan Neda[1]**
[1]Babes-Bolyai University, Cluj-Napoca, Romania, [2]Wigner Research Center for Physics, Budapest, Hungary, [3]Complexity Science Hub, Medical University Vienna, Wien, Austria

Since the seminal paper of Hirsch, in 2005 [1], scientist tried to link statistically the h index to the other two basic scientometric indicators: the total number of citations received by the researcher, N(cit) and the total number of papers published, N(pub), by him/her. Empirically, it was found that N(cit)=4 h^2 [2], and assuming that all allowed distributions of the N(cit) citations for the N(pub) papers are equally probable, Yong [3] proposed a theoretical scaling: N(cit)≃ 3.42 h^2. Seemingly both approaches work well for not too high N(cit) and N(pub) values. Exploiting the Paretian form for the distribution of citations for the papers authored by a researcher, here we discuss a novel scaling relations between h, N(pub) and N(cit). The analysis incorporates the Gini index as an inequality measure of citation distributions and a recently proposed inequality kernel, gintropy (resembling to the entropy kernel). We find a new upper bound for the h value as a function of the total number of citations, confirmed on massive data collected from Google Scholar (Figure 1). Our analyses reveals also that the individualized Gini index calculated for the citations received by the publications of an author peaks around 0.8, a value much higher than the one usually reported for socio-economic inequalities. Work supported by UEFISCDI, through the grant PN-III-P4-ID-PCE-2020-0647.

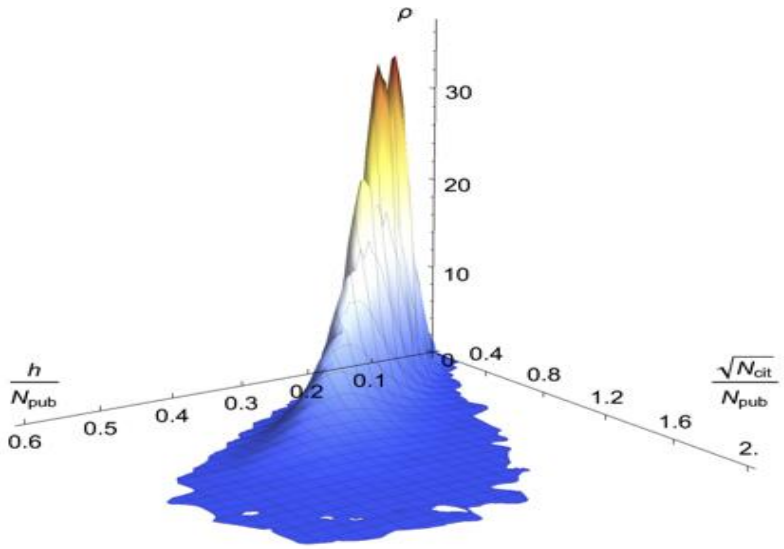

Figure 1. Distribution of the points [√N(cit)/N(pub), h/N(pub)], gathered form the profile of 43 656 researchers with N(pub)>100 and N(cit)>10 000 gathered from Google Scholar.

References

[1] J.E. Hirsch, An index to quantify an individual's scientific output. ®PNAS, vol. 102, 16569-16572 (2005).
[2] W. Glanzel, On the h-index - A mathematical approach to a new measure of publication activity and citation impact, Scientometrics vol. 67, 315-321 (2006).
[3] A. Yong, Critique of Hirsh's Citation index: A Combinatorial Fermi Problem, Notices of the American Mathematical Society, vol. 61, 1040-1050 (2021)