

“Quantifying merit in science”

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The problem of citation-based metrics of a researcher's performance is essentially about ranking scientists. In this age of big data and high social and professional mobility, ranking has become one of the central issues in social life and information technologies. Ranking algorithms, including the famed Google PageRank, enable automated selection of relevant information and the efficient functioning of the search engines. Ranking is an obligatory task of various selection and evaluation boards, significantly influencing academic careers and even reshaping research behaviours.

Currently the ranking of scientists is largely based on the h -index (Hirsch, 2005) as a measure of an individual's scientific research output. In our work “Ranking scientists” [Nature Physics 11 (2015) 882], to examine the performance of this metric, we studied a representative sample of researchers from physics and complex systems from the Thompson Reuters Web of Knowledge database and analysed correlations between their h -index and number of papers, N , and total number of citations. From these statistics we find that for a researcher having a given total number of citations, his or her h -index, on average, markedly increases with N . Consequently the h -index is not merely imperfect but it unfairly favors modestly performing scientists and punishes stronger researchers with a large mean number of citations per paper.

We proposed a new simple measure of scientific research output that focuses on a researcher's most cited paper to substantially indicate his or her major achievement, but also accounts for h . We introduced the scientific output index (o -index) that is the geometric mean of the number of citations of the most cited paper and the h -index of a researcher. We showed that the o -index clearly distinguishes successful researchers and provides a natural, easily implementable ranking criterion for scientists.

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FIGURE 1

Correlations between h -index, total number of citations, C , and the mean number of citations per paper, $\langle c \rangle$, for individual researchers. The colour of a dot shows the mean number of citations $\langle c \rangle$ for the researcher's papers. The bright dots tend to occur at the bottom of the plot, indicating that for a given C , on average, h decreases with increasing $\langle c \rangle$.

