

Journal- and Time- normalization of the Fat-tailed Citations Distributions

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Academic papers have been played as a protagonist to disseminate the expertise. Naturally, analysing paper citation pattern is an efficient and essential mean for investigating the knowledge structure of science and technology. For decades, it has been observed that citation of scientific literature follows a heterogeneous and fat-tailed distribution, and many of them suggest power-law distribution or its siblings. However, many studies are limited to small-scale approaches; it is thus hard to generalize. Tackling this issue, we investigate 21 years of citation evolution through systematic analysis entire citation history of 42 423 644 scientific literature published from 1996 to 2016 contained in SCOPUS. We tested six candidate distributions for the papers in three distinct levels of SJR (Scimago Journal & Country Rank) classification scheme. First, we observe the raw number of annual citation acquisitions tend to follow the log-normal distribution for all disciplines, except the first year of the publication. We also find the significant disparity of yearly acquired citation number among the journals, which suggests that it is essential to remove the citation surplus inherited from the prestige of the journals. Our simple method that separating citation preference of individual article from the inherited citation of the journals reveals unexpected regularity on the normalized annual acquisitions of citation for the entire fields of science. Specifically, the probability distributions of annual citation acquisitions behave as power-law with an exponential cut-off of the exponents around 2.3, regardless of its publication and citation year. Our result implies that intensity of attention for a scientific article also follows a fat-tailed distribution, which is power-law with an exponential cut-off.