CITATION NETWORKS AS A WINDOW TO SCIENCE: 
A CASE STUDY

REMCO VAN DER HOFSTAD
Department of Mathematics and Computer Science, Eindhoven University of Technology, 
P.O. Box 513, 5600 MB Eindhoven 
e-mail: rhofstad@win.tue.nl

Citation patterns between papers form a window to how science works. In citation networks, the nodes are papers and the directed edges are formed by one paper citing the other. Citation networks give us a wealth of information about differences in citation cultures between subfields, how scientists collaborate, etc. These insights are useful to interpret citation statistics of papers and scientists beyond simply counting citations. How long does it take publications to be cited? How long does it take papers to be forgotten, and how much does this depend on the citation patterns of the papers early on? How many citations do papers get, and how do these develop in time? How variable are citation patterns when comparing papers within a field, as well as between fields? Can one quantify what a ‘good’ paper is based on citation network structure?

In this talk, we present empirical data of citation patterns obtained from the Web of Science database. We investigate aging of citation patterns, the presence of dynamical power laws in them, as well as how predictable citations behave after having observed them for a while. We then continue to describe a possible model for them based on preferential attachment models with aging and fitness, that, on a qualitative level, shows similar connectivity patterns as in citation networks. We also discuss PageRank, which is an algorithm that gives an order to vertices in a directed network, and show how local weak convergence can be used to analyze PageRank in large graph limits. We close with open problems.

We assume no prior knowledge in graph theory, probability or otherwise. This is joint work with Alessandro Garavaglia (TU/e), Nelly Litvak (TU/e and Twente University), and Gerhard Woeginger (RWTH Aachen).

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