SOE 24: Scientometric maps and dynamical models of scientific collaboration networks (accompanying symposium SYSM)

Time: Thursday 15:00–16:30   Location: H36

SOE 24.1 Thu 15:00 H36
Reclaiming the value of interdisciplinary research: a new index of scientific impact — •Elisa Omodei, Manlio De Domenico, and Alex Arenas — Department of Mathematics and Computer Science, Rovira i Virgili University, Tarragona, Spain

Defining an appropriate measure to assess the impact of scientific research represents a fundamental task of today's science of science. Nowadays most funding and hiring decisions are in fact based on quantitative indices of production. Several measures have been proposed, from citation count and the h-index, to more advanced graph-based metrics such as the science author rank algorithm. An important issue that has been mostly ignored by the previously proposed indices is the opportune ranking of scholars who work at the crossroad of different research areas and disciplines. Their scientific production is in fact very often underestimated because its impact cannot be assessed by considering only the specific discipline of the department of affiliation. Here we propose a method based on the analysis of bipartite interconnected multilayer networks of citations and disciplines, to assess scholars, institutions and countries interdisciplinary importance. Using data about physics publications and US patents, we compare the ranking obtained using our method to those obtained using other indices of scientific impact, and show that the scholars whose work has had fundamental implications in different areas are indeed found to gain importance when ranked according to our method.

SOE 24.2 Thu 15:15 H36
A textual measure of the interdisciplinarity of scientific papers — •Laercio Dias, Martin Gerlach, and Eduardo G. Altmann — Max Planck Institute for the Physics of Complex Systems, D-01187 Dresden, Germany

We are interested in investigating the role and impact of interdisciplinary publications in the evolution of scientific ideas. A crucial point is how to quantify interdisciplinarity. The traditional approach is to use citation networks. The goal of our work is to construct a measure of interdisciplinarity entirely based on the text of articles, taking advantage of the increasing availability of full text of publications. We propose and compare different methods based on Jensen-Shannon-type of divergences, following the ideas recently proposed in Ref. [1].

[1] M. Gerlach, F. Font-Clos, and E. G. Altmann, "On the similarity of symbol-frequency distributions with heavy tails", aXiv:1510.00277 (2015)

SOE 24.3 Thu 15:30 H36
Dynamical model of the scientific process: Knowledge generation embedded in the scientific map of science — •Jan Moritz Joseph[1] and Jens Christian Claussen[2,3] — [1]Institut für Technische Informatik, Universität zu Lübeck, Germany — [2]Computational Systems Biology, Jacobs University Bremen, Germany — [3]INB, Universität zu Lübeck, Germany

We investigate a dynamical growth model [1] of the scientific process comprised by authors writing collaborative papers, where the location of authors and papers are defined in a scientific space [2] in which distances in these "maps of science" are defined by similarity between document texts. The goal of our model is to provide a minimal model of the dynamical evolution of the topological structure (beyond network adjacency and geographical author location) of scientific publications. The model fosters novelty and multidisciplinary of new papers, as well as a retirement mechanism which prevents large groups to dominate topics forever. We demonstrate that our model can generate a nontrivial topological structure comparable to [2,3]. We examine special and structural characteristics of the model in comparison to available data of the UCSD Map of Science [3]. While our model is in some sense minimalistic, it allows to study the influence of global steering parameters on the development of science.

[1] J.M. Joseph and J.C. Claussen, arXiv.org/abs/1407.8422
[2] K.W. Boyack, R. Klavans and K. Börner, Mapping the backbone of Science, Scientometrics 64, 351 (2005)
[3] K. Börner et al., Plos One 7, e39464 (2012)

SOE 24.4 Thu 15:45 H36
Evolution of scientific collaboration and discovery on epistemological graphs — •Fariba Karimi[1] and Ammar Nejati[2] — [1]GESIS institue for computational social science, Cologne, Germany — [2]Physics Department, Bonn University

Scientific research is not a task performed by isolated researchers; researchers communicate their ideas, inspire each other and eventually, make a major impact by their scientific discoveries. The new ideas can diffuse in the collaboration network by an adoption mechanism and create a macro-scale impact on the dynamic of science and its paradigm shifts. So far in modelling scientific collaboration, it has been assumed that research topics are objects that scientists pick from a 'pool of ideas', and research collaborations are not related to the inherent structure of the underlying scientific field. Although these assumptions simplify the modelling of scientific collaboration and discovery, they provide no insight on how research topics are connected intrinsically, and to what extend such a connectivity impacts the discoverability of new ideas or the collaboration pattern. In this work, we model the process of scientific discovery and collaboration by assuming that the scientific activity occurs on an underlying (static) epistemological network. Researchers move and discover this network, they establish collaborations with nearby researchers and they can adopt new researchers into the field. Our results show that through this discovery and collaboration 'game', large-scale scientific collaboration patterns emerge, novel scientific fields are established and ultimately, scientific paradigms change in the course of evolution.

SOE 24.5 Thu 16:00 H36
Using arxiv data to estimate interdisciplinarity and its impact on academic success — Leonhard Horstmeyer[1] and •Stefan Pfenninger[2] — [1]Max-Planck-Institute for Mathematics in the Sciences, Leipzig, Germany — [2]ETH Zurich

Interdisciplinarity in research is hard to capture formally and empirically, in particular in the context of preprint publishing. We introduce an entropy-based measure of author interdisciplinarity. We put forward a cleaning algorithm for preprint databases and a clustering algorithm for scientific communities based on mixture models. Equipped with these we study the arxiv.org database with respect to the community dynamics and the relation between interdisciplinarity and estimates of academic success such as the network centrality or the impact factor of the journals in which arxiv submissions were published.

SOE 24.6 Thu 16:15 H36
Citation Networks and Economic Pluralism — •Florentin Glötzl — Welthandelsplatz 2/D5, 1020 Wien

Pluralism has become a central issue not only in the public discourse but also in heterodox economics, as the focus on impact factors and rankings based on citations continues to increase. This marketization of science has been an institutional vehicle for the economic mainstream to promote its ideas. Citations thus have become a central currency in economics as a discipline. At the same time they allow to reveal patterns of interaction, segregation, clusters and cliques in the discourse. This endeavor is paticularly important in the context of a contested discipline such as economics, where heterodox scholars have been increasingly marginalized.

In this paper we investigate these patterns applying bibliometric tools as well as social network analysis and graph theory to citations on the journal level for 254 major journals in economics between 1956 and 2014.

We find that articles in heterodox journals cite more heterodox journals than articles in orthodox journals, but still have negative "citation export rates", thereby reinforcing the institutional dominance of the mainstream. Orthodox journals completely disregard heterodox journals. Moreover, the citation networks reveal a clear "mainstream core - heterodox periphery" structure which has formed over the last decades. This is consistent with the paradigmatic map of the current discourse in the discipline of economics by Dobusch & Kapeller (2012). These findings imply serious questions for economic pluralism in the future.

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