A socio-epistemic approach to identify communities of scientific collaboration

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ABSTRACT

The processes that drive collaboration in scientific environments are embedded within the social, technical, cultural and epistemic practices of the constituent research communities. This poster presents a methodology to unpack specific social and epistemic dimensions of scientific collaboration using, as a case study, a "little science" research center: the Center for Embedded Networked Sensing (CENS).

CENS is a National Science Foundation venture involved in the development and application of wireless sensing systems to critical scientific and societal pursuits. CENS consists of scholars at all levels (faculty, scientists, engineers, graduate and undergraduate students) from five member institutions with a headquarter base located at the University of California, Los Angeles. The type of research conducted at CENS spans across a wide spectrum of disciplines and applications (from biology to seismology, from wireless telecommunications to statistics) requiring continuous cooperation among participating researchers. Unlike "Big science" collaborations [3], such as those typically found in many high energy physics and observational astronomy laboratories, CENS is a typical "little science" research center: CENS research does not require continuous use of massive amounts of human and computational resources. Yet, similar to big science endeavors, CENS research is highly collaborative and relies heavily on information and communication technologies. Since multiple disciplines intersect at CENS, multiple scholarly and scientific practices of collaboration exist. Despite such multitude of practices, a collaborative activity that is performed across the entire spectrum of disciplines is the production and publication of scholarly artifacts in the form of conference papers and journal articles. Scholarly publication is entrenched in the modus operandi of engineers, natural scientists, statisticians, computer scientists and life scientists alike and thus depicts very well the extent and arrangement of scientific collaboration at CENS.

In this poster, I present the methods by which the scholarly output of CENS researchers can be analyzed to identify communities of collaboration using a socio-epistemic approach. I employ the entire historical bibliographic record of CENS, consisting of over 600 manuscripts, authored by nearly 300 authors over a period of 7 years: from the inception of CENS to present day (2002-2008). I construct two networks of scientific collaboration:

1. a social network of coauthorship, linking individuals that have coauthored scholarly artifacts (journal articles and conference papers). This consists of a weighted network in which each author of a scholarly item, represented by a node, is connected to another author, represented by another node, if a coauthorship event exists.

2. a social epistemic network of intellectual relationship, linking individuals who have utilized identical or related concepts, keyphrases, and knowledge constructs in their scholarly production. A social epistemic network can be intended as an extension of an "epistemic network" — a network describing associations between the many heterogeneous entities that lead to the construction of scientific facts into an array that is "strong and durable" [2, 4]. The social epistemic network consists of a weighted network in which authors, represented by nodes, are connected with one another if they have employed similar or related topics in their scholarly production.

This poster reports on ongoing work directed at the analysis of the structure and evolution of these networks of scientific interaction. In particular, I introduce a theoretical framework to analyze the community structures of these networks of scientific collaboration from a socio-epistemic perspective. I employ a popular community detection mechanism, Newman's leading eigenvector algorithm [5], to identify communities of collaborating researchers in the two aforementioned networks. This method computes the repartition of the network in structural communities based on the vertices' eigenvector centrality [1]. Each community repartition captures a different structural arrangement. I present the results of a preliminary comparative analysis aimed at delineating structural differences among the detected configurations of communities of scientific collaboration. This work is expected to determine how social and epistemic networks of scientific collaboration, constructed from the same bibliographic

data, interface with each other. Moreover, it will provide a platform for future work aimed at the investigation of the relationship between communities of collaboration and given organizational, disciplinary, and institutional arrangements of scientific research.

Keywords
social studies of science, laboratory studies, social networks, community detection, epistemic networks, socio-epistemic analysis, scientific collaboration

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