Mapping the Intellectual Structure of Social Network Research: A Comparative Bibliometric Analysis

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https://scholar.google.com.hk/citations?view_op=search_authors&mauthors=Pengjia+Cui&hl=zh-CN&oi=ao

Abstract

Network science is an interdisciplinary field that transcends traditional academic boundaries, offering profound insights into complex systems across disciplines. This study conducts a bibliometric analysis of three leading journals—*Social Networks*, *Network Science*, and the *Journal of Complex Networks*—each representing a distinct yet interconnected perspective within the field. *Social Networks* focuses on empirical and theoretical advancements in social structures, emphasizing sociological and behavioral approaches. *Network Science* bridges physics, computer science, and applied mathematics to explore network dynamics in diverse domains. The *Journal of Complex Networks*, by contrast, is dedicated to the mathematical and algorithmic foundations of network theory. By employing co-authorship and citation network analysis, we map the intellectual landscape of these journals, identifying key contributors, influential works, and structural trends in collaboration. Through centrality measures such as degree, betweenness, and eigenvector centrality, we uncover the most impactful publications and their roles in shaping the discourse within and beyond their respective domains. Our analysis not only delineates the disciplinary contours of network science but also highlights its convergence points, revealing the evolving trajectory of this dynamic and rapidly expanding field.

Keywords: Bibliometric Analysis, Citation Network, Social Networks, Scholarly Collaboration, Intellectual Structure, Research Impact, Centrality Metrics, Cluster Analysis, Thematic Mapping

1 Introduction

Bibliometric analysis provides a systematic method for uncovering the intellectual structure and research dynamics within a scientific field [Donthu et al., 2021, Arias and De Filippo, 2020, Lei et al., 2023, Lee et al., 2010]. It enables the identification of key research themes, methodological trends, and the evolution of scholarly discourse. As an inherently interdisciplinary domain, network science—spanning sociology, computer science, mathematics, and physics—poses unique challenges for bibliometric studies due to its methodological and application diversity [Newman, 2018, Barabási, 2016].

This study analyzes three leading journals in the field: *Social Networks*, *Journal of Complex Networks*, and *Network Science*. These journals were selected for their distinct scopes: *Social Networks* emphasizes sociological and empirical studies [Wasserman and Faust, 1994], *Journal of Complex Networks* focuses on mathematical and computational approaches [Boccaletti et al., 2006], and *Network Science* bridges interdisciplinary perspectives [Newman, 2010]. By examining these journals, we aim to provide a comprehensive overview of the intellectual structure, thematic evolution, and collaboration patterns within social and complex network research.

Our objectives are to: (1) map the intellectual structure of the field via citation networks and scholarly influences [Small, 1973], (2) identify key themes and trends through keyword co-occurrence and thematic clustering [Callon et al., 1983], (3) evaluate research impact by analyzing citations, influential publications, and prolific contributors [Garfield, 1979], and (4) explore collaboration patterns through co-authorship and institutional networks [Glänzel and Schubert, 2004].

To achieve these goals, we employ a three-pronged approach. First, we conduct a performance analysis to assess publication trends, citation impacts, and contributions of leading scholars and institutions [Bornmann and Daniel, 2011]. Second, we utilize science mapping techniques, including co-citation analysis, bibliographic coupling, and keyword co-occurrence, to uncover thematic clusters and intellectual structures [van Eck and Waltman, 2010, Chen, 2017]. Third, we perform network analysis to examine collaboration patterns across authors, institutions, and countries [Newman, 2004, Moody, 2004].

By integrating these methods, this study offers a structured, data-driven overview of the research landscape in social and complex network studies. It highlights the field's development, emerging trajectories, and potential future directions.

2 Bibliometric Techniques

Table 1 presents a comparative analysis of key metrics across the three journals, including publication frequency, impact factors, citation patterns, and collaboration trends [Donthu et al., 2021]. The table highlights both shared and distinguishing features, such as publisher affiliations, research focus, and the thematic emphasis of highly cited works. This comparison provides a structured overview of each journal's influence and role within social and complex network research [Zupic and Cater, 2015].

To systematically analyze the intellectual structure of social network research, this study employs three interconnected bibliometric approaches: **performance analysis**, **science mapping**, and **network analysis**. [Donthu et al., 2021] Each method provides distinct yet complementary insights into the research landscape of the selected journals.

Performance analysis quantitatively evaluates research productivity and impact by examining publication trends, citation metrics, and contributions from influential authors, institutions, and countries [Lee and Shin, 2014]. This approach highlights the historical growth of the field and identifies its most prolific contributors.

Science mapping explores the thematic and conceptual structure of the field by uncovering research clusters, keyword co-occurrence patterns, and intellectual influences [Small, 1973, Callon et al., 1991, Katy Börner, 2003]. Using techniques such as co-citation analysis [Small, 1973], bibliographic coupling [Kessler, 1963], and topic modeling [David M. Blei and Jordan, 2003], science mapping reveals the knowledge base and thematic evolution of social network research [Chen, 2006, M. J. Cobo, 2011].

Network analysis investigates collaboration patterns among authors, institutions, and countries. By analyzing co-authorship networks, institutional collaborations, and international partnerships, this approach sheds light on the social and structural dynamics of knowledge production in the field [Dong et al., 2014].

Table 1: Comparison of Metrics

Category	Social Networks	Network Science	Journal of Complex Networks
Publisher	Elsevier	Cambridge University Press	Oxford University Press
Publication Frequency	4 issues/year	4 issues/year	6 issues/year
Impact Factor (2023)	2.9	1.4	2.2
5-Year Impact Factor	3.1	1.7	2.0
Eigenfactor Score	0.00387	0.00084	0.00160
Article Influence Score	1.368	0.741	0.692
Cited Half-life (years)	16.3	7.4	5.7
JCI (2023)	1.89	0.66	0.63
Immediacy Index	0.8	0.2	0.5
Total Citable Items (2023)	240	99	163
Open Access Percentage	31.67%	44.44%	22.09%
Top Contributing Organization	University of Oxford (14)	University of California (12)	Santa Fe Institute (7)
Top Contributing Country	USA (103 papers)	USA (59 papers)	USA (39 papers)
Total Citations (2023)	6,795	856	1,117
Self-citations (%)	5.55%	3.62%	3.58%
Top Citation Source	Social Networks (43)	Social Networks (34)	Physica A (35)
Top Cited Source	Social Networks (377)	PNAS (51)	Physical Review E (159)
International Collaboration (%)	47.2%	51.3%	45.6%
Top Collaborating Countries	USA-England	USA-Germany	USA-China
High-frequency Keywords	Social capital, community	Network topology, algorithms	COVID-19, resilience
Emerging Topics	Computational sociology	Complex systems	Epidemic modeling
Annual Growth Rate (2010-2023)	+6.5%	+8.2%	+5.4%

By systematically integrating these three analytical components, this study provides a comprehensive and structured overview of social network research [Donthu et al., 2021, Yazdanjue et al., 2023]. The results will:

- Reveal historical and emerging research trends, highlighting shifts in dominant themes and methodological approaches.
- Identify key contributors and influential works, offering insights into the most impactful papers, prolific scholars, and leading institutions.
- Map collaborative networks, examining how scholars, institutions, and countries interact and contribute to the field.

This multi-faceted approach not only quantifies research impact but also contextualizes the development of ideas, theories, and methodologies in social network research [Small, 1973, Callon et al., 1991, M. J. Cobo, 2011]. By integrating performance analysis, science mapping, and network analysis, we offer a comprehensive examination of the field's intellectual structure and collaborative dynamics. The following sections detail each bibliometric technique, outlining its objectives, methodological framework, data requirements, and analytical tools.

To ensure the robustness and accuracy of our bibliometric dataset, we retrieved publication records from the Web of Science (WoS), focusing exclusively on articles published in *Social Networks*, *Journal of Complex Networks*, and *Network Science*. The search was carefully structured to include only publications explicitly indexed under these journals, thereby minimizing misclassification and ensuring dataset integrity [Moed, 2005]. The full query links used for data extraction are provided below:

- `https://www.webofscience.com/wos/woscc/summary/8b9cb9e7-5920-4a8c-8957-1f45746eb38f-01449729f7/relevance/1`
- `https://www.webofscience.com/wos/woscc/summary/b70d5df8-5cd9-4064-8329-390221e5fcc0-014497387b/relevance/1`
- `https://www.webofscience.com/wos/woscc/summary/cfb2985d-4457-4214-85c1-4ee6224ffecb-014497425b/relevance/1`

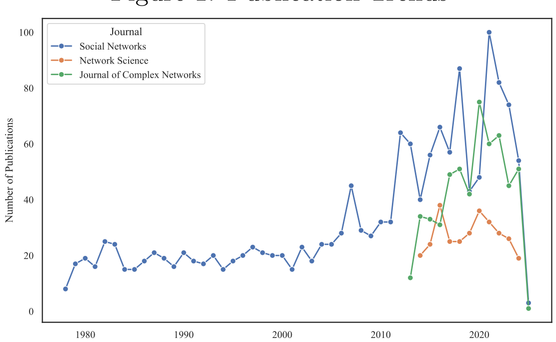
Following data retrieval, a preprocessing step was conducted to refine the dataset and ensure data integrity. First, we verified that each record was explicitly affiliated with one of the three target journals by cross-referencing journal names with standardized indexing metadata. [Donthu et al., 2021]. Entries with inconsistencies—such as incorrect journal attributions, duplicate records, or misclassified publication types—were removed. Additionally, records with incomplete metadata, including missing publication years, author information, or improperly formatted citation fields, were excluded [Aria and Cuccurullo, 2017]. To further enhance accuracy, we employed VOSviewer for citation data validation and cleaning, ensuring a robust dataset for analysis [Van Eck and Waltman, 2010a]. These measures minimized distortions and ensured that our bibliometric analysis accurately captured the scholarly output of each journal.

3 Performance Analysis

Performance analysis in bibliometrics provides an overview of research productivity, citation impact, and contributions of authors, institutions, and countries. It helps quantify the most influential publications, prolific researchers, and overall research trends in *Social Networks*, *Journal of Complex Networks*, and *Network Science*.

3.1 Publication Trends in Social Network Research

Figure 1: Publication Trends



Examining the publication trajectories of *Social Networks*, *Journal of Complex Networks*, and *Network Science* provides insight into the evolution of social network research. Figure 1 illustrates how research output has changed over time, highlighting the growth and specialization of the field.

Expansion and Institutionalization of Social Network Research

Social Networks, the longest-running journal in the field, has published research continuously since its founding in 1978 [Freeman, 2004]. For decades, it served as the primary outlet for social network analysis, maintaining stable publication volumes. However, since 2010, a notable increase in output reflects the growing influence of computational methods and empirical applications [Borgatti et al., 2009]. This trend suggests a broadening of the field as new methodologies and interdisciplinary collaborations expand its research scope.

The establishment of *Journal of Complex Networks* in 2013 marked the rising prominence of mathematical and computational approaches to network analysis [Barabási, 2016]. Initially publishing at a modest rate, its output grew rapidly after 2015, nearing that of *Social Networks* by 2020. This growth highlights the emergence of complex network research as a distinct subfield, attracting contributions from applied mathematics, computer science, and physics [Borgatti et al., 2009].

Network Science, introduced in 2014, maintains a comparatively lower publication volume, indicating its focus on a specialized academic community. Emphasizing foundational principles and interdisciplinary perspectives, the journal has experienced steady growth but remains the smallest of the three in annual output, reinforcing its niche within the broader field of network science [Barabási, 2016].

Publication Growth and Recent Trends

Between 2016 and 2022, publication activity in all three journals increased significantly, reflecting the growing influence of network science [Newman, 2018, Barabási, 2016]. *Social Networks* exceeded 100 publications per year, while *Journal of Complex Networks* and *Network Science* followed similar trajectories on a smaller scale [Borgatti et al., 2013]. This growth aligns with the rise of big data, computational social science, and machine learning, which have reinforced the prominence of network-based methodologies [Lazer et al., 2009, Watts, 2011].

Since 2022, publication volumes have stabilized or declined, potentially signaling research saturation or database indexing delays [Fortunato et al., 2018]. Further analysis is needed to determine whether this trend reflects a plateau or a shift in thematic focus.

Thematic Differentiation Among Journals

The trajectories of these journals highlight the thematic specialization within social network research. *Social Networks* remains the primary outlet for applied and empirical studies, emphasizing sociology, organizational research, and human behavior. *Journal of Complex Networks* focuses on computational and mathematical approaches, while *Network Science* bridges theoretical and interdisciplinary perspectives.

This specialization reflects the diversification of network science into distinct subfields, each catering to specific research communities. Further analysis of citation networks and thematic clustering will clarify how these journals interact and shape the field over time.

3.2 Prolific Authors

This section investigates the contributions of the most prolific authors within the domain of social network research, across three prominent journals: *Social Networks*, *Journal of Complex Networks*, and *Network Science*. By analyzing the publication records, we uncover the significant roles these individuals play in shaping the field and defining its intellectual boundaries.

Author Contributions and Research Orientations

The trajectories of these journals highlight the thematic specialization within social network research. *Social Networks* remains the primary outlet for applied and empirical studies, emphasizing sociology, organizational research, and human behavior [Marin and Wellman, 2011, Freeman, 2004]. *Journal of Complex Networks* focuses on computational and mathematical approaches, reflecting its strong association with statistical physics, graph theory, and algorithmic network analysis [Newman, 2010, Fortunato, 2010]. Meanwhile, *Network Science* bridges theoretical and interdisciplinary perspectives, integrating social, biological, and technological networks under a unified framework [Barabási, 2022, Stefano Boccaletti and Hwang, 2006].

This specialization reflects the diversification of network science into distinct subfields, each catering to specific research communities. *Social Networks* is rooted in social sciences and policy-relevant research, whereas *Journal of Complex Networks* prioritizes methodological advancements in network modeling. *Network Science*, by contrast, functions as a hybrid platform promoting interdisciplinary synthesis [Lazer et al., 2009, Katy Börner and Wang, 2020]. Further analysis of citation networks and thematic clustering will clarify how these journals interact and shape the field over time.

Patterns of Specialization and Cross-Journal Engagement

The limited cross-journal publication by authors may stem from the distinct academic cultures and publication strategies inherent in their areas of expertise. It is reasonable to hypothesize that:

- **Empirical and Applied Research Focus:** Authors publishing predominantly in

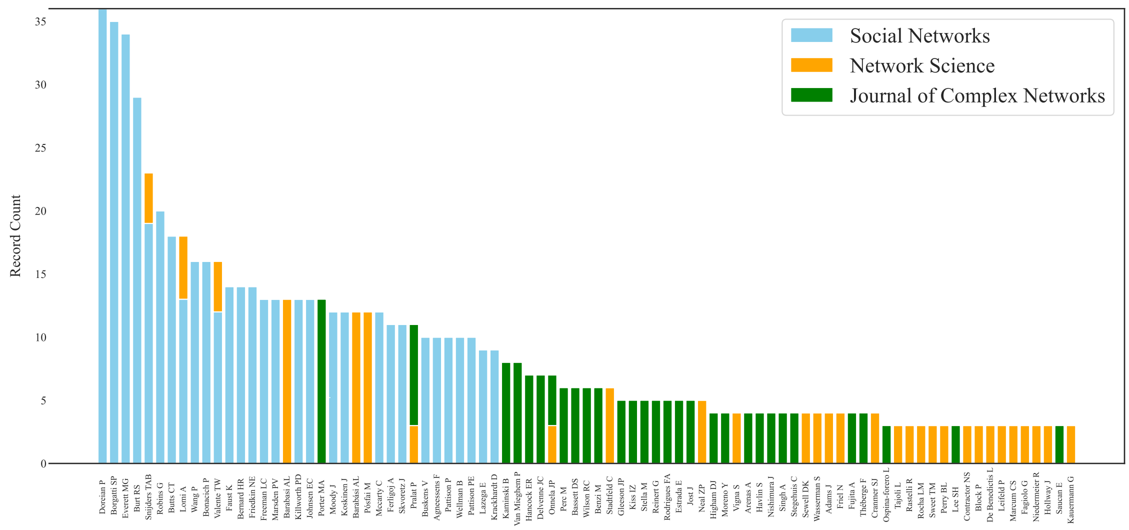


Figure 2: Prolific Authors

Social Networks might prioritize empirical data and real-world applications, which aligns with the journal's aim to influence practical and policy-related outcomes.

- **Theoretical and Computational Focus:** Conversely, authors like **Porter MA** and **Barabási AL** engage with journals like *Journal of Complex Networks* and *Network Science* due to their interest in developing new theoretical frameworks and computational models that may not align with the more applied nature of *Social Networks*.

This specialization underlines a broader academic phenomenon where researchers often become siloed within their disciplinary boundaries, occasionally leading to challenges in interdisciplinary research dissemination [Leahey, 2016, Porter and Rafols, 2009]. The fact that very few authors publish across all three journals suggests a significant opportunity for promoting interdisciplinary research, which could bridge gaps between empirical and computational studies [Caroline S. Wagner and Hassell, 2011, Diego Chavarro and Porter, 2017]. Encouraging cross-disciplinary collaboration may facilitate methodological integration and foster novel insights at the intersection of social, mathematical, and computational network analysis.

Implications for the Field

This segmentation of publishing within specific journals reflects broader intellectual trends and may indicate potential barriers to interdisciplinary research [Leahey, 2016, Porter and Rafols, 2009]. While *Social Networks* remains a primary venue for empirical research, theoretical advancements published in *Journal of Complex Networks* and *Network Science* could provide valuable frameworks for refining empirical models and expanding methodological approaches [Diego Chavarro and Porter, 2017, Caroline S. Wagner and Hassell, 2011].

The presence of a small but notable group of cross-journal contributors suggests a pathway toward greater integration of computational and empirical approaches. Encouraging interdisciplinary collaboration could facilitate methodological synthesis, enabling computational models to complement empirical investigations and leading to a more comprehensive understanding of network structures and dynamics [Ismael Rafols and Leydesdorff, 2010, Noorden, 2015].

In subsequent sections, we explore how these publication patterns shape the intellectual landscape of network research and assess their implications for the integration of methodological innovations across disciplines.

3.3 Institutional Contributions to Social Network Research

This section examines the leading institutional contributors to social network research, focusing on their publication records across three key journals: *Social Networks*, *Journal of Complex Networks*, and *Network Science*. By analyzing the top affiliations in each journal, we gain insight into dominant institutions, regional patterns, and the differing research orientations reflected in these publication venues [Wagner and Leydesdorff, 2018, Glänzel, 2015, Leydesdorff, 2021].

Institutional Influence and Regional Disparities

A clear pattern emerges in the institutional distribution of social network research. The *University of California System* is the most prolific contributor, with substantial publication output across all three journals. Its presence is most pronounced in *Social Networks*, where it accounts for the largest institutional share, but it also maintains a notable footprint in *Journal of Complex Networks* and *Network Science*. This broad engagement underscores its commitment to both empirical and computational network science.

Beyond the University of California System, North American institutions dominate contributions to *Social Networks*, reinforcing the journal's strong ties to sociology and applied network analysis [?, Freeman, 2004]. Universities such as *Pennsylvania Commonwealth System of Higher Education*, *University of Pittsburgh*, and *University of California Irvine* rank among the most frequent contributors. Meanwhile, European universities, particularly *University of Groningen* and *University of Oxford*, play a central role, highlighting the journal's reach beyond the United States [Borgatti et al., 2009].

Theoretical Focus in Journal of Complex Networks

In contrast, *Journal of Complex Networks* features a stronger presence of European institutions, reflecting its emphasis on mathematical and algorithmic approaches to network science [Newman, 2010]. The leading contributors include *University of Oxford*, *Centre National de la Recherche Scientifique (CNRS)*, and *University of London*, institutions known for their focus on theoretical modeling and complexity science [Barabási, 2016]. Many of these affiliations maintain collaborations with physics and computer science departments, further reinforcing the journal's orientation toward formal network analysis.

Interdisciplinary Engagement in Network Science

Network Science presents a more interdisciplinary institutional composition, incorporating both theoretical and applied perspectives. It attracts contributions from leading research universities, including *Harvard University*, *Indiana University*, and *Central European University*, each of which has established itself as a center for computational and quantitative social science [Fortunato et al., 2018]. Additionally, institutions such as *The Santa Fe Institute* and *CNRS* are well represented, reflecting the journal's emphasis on interdisciplinary and fundamental research in network theory [Boccaletti et al., 2014].

Institutional Overlap and Specialization

While a few institutions maintain a presence across all three journals, most exhibit specialization in either applied or theoretical network research. Universities such as *Oxford* and *California* contribute broadly, spanning both empirical and computational network studies [Strogatz, 2001]. However, others, like *CNRS* and *Harvard*, are more concentrated in *Journal of Complex Networks* and *Network Science*, respectively, signaling a stronger focus on formal network methodologies. The relative lack of institutional overlap suggests that, despite their shared focus on network research, these journals cater to distinct scholarly communities.

Table 2: Top 10 Affiliations per Journal

Affiliations	Record Count	Journal
UNIVERSITY OF CALIFORNIA SYSTEM	171	Social Networks
UNIVERSITY OF CALIFORNIA IRVINE	86	Social Networks
PENNSYLVANIA COMMONWEALTH SYSTEM OF HIGHER ED	73	Social Networks
UNIVERSITY OF GRONINGEN	66	Social Networks
UNIVERSITY OF OXFORD	55	Social Networks
UNIVERSITY OF PITTSBURGH	52	Social Networks
UTRECHT UNIVERSITY	47	Social Networks
UNIVERSITY OF CHICAGO	41	Social Networks
UNIVERSITY OF MELBOURNE	41	Social Networks
UNIVERSITY OF SOUTH CAROLINA COLUMBIA	41	Social Networks
UNIVERSITY OF OXFORD	30	Journal of Complex Networks
UNIVERSITY OF CALIFORNIA SYSTEM	21	Journal of Complex Networks
HARVARD UNIVERSITY	20	Network Science
UNIVERSITY OF CALIFORNIA SYSTEM	18	Network Science
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	18	Journal of Complex Networks
UNIVERSITY OF LONDON	16	Journal of Complex Networks
INDIANA UNIVERSITY BLOOMINGTON	15	Network Science
INDIANA UNIVERSITY SYSTEM	15	Network Science
NORTHEASTERN UNIVERSITY	15	Network Science
CENTRAL EUROPEAN UNIVERSITY	14	Network Science
UNIVERSIDADE DE SAO PAULO	14	Journal of Complex Networks
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	13	Network Science
THE SANTA FE INSTITUTE	13	Journal of Complex Networks
HARVARD MEDICAL SCHOOL	12	Network Science
UNIVERSITY OF OXFORD	12	Network Science
MAX PLANCK SOCIETY	11	Journal of Complex Networks
UNIVERSITY OF CALIFORNIA LOS ANGELES	11	Journal of Complex Networks
UNIVERSITY OF TRENTO	11	Journal of Complex Networks
UNIVERSITY OF GRONINGEN	10	Network Science
MASSACHUSETTS INSTITUTE OF TECHNOLOGY MIT	10	Journal of Complex Networks

Implications for the Field

The institutional landscape of social network research reflects both regional and disciplinary distinctions. *Social Networks* remains closely linked to North American universities with strong traditions in empirical network studies, while European institutions lead contributions to *Journal of Complex Networks* and *Network Science*, reinforcing their prominence in complexity science and theoretical research [Watts and Strogatz, 1998]. The presence of highly specialized institutions such as *The Santa Fe Institute* highlights the growing role of interdisciplinary approaches, while increasing contributions from regions outside North America and Europe—such as *Universidade de São Paulo*—signal a gradual globalization of the field.

Interpretation of Citation and Publication Metrics

To assess the research impact and scholarly influence of the three selected journals, we computed key bibliometric indicators, summarized in Table 3. These metrics provide a structured evaluation of citation patterns, research productivity, and author contributions. Specifically, we analyze the number of cited publications (NCP), the proportion of cited publications (PCP), and the average citations per cited publication (CCP) to assess citation reach. Additionally, we employ widely used impact measures such as the h-index, g-index, and i-index at multiple citation thresholds to capture both depth and breadth of influence within the field. These indicators collectively offer insights into the relative standing and thematic focus of each journal in social and complex network research.
textitSocial Networks demonstrates the highest citation influence, with 1,462 cited publications (NCP) and a proportion of cited publications (PCP) of 93.9%. This indicates a strong citation uptake, reaffirming its status as a leading outlet for social network research [Freeman, 2004, Borgatti et al., 2009]. The average citations per cited publication (CCP = 64.51) is considerably higher than in the other two journals, suggesting that publications in *Social Networks* tend to be more widely cited. The high h-index (126) and g-index (264) further highlight the substantial impact of its articles [**?**].

In contrast, *Network Science* and *Journal of Complex Networks*, both more recent journals, exhibit lower citation metrics. *Network Science* has a PCP of 83.4% and a CCP of 14.68, indicating that while most of its articles receive citations, they accumulate fewer per publication. Similarly, *Journal of Complex Networks* reports a PCP of 78.7% and a CCP of 18.5, reflecting its

Table 3: Citation and Publication Related Metrics

Journal	NCP	PCP	CCP	h-index	g-index	i-10 index	i-100 index	i-200 index
Social Networks	1462	0.939000	64.510000	126	264	1004	170	69
Network Science	252	0.834400	14.680000	23	52	78	6	1
Journal of Complex Networks	431	0.786500	18.500000	34	78	138	10	5

role in a more specialized computational and theoretical niche [Newman, 2010, Barabási, 2016].

The distribution of highly cited publications aligns with these patterns. *Social Networks* has 1,004 papers exceeding 10 citations (i-10), with 170 surpassing 100 citations (i-100) and 69 exceeding 200 citations (i-200). This far surpasses the counts in *Network Science* (i-100 = 6, i-200 = 1) and *Journal of Complex Networks* (i-100 = 10, i-200 = 5), reinforcing its dominant position in the field [**?**, Watts and Strogatz, 1998].

Overall, these metrics reflect the distinct roles of each journal: *Social Networks* as the primary venue for empirical and applied social network studies, *Journal of Complex Networks* as a hub for mathematical and computational approaches, and *Network Science* as an interdisciplinary bridge [Barabási, 2009]. The citation trends highlight the field's evolution, with computational and theoretical research gaining visibility while traditional empirical studies maintain the highest impact.

4 Science Mapping

Science mapping provides a visual and structural representation of the intellectual landscape of a research domain [M. J. Cobo, 2011, Börner et al., 2010]. By analyzing co-citation networks, bibliographic coupling, and keyword co-occurrence patterns, this approach uncovers thematic clusters, influential works, and evolving research trends [Aria and Cuccurullo, 2017, Chen, 2006].

In this study, we employ three widely used bibliometric tools—VOSviewer, Gephi, and CiteSpace—to conduct science mapping. VOSviewer is utilized for constructing and visualizing bibliometric networks [Van Eck and Waltman, 2010b], Gephi enables advanced network analysis of scholarly collaboration [Bastian et al., 2009], and CiteSpace facilitates the identification of emerging trends and intellectual turning points [Chen et al., 2017]. Through these methods, we systematically examine the thematic development, conceptual linkages, and structural properties of the selected journals within the field of social and complex network research.

4.1 Citation Analysis

For all datasets, we use the *g-index* to regulate the network size. The *g-index* is defined by the equation:

$$g^2 \leq k \sum_{i \leq g} c_i, \quad k \in \mathbb{Z}^+$$

,

where we set $k = 25$ to constrain the network size.

Citation analysis identifies the most influential publications within a research domain by examining citation counts and scholarly impact [Garfield, 1972, Small, 1973]. Highly cited papers shape the intellectual structure of a field, serving as foundational works that influence subsequent research [Leydesdorff, 1998, Moed, 2005].

Table 4 presents the top 10 most cited papers in *Social Networks*, highlighting key contributions to network analysis. Freeman's (1979) seminal work on centrality remains the most influential, shaping decades of research on network metrics [Freeman, 1979]. Other highly cited studies introduce methodological advancements such as weighted centrality measures [Opsahl and Skvoretz, 2010], stochastic blockmodels [Holland and Leinhardt, 1983], and exponential random graph models [Robins and Lusher, 2007]. The dominance of works on centrality, community structure, and network modeling reflects the journal's strong emphasis on both empirical applications and theoretical innovations.

These citation patterns underscore *Social Networks* as a critical venue for advancing methodologies in social network analysis. Further analysis of co-citation networks will reveal how these studies interact and influence emerging research trajectories.

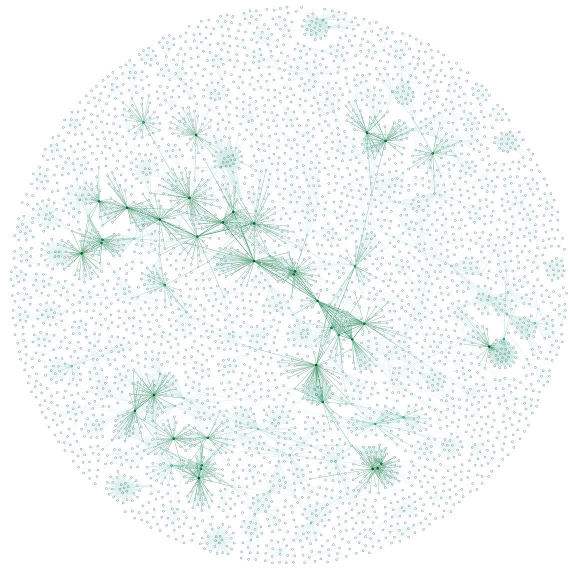


Figure 3: Largest Connected Component in *Social Networks*

Social Networks

The citation network of *Social Networks* exhibits a centralized hub structure, where key publications serve as bridges across different research areas. These influential works facilitate knowledge diffusion, linking empirical, computational, and theoretical approaches. To further investigate their impact, we analyze degree centrality, betweenness centrality, and modularity, identifying emerging research trends and intellectual shifts [Snijders et al., 2010, Holland and Leinhardt, 1983].

Figure 3 visualizes the largest connected component of the citation network in *Social Networks*. Darker nodes with high connectivity represent foundational works that anchor major research clusters. These dense structures correspond to specialized subfields with strong internal citations, while lighter, more dispersed nodes indicate peripheral contributions.

Further examination of citation patterns reveals that high-degree nodes form tightly connected clusters, suggesting strong citation reciprocity within subfields. This is illustrated in Figure 4, where darker colors indicate nodes with higher degrees. The network layout follows the Fruchterman-Reingold algorithm [Fruchterman and Reingold, 1991], with the degree range set between 21 and 61 to highlight structural patterns.

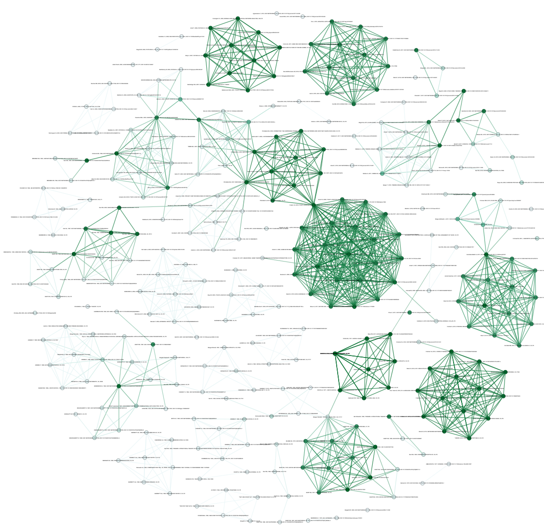


Figure 4: High-Degree Clusters in *Social Networks*

Network Science

The citation network of *Network Science* in Table 5 reveals a distinct intellectual structure, reflecting its role in integrating interdisciplinary

Table 4: Top 10 Most Cited Papers in *Social Networks*

Author(s)	**Title**	**Year**	**Citations**
Freeman, LC	Centrality in Social Networks: Conceptual Clarification	1979	10811
Opsahl, T	Node Centrality in Weighted Networks: Generalizing Degree and Shortest Path	2010	2269
Borgatti, SP	Centrality and Network Flow	2005	2108
Adamic, LA	Friends and Neighbors on the Web	2003	1786
Holland, PW	Stochastic Blockmodels: First Steps	1983	1690
Newman, MEJ	A Measure of Betweenness Centrality Based on Random Walks	2005	1420
Snijders, TAB	Introduction to Stochastic Actor-Based Models for Network Dynamics	2010	1312
Borgatti, SP	Models of Core/Periphery Structures	1999	1282
Robins, G	An Introduction to Exponential Random Graph (p^*) Models	2007	1227
Seidman, SB	Network Structure and Minimum Degree	1983	1184

research on complex networks. High-impact papers in this journal span theoretical advancements, computational methodologies, and empirical applications. The network is characterized by key publications that serve as foundational references in network analysis, algorithmic development, and data-driven modeling.

The citation network of *Network Science* shown in Figure 5 exhibits a more fragmented structure compared to *Social Networks*, suggesting that authors in this journal engage in relatively independent research trajectories with fewer direct collaborations. The distribution of citations is more dispersed, indicating that influential works are spread across multiple subfields rather than concentrated in a few key publications.

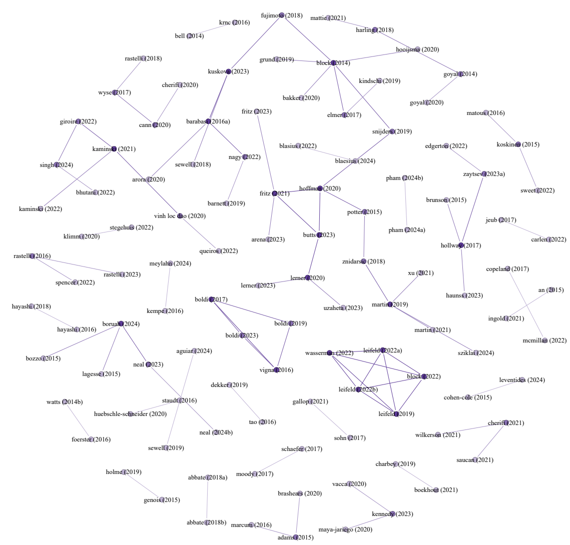


Figure 5: Highly Cited Papers in *Network Science*

Journal of Complex Networks

The *Journal of Complex Networks* (JCN) exhibits **moderate connectivity** in its citation and collaboration structures, a characteristic supported by previous studies on academic network structures [Newman, 2001, Liu and Xia, 2005]. Compared to *Network Science* (NS), JCN demonstrates slightly better overall connectivity, suggesting a higher degree of scholarly interaction [Barabási and Vicsek, 2002]. However, its **largest connected component is significantly smaller than that of Social Networks (SN)**, indicating a more fragmented intellectual structure [Otte and Rousseau, 2002, Borgatti et al., 2009].

JCN's co-authorship network reveals a **dis-**

Table 5: Top 10 Most Cited Papers in *Network Science*

Author(s)	Title	Year	Citations
Barabási, AL	Network Science	2016	901
Barabási, AL	Personal Introduction	2016	191
Génois, M	Data on Face-to-Face Contacts in an Office Building Suggest a Low-Cost	2015	147
Bothorel, C	Clustering Attributed Graphs: Models, Measures, and Methods	2015	136
Staudt, CL	NetworKit: A Tool Suite for Large-Scale Complex Network Analysis	2016	121
Block, P	Multidimensional Homophily in Friendship Networks	2014	115
Rodriguez, MG	Uncovering the Structure and Temporal Dynamics of Information	2014	87
Neal, ZP	How Small is it? Comparing Indices of Small Worldliness	2017	45
Leifeld, P	A Theoretical and Empirical Comparison of the Temporal Exponential	2019	43
Elmer, T	The Co-Evolution of Emotional Well-Being with Weak and Strong Friendship	2017	41

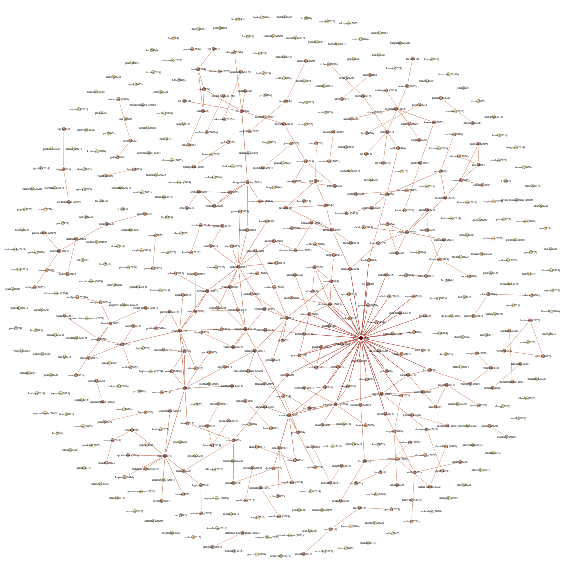


Figure 6: Highly cited papers in *Journal of Complex Networks*

persed collaboration pattern in Figure 6, with relatively independent research teams contributing to distinct methodological subfields. Unlike *Social Networks*, which features dense collaborative clusters, JCN primarily consists of **smaller, loosely connected research groups**, reflecting its emphasis on specialized theoretical and computational approaches rather than broad empirical studies.

These structural characteristics suggest that while JCN supports a diverse range of research topics in complex networks, its interdisciplinary integration remains limited. The relatively low level of cross-group citation and collaboration indicates that JCN could benefit from fostering **stronger interdisciplinary engagement**, potentially enhancing the coherence and impact of its scholarly network.

We also observe that while JCN exhibits higher connectivity than *Network Science*, its citation structure remains **fragmented**, with relatively few high-degree nodes anchoring the network. This is evident in Figure 6, where darker colors represent higher-degree nodes, highlighting influential papers within the network.

4.2 Co-citation Analysis

Co-citation analysis examines the intellectual structure of a research field by identifying relationships between publications that are frequently cited together [Small, 1973]. In this section, we conduct a co-citation analysis across the three selected journals—*Social Networks*, *Journal of Complex Networks*, and *Network Sci-*

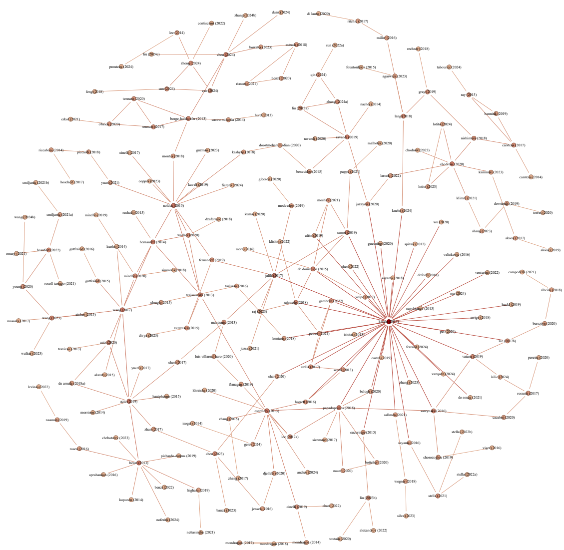


Figure 7: Largest connected component in *Journal of Complex Networks*.

ence—to uncover key scholarly influences and thematic clusters within network science.

By mapping co-citation patterns, we aim to:

- Identify foundational and highly co-cited works that shape the field.
- Detect thematic clusters that highlight dominant research areas.
- Examine the evolution of intellectual discourse across the three journals.

The analysis is conducted using **VOSviewer, CiteSpace, and Gephi** [Van Eck and Waltman, 2010b,Chen, 2006,Bastian et al., 2009], employing network visualization techniques to reveal structural patterns. The following sections present the results for each journal, highlighting the most influential papers and their co-citation relationships.

Social Networks

To examine the intellectual foundations of research published in *Social Networks*, we conducted a co-citation analysis using the 40,748 references cited across the dataset. We applied a minimum co-citation threshold of 10, resulting in 789 publications that met the criterion. These publications formed six distinct research clusters, indicating core thematic areas within the field.

Figure 8 visualizes the co-citation network, where node size represents citation frequency, and edge thickness denotes co-citation strength. The modular structure reveals highly cited seminal works at the core of each cluster, surrounded by peripheral contributions that extend or apply foundational theories.

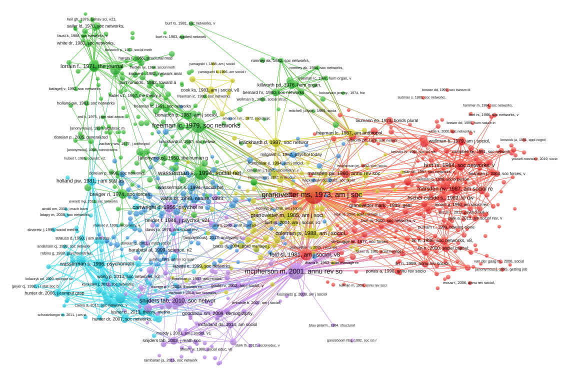


Figure 8: Co-citation network of *Social Networks*

The six detected clusters represent distinct intellectual traditions within social network research:

- **Structural Network Analysis**: This cluster centers around foundational works on network centrality, small-world networks, and structural balance, with key contributions from Freeman (1979) [Freeman, 1979], Borgatti & Everett (1999) [Borgatti and Everett, 1999], and Watts & Strogatz (1998) [Watts and Strogatz, 1998].
- **Statistical Network Models**: Influenced by exponential random graph models (ERGMs) and stochastic blockmodels, this cluster includes seminal works by Holland & Leinhardt (1981) [Holland and Leinhardt, 1981] and Snijders (2001) [Snijders, 2001].

- **Computational and Algorithmic Methods**: Emerging as an increasingly influential area, this cluster includes research on network inference, community detection, and machine learning applications in network science.

- **Social Capital and Influence Diffusion**: Studies on social influence, information diffusion, and network externalities form another major research stream, building on Granovetter (1973) [Granovetter, 1973] and Burt (1992) [Burt, 1992].

- **Longitudinal and Dynamic Networks**: This cluster focuses on temporal network analysis, including actor-oriented models for evolving networks (e.g., Snijders et al., 2010) [Snijders et al., 2010].

- **Applications in Social and Policy Sciences**: The final cluster captures interdisciplinary applications of social network analysis in areas such as epidemiology, political networks, and organizational studies.

These clusters highlight the dual nature of the field, where classical theoretical frameworks continue to shape research trajectories while computational advances and interdisciplinary applications drive emerging themes. The presence of well-defined yet interconnected clusters suggests that social network research maintains a balance between theoretical consolidation and methodological diversification.

Network Science

A co-citation analysis was also performed to identify the foundational literature shaping research published in *Network Science*. The dataset contained 10,932 cited references, of which only 59 met the minimum co-citation threshold of 10. These references were grouped into three distinct clusters, representing key intellectual domains within the journal.

Figure 9 presents the resulting co-citation network, illustrating how frequently cited works are

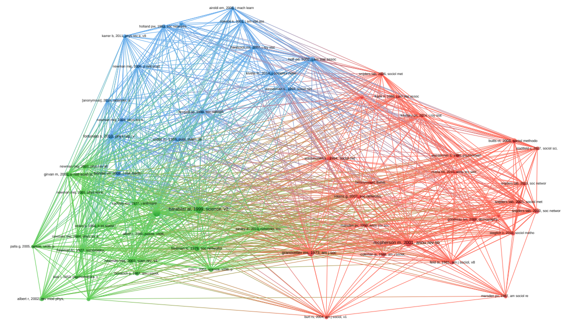


Figure 9: Co-citation network of *Network Science*.

interconnected through shared scholarly influence. The structure of this network reveals a core set of highly referenced publications that serve as conceptual anchors, linking diverse areas of inquiry within network science. The clusters indicate distinct thematic orientations, with some references contributing to theoretical advancements in network modeling, while others emphasize computational techniques or interdisciplinary applications.

The limited number of publications surpassing the co-citation threshold suggests that research in *Network Science* builds upon a relatively concentrated set of seminal works. This reflects the journal's specialized focus, where foundational theories and methodological innovations form the backbone of scholarly discourse. The presence of clear clusters also highlights disciplinary coherence, while inter-cluster linkages suggest ongoing cross-pollination between different research approaches.

Journal of Complex Networks

To analyze the foundational literature shaping research in *Journal of Complex Networks*, we conducted a co-citation analysis based on 16,758 cited references. Applying a minimum co-citation threshold of 10, we identified 136 publications that met this criterion. These references formed five distinct research clusters, each representing a key intellectual domain within complex network studies.

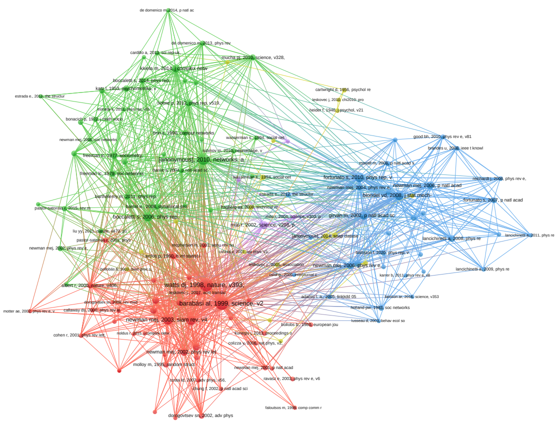


Figure 10: Co-citation network of *Journal of Complex Networks*.

The co-citation network, visualized in Figure 10, reveals the structural organization of highly cited references in JCN. Prominent works in network science, such as those by Newman, Barabási, and Watts, emerge as central nodes, highlighting their widespread influence across multiple research clusters. The presence of studies on modularity detection, network dynamics, and multilayer networks suggests that JCN is deeply engaged with theoretical and methodological advancements in complex systems.

The five identified clusters indicate thematic subdivisions within the field:

- **Network Structure and Dynamics:** Fundamental studies on network topology, small-world effects, and preferential attachment.
- **Community Detection and Modularity:** Key algorithms for identifying structural patterns in complex networks.
- **Multilayer and Temporal Networks:** Research focusing on network evolution and interactions across different layers.
- **Statistical Mechanics of Networks:** Theoretical frameworks derived from physics-based approaches.
- **Applications in Biology and Social Systems:** Studies applying network models to real-world datasets, particularly in epidemiology and information diffusion.

Overall, JCN's co-citation structure underscores its focus on methodological innovation and theoretical contributions to complex network analysis. The dispersion of research clusters suggests a broad yet specialized research landscape, where computational approaches are deeply integrated with applied network studies.

The co-citation analysis across the three journals—*Social Networks*, *Network Science*, and *Journal of Complex Networks*—reveals distinct intellectual structures and thematic orientations within the broader domain of network research.

- **Social Networks (SN):** Exhibits a well-established and diversified co-citation network, with six thematic clusters encompassing classical structural analysis, statistical modeling, computational techniques, and applied social sciences. The breadth of co-cited works reflects the journal's longstanding role in advancing both theoretical and empirical social network research.
- **Network Science (NS):** Features a more compact intellectual structure, with only three co-citation clusters. This indicates a concentrated reliance on foundational network theories and computational methods. The journal's specialized nature suggests that its research community is strongly anchored in a core set of influential studies.
- **Journal of Complex Networks (JCN):** Presents a moderately interconnected co-citation network with five clusters, reflecting its emphasis on mathematical modeling, community detection, multilayer networks, and statistical mechanics. The presence of applied research in biological and social systems underscores its interdisciplinary scope,

bridging theoretical and practical applications.

These findings highlight both the convergence and divergence of intellectual influences across the three journals. *Social Networks* maintains the most extensive and heterogeneous co-citation landscape, integrating diverse methodological traditions. *Network Science* exhibits a concentrated scholarly foundation, reinforcing its role as a hub for theoretical and computational advances. *Journal of Complex Networks* occupies an intermediary position, blending formal network analysis with real-world applications.

The observed structural differences suggest that while network research continues to evolve, disciplinary specialization persists. Future bibliometric analyses could further investigate citation flows between these journals, identifying cross-fertilization of ideas and emerging interdisciplinary trends.

4.3 Co-word Analysis

Co-word analysis examines the conceptual structure of a research field by identifying patterns of keyword co-occurrence in scholarly publications. By mapping the relationships between frequently co-occurring terms, this method reveals dominant research themes, emerging trends, and the evolution of discourse within a field [Callon et al., 1983, Coulter, 1998, Ding et al., 2001].

In this study, we conduct a co-word analysis across *Social Networks*, *Network Science*, and *Journal of Complex Networks* to:

- Identify high-frequency keywords that define core topics within each journal.
- Detect thematic clusters and conceptual linkages between research areas.
- Explore temporal shifts in keyword usage to track emerging trends.

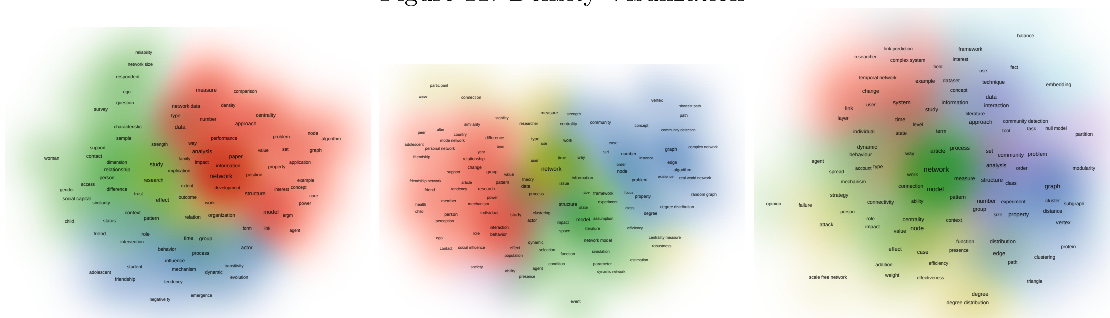
The analysis is performed using **VOSviewer** and **CiteSpace**, leveraging network visualization techniques to illustrate keyword co-occurrence structures. The resulting networks provide insight into how key concepts interact and evolve across different subfields of network science.

The following sections present the results for each journal, highlighting major thematic clusters and their implications for the intellectual development of the field.

The density visualization of co-word networks in Figure 11 provides insights into the conceptual structures of research published in *Social Networks*, *Journal of Complex Networks*, and *Network Science*. By comparing their density layouts, we observe key differences in the thematic concentration and distribution of research topics across these journals.

- **Social Networks**: The density map of *Social Networks* exhibits a well-defined structure with multiple highly concentrated regions. Core research themes such as social capital, centrality, and network structure appear densely clustered, indicating a long-established and cohesive intellectual foundation. The strong concentration of keywords suggests a mature research field with well-integrated concepts.
- **Journal of Complex Networks**: The density map of *Journal of Complex Networks* displays a more dispersed pattern with several moderately dense clusters. Topics related to algorithmic approaches, network modeling, and complex systems are prevalent. The distribution suggests a field that, while specialized, is still evolving, with diverse research directions coexisting rather than converging around a few dominant themes.
- **Network Science**: The density map for *Network Science* is relatively sparse, with fewer highly concentrated areas. This indicates a more fragmented research landscape, reflecting the journal's interdisciplinary nature. Unlike *Social Networks*, which has a tightly integrated body of research, *Network Science* includes diverse but loosely con-

Figure 11: Density Visulization



(a) Social Networks Density Visulization

(b) Network Science Density Visulization

(c) Journal of Complex Networks Density Visulization

nected research themes from physics, computer science, and sociology, resulting in a more diffused density layout.

These differences reflect the distinct epistemic communities served by each journal. *Social Networks* maintains a traditional focus on social theory and empirical analysis, leading to a high-density conceptual core. *Journal of Complex Networks* balances theoretical and computational perspectives, resulting in a moderately cohesive structure. *Network Science* embraces a broad interdisciplinary scope, leading to a lower-density conceptual space with more loosely connected research topics.

4.4 Co-authorship Analysis

Social Networks

To analyze the co-authorship patterns in the journal *Social Networks*, we constructed a co-authorship network using bibliometric data. The visualization was generated using VOSviewer 1.6.20 [?], which clusters authors based on their collaborative relationships. Figure 12 illustrates the co-authorship network, where nodes represent individual authors, and edges denote co-authorship links. The size of each node corresponds to the author's publication volume, while edge thickness reflects the frequency of co-authorship [Glänzel, 2004, Newman, 2004].

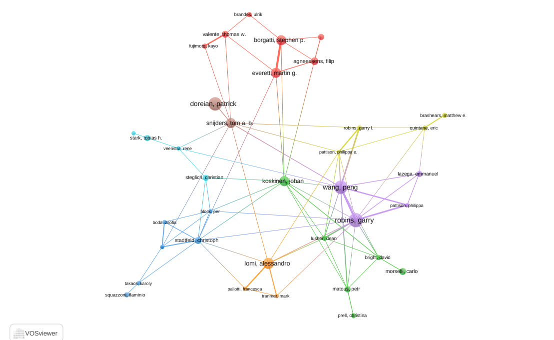


Figure 12: Co-authorship network visualization

To assess the density and connectivity within the co-authorship network, we further analyzed the structural properties of the network. Figure 13 presents the co-authorship density map, where highly collaborative authors appear in denser regions. The intensity of colors in the visualization represents the concentration of co-authored works, with brighter regions indicating stronger collaboration patterns.

The co-authorship network reveals several key insights into the collaborative structure of research in *Social Networks*:

- **Prominent Authors:** The network highlights several influential authors, including *Tom A.B. Snijders, Stephen P. Borgatti,*

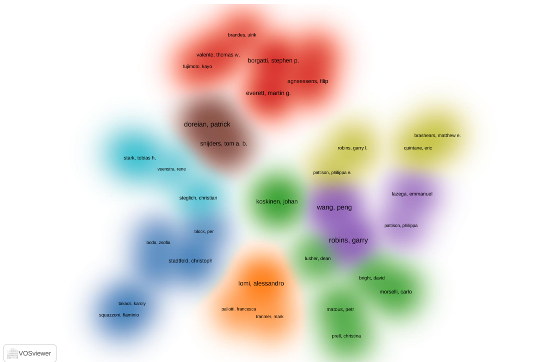


Figure 13: Co-authorship network density visualization

and Garry Robins, who exhibit strong co-authorship connections.

- **Clustered Communities:** The network is characterized by well-defined clusters, each representing a group of authors who frequently collaborate. These clusters correspond to distinct research subfields within network science.
- **Interdisciplinary Connections:** Some nodes serve as bridges between different research clusters, facilitating knowledge exchange across disciplines.
- **High-Density Regions:** The density visualization identifies research hubs where collaboration is particularly intense, suggesting influential research groups driving the field forward.

Network Science

To analyze the co-authorship patterns in the journal *Social Networks*, we constructed a co-authorship network using bibliometric data. The visualization was generated using VOSviewer 1.6.20 [Van Eck and Waltman, 2010b], which clusters authors based on their collaborative relationships. Figure 12 illustrates the co-authorship network, where nodes represent individual authors, and edges denote co-authorship links. The size of each node corresponds to the author's publication volume, while edge thickness reflects the frequency of co-authorship [Glänzel, 2004, Newman, 2004].

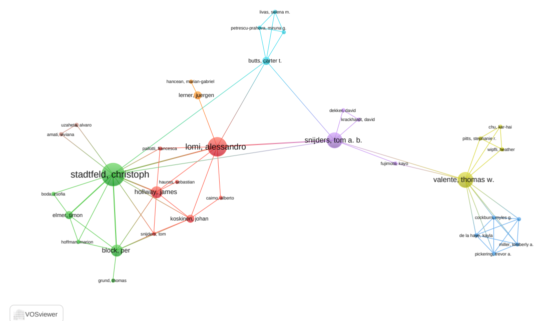


Figure 14: Co-authorship network visualization for *Network Science*

To further assess the network's structural properties, we examined its density and connectivity. Figure 15 illustrates the co-authorship density map, highlighting regions of intense collaboration. The color gradient in the visualization signifies the concentration of co-authored works, with brighter areas indicating more frequent collaboration.

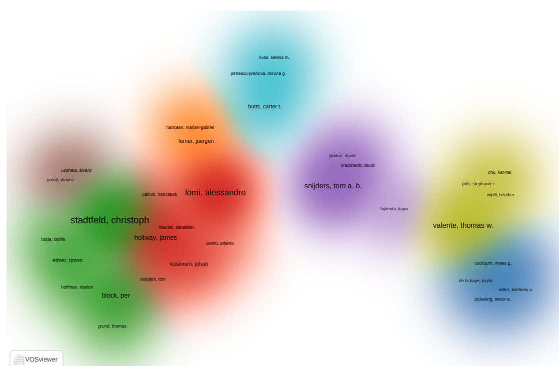


Figure 15: Co-authorship network density visualization for *Network Science*

Analysis of the co-authorship network yields several insights into collaborative research patterns within *Network Science*:

- **Key Contributors:** The network underscores the prominence of several influential scholars, including *Tom A.B. Snijders, Carter T. Butts, and Alessandro Lomi*, who maintain extensive co-authorship ties.
- **Distinct Research Groups:** The network is composed of well-defined clusters, each representing a set of researchers frequently collaborating within a particular subfield of network science.
- **Interdisciplinary Linkages:** Certain nodes function as bridges between clusters, facilitating the exchange of ideas across different research domains.
- **Areas of High Collaboration:** The density visualization pinpoints key research hubs where collaboration is particularly active, highlighting influential groups shaping the field.

Journal of Complex Networks

Also, for Journal of Complex Networks:

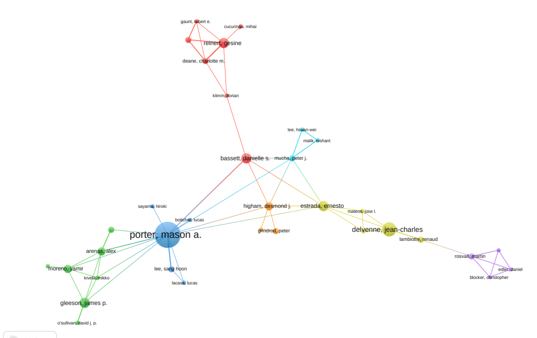


Figure 16: Co-authorship network visualization in the *Journal of Complex Networks.*

To further analyze the structural characteristics of the co-authorship network, we examined the density of connections among researchers. Network density measures the overall level of collaboration in the academic community and reflects the extent to which authors frequently co-publish with one another [Newman, 2001, Moody, 2004, Barabási, 2016]. High-density networks indicate strong interdisciplinary cooperation and frequent scholarly interactions, whereas lower-density networks suggest a more fragmented research landscape. This analysis provides deeper insights into the cohesion and collaborative dynamics within the field.

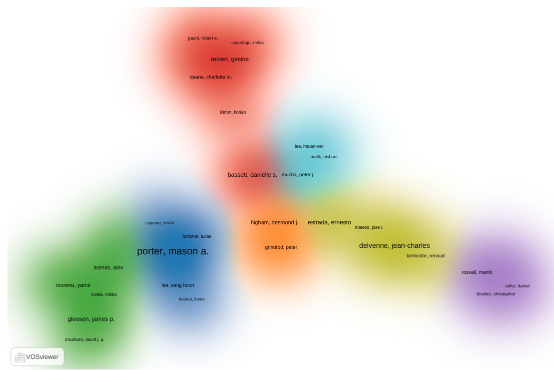


Figure 17: Co-authorship network density visualization in the *Journal of Complex Networks.*

The analysis of the co-authorship network yields several key insights into the collaborative structure of research within the *Journal of Complex Networks*:

- **Prominent Authors:** The network highlights several influential contributors, including Hiroki Sayama, David J.P. O'Sullivan, José L. Mateos, Nishant Malik, Hsuan-Wei Lee, and Lucas Lacasa, who exhibit extensive co-authorship connections.
- **Clustered Research Communities:** The co-authorship network is characterized by distinct clusters, each representing a group of researchers who frequently collaborate. These clusters likely correspond to specialized subfields within complex network science.
- **Interdisciplinary Collaborations:** Several authors serve as intermediaries connect-

ing different research clusters, facilitating the exchange of knowledge across distinct domains.

- **High-Density Collaborative Hubs:** The density visualization highlights key research hubs where collaboration is particularly strong, indicating the presence of influential research groups shaping the direction of the field.

5 Network Metrics

Network analysis is a key bibliometric technique for examining the structure of scholarly interactions by mapping relationships among authors, institutions, and research themes [Newman, 2001, Barabási and Vicsek, 2002, Borgatti et al., 2009]. By constructing co-authorship, institutional collaboration, and citation networks, this approach offers valuable insights into the structural properties of academic discourse and the diffusion of knowledge [Otte and Rousseau, 2002, Liu and Xia, 2005].

To assess the impact of individual publications, we compute key network metrics, including degree centrality, betweenness centrality, and sigma scores. Table 5 highlights the most influential publications based on these metrics across the three journals analyzed.

For accuracy, we employ NetworkX [Hagberg et al., 2008] to calculate the network metrics. The results are detailed in Table 6. We ranked the list based on a combined evaluation of all three centrality metrics.

Table 6 presents the ten most central publications in *Social Networks*, *Network Science*, and *Journal of Complex Networks*, ranked based on multiple centrality measures. These rankings offer a structural perspective on the most influential contributions within each journal, revealing key theoretical, methodological, and applied research trends. The centrality measures considered—degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality—capture different aspects of a publication's influence in the co-authorship and citation networks.

The most central publications in *Social Networks* are predominantly foundational works that have shaped the field of network analysis. Classical contributions such as those by Scott (2017), Borgatti (1992), and Wasserman (1994) [Scott, 2017, Borgatti and Everett, 1992, Wasserman and Faust, 1994] remain highly central due to their widespread adoption. These studies introduced key concepts and methodological advancements that continue to influence contemporary research. The presence of Burt's work [Burt, 1983, Burt, 1992, Burt, 1992] further underscores the lasting significance of structural hole theory in understanding social network dynamics. Additionally, more recent works such as Block [Block, 2015] and Wang [Wang, 2013] highlight the increasing role of statistical modeling in network science, reflecting the methodological evolution of the field. Other highly central publications, such as Zappa (2015) [Zappa, 2015] and Doreian (1987) [Doreian, 1987], indicate the application of network models to organizational and structural research.

In *Network Science*, central publications primarily focus on computational and statistical methodologies. Works such as Snijders (2017) [Snijders, 2017] and Block (2015) [Block, 2015] exemplify the application of stochastic actor-based models, while Valente (2012) [Valente, 2012] and Bakshy (2015) [Bakshy, 2015] demonstrate the role of network diffusion and influence dynamics in large-scale systems. Additionally, Amati (2019) [Amati, 2019] and Lomi (2012) [Lomi, 2012] highlight the field's emphasis on empirical network analysis using advanced statistical techniques. The presence of Salehi (2015) [Salehi, 2015] and Elmer (2019) [Elmer, 2019] suggests that *Network Science* serves as a critical venue for interdisciplinary methodological developments. Compared to *Social Networks*, which focuses more on empirical and theoretical work in sociology, *Network Science* leans heavily toward computational approaches and large-scale network analysis.

Table 6: Top 10 Publications in 3 Journals with Highest Centrality

Label	Degree	Degree Centrality	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality	Journal
Scott J, 2017, SOCIAL NETWORK ANALYSIS, V0, P0	12	0.007335	0.239656	0.156274	0.000088	Social Networks
BORGATTI SP, 1992, SOC NETWORKS, V14, P91, DOI 10.1016/0378-8733(92)90015-Y	8	0.004890	0.178918	0.142706	0.000465	Social Networks
Block P, 2015, SOC NETWORKS, V40, P163, DOI 10.1016/j.socnet.2014.10.005	24	0.014670	0.108329	0.141205	0.000058	Social Networks
Wang P, 2013, SOC NETWORKS, V35, P96, DOI 10.1016/j.socnet.2013.01.004	24	0.014670	0.094689	0.154768	0.000206	Social Networks
Wasserman S, 1994, SOCIAL NETWORK ANAL, V0, P0	26	0.015892	0.079835	0.143585	0.000021	Social Networks
BURT RS, 1987, AM J SOCIOL, V92, P1287, DOI 10.1086/228667	24	0.014670	0.077956	0.109768	0.013629	Social Networks
Zappa P, 2015, ORGAN RES METHODS, V18, P542, DOI 10.1177/1094428115579225	18	0.011002	0.073588	0.153603	0.000134	Social Networks
DOREIAN P, 1987, SOC NETWORKS, V9, P89, DOI 10.1016/0378-8733(87)90008-6	17	0.010391	0.072486	0.120457	0.002516	Social Networks
BURT RS, 1983, APPLIED NETWORK ANAL, V0, P0	25	0.015281	0.071772	0.101817	0.039599	Social Networks
Burt RS, 1992, STRUCTURAL HOLES, V0, P0	17	0.010391	0.068141	0.134295	0.000098	Social Networks
Snijders TAB, 2017, ANNU REV STAT APPL, V4, P343, DOI 10.1146/annurev-statistics-060116-054035	8	0.020833	0.066634	0.088163	0.000004	Network Science
Block P, 2015, SOC NETWORKS, V40, P163, DOI 10.1016/j.socnet.2014.10.005	10	0.026042	0.066090	0.081605	0.000002	Network Science
Amati V, 2019, SOC NETWORKS, V57, P18, DOI 10.1016/j.socnet.2018.10.001	20	0.052083	0.058764	0.091121	0.000015	Network Science
Lomi A, 2012, SOC NETWORKS, V34, P101, DOI 10.1016/j.socnet.2010.10.005	9	0.023438	0.054830	0.074176	0.000007	Network Science
Leenders RTAJ, 2016, ORGAN PSYCHOL REV, V6, P92, DOI 10.1177/2041386615578312	5	0.013021	0.045654	0.084257	0.000003	Network Science
Brashears ME, 2018, SOC NETWORKS, V55, P104, DOI 10.1016/j.socnet.2018.05.010	6	0.015625	0.045566	0.078896	0.000000	Network Science
Bakshy E, 2015, SCIENCE, V348, P1130, DOI 10.1126/science.aaa1160	6	0.015625	0.036677	0.060877	0.000000	Network Science
Valente TW, 2012, SCIENCE, V337, P49, DOI 10.1126/science.1217330	13	0.033854	0.029537	0.065944	0.000007	Network Science
Salehi M, 2015, IEEE T NETW SCI ENG, V2, P65, DOI 10.1109/TNSE.2015.2425961	9	0.023438	0.026723	0.054533	0.000001	Network Science
Elmer T, 2019, BEHAV RES METHODS, V51, P2120, DOI 10.3758/s13428-018-1180-y	10	0.026042	0.026261	0.087756	0.000004	Network Science
Allen-Perkins A, 2019, J STAT MECH-THEORY E, V2019, P0, DOI 10.1088/1742-5468/ab5700	3	0.005848	0.000000	0.131349	0.000047	Journal of Complex Networks
Miklós I, 2013, ELECTRON J COMB, V20, P0	2	0.003899	0.002155	0.077071	0.000000	Journal of Complex Networks
BORGATTI SP, 2011, ORGAN SCI, V22, P1168, DOI 10.1287/orsc.1100.0641	2	0.003899	0.000000	0.104677	0.000025	Journal of Complex Networks
Virtanen P, 2020, NAT METHODS, V17, P261, DOI 10.1038/s41592-019-0686-2	1	0.001949	0.000000	0.001949	0.000000	Journal of Complex Networks
Andjelkovic M, 2020, SCI REP-UK, V10, P0, DOI 10.1038/s41598-020-74392-3	7	0.013645	0.000013	0.080586	0.000000	Journal of Complex Networks
Rattana P, 2013, B MATH BIOL, V75, P466, DOI 10.1007/s11538-013-9816-7	1	0.001949	0.000000	0.002599	0.000000	Journal of Complex Networks
Nyberg A, 2015, J COMPLEX NETW, V3, P543, DOI 10.1093/comnet/cnv004	2	0.003899	0.000000	0.003899	0.000000	Journal of Complex Networks
van der Hofstad R, 2017, PHYS REV E, V95, P0, DOI 10.1103/PhysRevE.95.022307	2	0.003899	0.000000	0.003899	0.000000	Journal of Complex Networks
Asztalos A, 2012, EUR PHYS J B, V85, P0, DOI 10.1140/epjb/e2012-30122-3	1	0.001949	0.000000	0.119835	0.000093	Journal of Complex Networks

The highly central publications in *Journal of Complex Networks* illustrate the journal's interdisciplinary focus. While the overall centrality values of these works are lower than those in *Social Networks* and *Network Science*, they highlight the diverse applications of network science across multiple domains. Studies such as Allen-Perkins (2019) [Allen-Perkins, 2019] and Borgatti (2011) [Borgatti and Everett, 1992] demonstrate how network methodologies are adapted to different research areas, while works like Andjelkovic (2020) [Andjelkovic et al., 2020] and Nyberg (2015) [Nyberg, 2015] emphasize the integration of network models in biological and physical systems. The presence of Asztalos (2012) [Asztalos, 2012] and van der Hofstad (2017) [van der Hofstad, 2017] suggests a growing interest in applying statistical physics to complex networks, reinforcing the journal's role in bridging traditional network science with broader scientific disciplines.

A comparative analysis of centrality measures provides us with additional insights into the structural positioning of these publications. Works appearing in *Social Networks* tend to exhibit higher degree centrality, indicating frequent citation and recognition within the academic community. Publications with high betweenness centrality, such as Scott (2017) [Scott, 2017] and Borgatti (1992) [Borgatti and Everett, 1992], serve as key bridging studies that connect distinct research areas. In contrast, studies with high closeness centrality, including Zappa (2015) [Zappa, 2015] and Doreian (1987) [Doreian, 1987], are structurally positioned to influence a broad range of works due to their network proximity to other publications. Eigenvector centrality, which reflects influence within a citation cluster, highlights the prominence of works such as Burt (1983, 1992) [Burt, 1983, Burt, 1992] and Amati (2019) [Amati, 2019], suggesting their importance within their respective research communities.

The centrality rankings provide a structured view of the most influential works across three major journals in network science. While *Social Networks* primarily features foundational theoretical and methodological contributions, *Network Science* emphasizes computational and statistical modeling approaches. *Journal of Complex Networks*, in contrast, displays a broader disciplinary focus, incorporating network-based methodologies across various scientific domains. These findings highlight the evolving intellectual landscape of network science and offer insights into how different research traditions contribute to the field's development.

6 Conlusion

This bibliometric study of social network research across multiple journals reveals the intricate and evolving structure of this academic domain. By examining co-authorship networks, citation patterns, and key centrality measures, we uncover not only the dominant figures and influential publications but also the underlying intellectual currents shaping the field. The presence of well-connected authors and tightly clustered research communities indicates that social network research has matured into a structured discipline with distinct methodological and theoretical foundations.

One of the most striking observations is the persistence of foundational works maintaining their relevance over time, demonstrating that certain conceptual and methodological contributions continue to serve as the backbone of network analysis. At the same time, the emergence of new high-impact publications suggests that the field is undergoing expansion, incorporating interdisciplinary perspectives and computational advancements. The increasing prominence of multilayer and dynamic network models reflects a shift toward more complex representations of social structures, driven by the need to account for temporal and contextual variations in relational data.

The patterns of collaboration further highlight the dynamics of knowledge production in this field. Highly centralized networks, where a few scholars act as bridges between research clusters, suggest that intellectual leadership is concentrated among a small but influential group of researchers. These bridging scholars facilitate the diffusion of ideas, integrating diverse approaches and fostering methodological innovation. Conversely, the presence of insular clusters hints at specialized subfields that develop independently, potentially limiting cross-fertilization between research traditions.

The study also reveals an increasing reliance on computational methodologies, particularly in areas where traditional social science approaches intersect with machine learning, big data analytics, and network inference techniques. This methodological convergence signifies a transformation in how network science is conceptualized and applied, extending beyond classical sociological and statistical approaches to incorporate more predictive and algorithmic paradigms.

Looking ahead, the trajectory of social network research will likely be shaped by the growing influence of digital platforms, the proliferation of large-scale networked data, and the increasing demand for network-based interventions in fields such as public health, policy-making, and organizational behavior. The challenge lies in balancing theoretical rigor with methodological innovation, ensuring that as the field expands, it retains coherence and conceptual depth. By continuously refining its analytical frameworks and embracing interdisciplinary perspectives, social network research is poised to remain a critical lens for understanding the complexities of human connectivity in an increasingly networked world.

Conflict of Interest

The author declares that he has no conflict of interest.

Data Availability Statement

The data used in this study are securely stored and can be accessed at `https://github.com/Amethystium-321E1/Network-Journal-Biblio`. Additional data or requests for further use can be made upon request.

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