

Postprint: Interdisciplinarity in Library and Information Science from a Social Media Perspective

Authors: Wu Xiaolan, Zhang Chengzhi

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Abstract

[Purpose/Significance] In the social media context, informal academic communication has gradually emerged as a new frontier for scholarly exchange. Exploring the interdisciplinary characteristics of the Library and Information Science (LIS) field, which possesses a comprehensive interdisciplinary nature, can serve as a supplement and reference for research on traditional academic communication.

[Method/Process] Taking ScienceNet Blogs as a representative example, this study constructs disciplinary affinity trees from three perspectives: user friendship relations, comment relations, and recommendation relations, and then analyzes the interdisciplinary characteristics of LIS by utilizing the diversity indices of these affinity trees.

[Results/Conclusion] Through this study, it was found that a strong correlation exists between user disciplinary affinity trees and friend disciplinary affinity trees in the LIS field, and a very strong correlation exists between the disciplinary affinity trees of recommendation targets and those of comment targets. Furthermore, this study also found that “Computer Science”, “Management Science and Engineering”, and “Macro-management and Policy” are the most affine disciplines for LIS users on social media.

Full Text

Preamble

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Interdisciplinary Analysis of Library and Information Science from a Social Media Perspective

Wu Xiaolan^{1,2}, Zhang Chengzhi²

¹ School of Journalism and Communication, Nanjing Normal University, Nanjing 210046

² Department of Information Management, School of Economics and Management, Nanjing University of Science and Technology, Nanjing 210094

Abstract

[Purpose/Significance] With the development of Web 2.0, informal academic exchanges on social media have become a new frontier for scholarly communication. Exploring the interdisciplinary characteristics of Library and Information Science (LIS)—a field with inherently interdisciplinary properties—from a social media perspective can supplement and inform traditional academic exchange research. **[Method/Process]** Using ScienceNet.cn blogs as a representative platform, this study constructs discipline phylogenetic trees from three perspectives: user friendship relationships, comment relationships, and recommendation relationships. The interdisciplinary characteristics of LIS are then analyzed using diversity indices from these phylogenetic trees. **[Result/Conclusion]** The findings reveal a strong correlation between LIS users' discipline phylogenetic trees and their friends' discipline phylogenetic trees, and an extremely strong correlation between the discipline phylogenetic trees of recommended objects and commented objects. Additionally, “Computer Science,” “Management Science and Engineering,” and “Macro Management and Policy” emerge as the most closely related disciplines to LIS on social media.

Keywords: discipline phylogenetic tree, interdisciplinary distance, species diversity, ScienceNet.cn blogs

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Introduction

Library and Information Science (LIS) is formed through the intersection and integration of library science and information science. Its development has been a continuous process of actively incorporating theories and methods from other disciplines, making it a highly interdisciplinary field [1] that constantly engages in knowledge exchange with other disciplines. The flow of knowledge between disciplines can, to some extent, characterize their relationships—the greater the knowledge flow, the closer the relationship, and vice versa. Consequently, numerous scholars have investigated knowledge flow patterns in LIS. Since knowledge content itself cannot be directly measured, existing research primarily uses literature as the basic unit of measurement, analyzing the disciplinary classifications of references to study interdisciplinarity.

On social media, however, users are the central actors, and most information is user-generated. Therefore, this study adopts users as the basic unit of measurement to examine the interdisciplinary characteristics of LIS on social media. Given LIS's distinctive interdisciplinary nature, analyzing the patterns of

interdisciplinary knowledge exchange among its users on social media holds significant research value for understanding the field's position within the broader disciplinary landscape and its future development trajectory.

2. Related Research Overview

Modern science is evolving toward increasing specialization while simultaneously becoming more integrated, with enhanced cross-pollination between disciplinary knowledge and the emergence of interdisciplinary and peripheral fields. LIS is a comprehensive peripheral discipline situated between natural and social sciences, with strong practical applications that were traditionally centered on library and information services [2]. In today's web-dominated environment, LIS applications have expanded into e-government, e-commerce, social services, and enterprise competitiveness, underscoring its important role within the disciplinary ecosystem. This section reviews relevant research on LIS interdisciplinarity.

According to reference [3], “interdisciplinarity” refers to the characteristics of interdisciplinary research, including the breadth and intensity of knowledge integration across disciplines, and the patterns of interdisciplinary knowledge distribution and diffusion. LIS exhibits significant interdisciplinarity, continuously absorbing and integrating knowledge from other disciplines to enrich its theoretical foundations and methodological toolkit while also contributing knowledge outputs to other fields. Scholars have extensively studied LIS interdisciplinarity through various approaches:

J. O'Dell et al. [4] analyzed citations from 67 LIS journals in JCR (1996-2004), finding that approximately 34.9% of references came from computer science, 15% from business administration, and 9.4% from medicine—indicating that LIS research cites more related disciplines than in earlier periods (T. Meyer et al. [5], 1996). T.W. Chang et al. [6] employed citation analysis, bibliographic coupling, and author collaboration analysis on 7,704 papers from 10 LIS journals (1978-2007), identifying basic sciences, business administration, and computer science as major citation sources beyond the field itself. B. Cronin et al. [7] conceptualized references in information science papers as knowledge “imports” and citations as knowledge “exports” to examine knowledge exchange patterns. Su Xinning [2] analyzed LIS research characteristics using CSSCI citation and collaboration data, identifying development issues and future directions. Qiu Junping et al. [8] used Chinese Citation Database data to study knowledge diffusion breadth, intensity, and speed between library science, information science, archival science, and other disciplines. Qiu Junping et al. [9] analyzed 2,000-2012 bibliographic data from 12 influential LIS journals in Web of Science, examining interdisciplinary knowledge diffusion characteristics including diversity and cohesion, revealing close relationships with computer science, economics, medical informatics, and healthcare. Yang Jianlin et al. [10] used citation relationships to study interdisciplinary information exchange between information science and other fields. Zhang Jinzhu et al. [11] analyzed LIS interdisciplinarity

using disciplinary classifications of references from 8,273 papers (1997-2011) in 12 LIS journals.

In summary, scholars have conducted substantial research on LIS interdisciplinarity using citation analysis, co-word analysis, clustering, and social network analysis to examine knowledge propagation, exchange, flow, and impact. These studies, primarily based on formal academic literature databases, have significant implications for disciplinary positioning and development. However, with the rise of Web 2.0, informal academic exchanges on social media have become increasingly important, complementing formal academic communication. This study explores LIS interdisciplinarity from a social media perspective as a supplement to traditional research.

3. Research Methods

3.1 Research Framework

Academic blogs represent a form of informal academic exchange that complements traditional scholarly communication. Their key characteristic is “birds of a feather flock together”—scholars in specific fields tend to cluster in blog communities, engaging in academic exchange through linking, friending, recommending, and commenting on relevant blogs [12]. This study analyzes LIS interdisciplinarity by examining users and their interaction objects (friends, recommended objects, commented objects) and their disciplinary orientations. The research framework is illustrated in [Figure 1: see original paper].

The analysis relies on user friendship information and ScienceNet’s disciplinary classification system. We crawled the disciplinary classification framework and user information (self-reported research directions, friend relationships, recommended objects, commented objects). Using phylogenetic tree concepts and evaluation metrics from biology, we investigate LIS interdisciplinarity from both macro and micro perspectives:

1. **Macro Perspective on LIS Interdisciplinarity:** We first statistically analyze the research directions of all LIS users across four dimensions: (a) their self-reported research directions, (b) their friends’ research directions, (c) research directions of users they recommend, and (d) research directions of users they comment on. We then construct discipline phylogenetic trees using ScienceNet’s classification system, creating “user discipline phylogenetic trees,” “friend discipline phylogenetic trees,” “recommended object discipline phylogenetic trees,” and “commented object discipline phylogenetic trees.” Finally, we calculate statistical correlations among these four trees using Pearson correlation coefficients and identify the most closely related disciplines to LIS based on shared disciplines across the four trees (detailed in Section 3.2).
2. **Micro Perspective on LIS Interdisciplinarity:** We employ diversity metrics to analyze individual users’ interdisciplinarity, focusing on three

dimensions: richness, evenness, and differentiation. We construct three types of discipline phylogenetic trees for each user (friends, recommended objects, commented objects), calculate their diversity indices, and identify the most interdisciplinary users (detailed in Section 3.3).

3.2 Construction of Discipline Phylogenetic Trees and Correlation Metrics

The construction of discipline phylogenetic trees for all LIS users is critical. The process is illustrated in [Figure 2: see original paper]. Based on ScienceNet’s disciplinary classification, we categorize all content into eight major fields: life sciences, medical sciences, chemical sciences, engineering materials, information science, earth sciences, mathematical sciences, and management sciences. “Computer Science,” “Automation,” and “Electronics and Information Systems” belong to information science; “Library, Information and Documentation Science,” “Management Science and Engineering,” “Management,” and “Macro Management and Policy” belong to management sciences; “Mathematics” belongs to mathematical sciences; “Genetics and Bioinformatics” belongs to life sciences; and “Geography” belongs to earth sciences. This yields a discipline phylogenetic tree with five branches [Figure 2: see original paper].

Assuming we randomly sample 180 LIS users and count their self-reported second-level disciplinary directions on ScienceNet, sorted in descending order [FIGURE:2(a)], we can construct the corresponding discipline phylogenetic tree [FIGURE:2(b)]. Tips (terminal nodes) within the same branch share a length of 1, while tips from different sub-branches under the same main branch share a length of 0.75.

After constructing the trees, we use Pearson correlation coefficients to analyze statistical correlations, with significance testing. The Pearson correlation is appropriate as user friend distributions meet the requirements of normality, independence, and continuity. Given sample observations X_i and Y_i with means \bar{X} and \bar{Y} and sample size n , the correlation coefficient r is:

$$r = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 \sum(Y_i - \bar{Y})^2}}$$

where r ranges from -1 to 1. A value of 0 indicates no linear correlation, while values approaching ± 1 indicate stronger linear relationships.

3.3 Diversity Analysis and Metrics

Measuring interdisciplinarity essentially measures the diversity of disciplines involved in a paper (or set of papers) [13-14]. A. Stirling’s three-dimensional framework provides theoretical guidance: richness (number of disciplines),

evenness (distribution uniformity), and differentiation (disciplinary distinctiveness/relatedness) [15-16]. We adapt these concepts to analyze individual users' interdisciplinarity.

We treat each user's discipline phylogenetic tree as their academic pedigree, enabling the use of biodiversity metrics from ecology. Species diversity in ecology examines species distribution patterns within communities, considering not only species count but also inter-species relationships and functional diversity [17]. Three key indices are:

3.3.1 Phylogenetic Species Variability (PSV)

PSV quantifies how variation in a randomly chosen trait shared by all species in a community changes with phylogenetic relationships. $PSV = 1$ indicates phylogenetically unrelated species; values approaching 0 indicate increasing relatedness [18]:

$$PSV = \frac{n \cdot Tr(C) - \sum C}{n(n-1)} = 1 - \bar{C}$$

where n is species count, C is the phylogenetic covariance matrix, $Tr(C)$ is the trace of C , $\sum C$ is the sum of all matrix elements, and \bar{C} is the mean of off-diagonal elements.

3.3.2 Phylogenetic Species Richness (PSR)

PSR represents species count, calculated as [18]:

$$PSR = n \cdot PSV$$

3.3.3 Phylogenetic Species Evenness (PSE)

PSE modifies PSV to incorporate relative species abundance information. Maximum $PSE = 1$ indicates equal abundance and phylogenetic unrelatedness; values approaching 0 indicate increasing abundance disparity or phylogenetic relatedness [18]:

$$PSE = \frac{m \cdot \text{diag}(C)'M - M'CM}{m^2 - \bar{m}_i m}$$

where m is total abundance, \bar{m}_i is mean species abundance, C is the covariance matrix, and M is a column vector of species abundances.

4. Experiments and Results

4.1 Dataset

To analyze LIS users' interdisciplinary span, we first used a web crawler to collect "Management Sciences" bloggers on ScienceNet under the "Library, Information and Documentation Science" category. During analysis, we discovered active

LIS users (e.g., Wu Yishan, ID “1557”) not listed in the directory. By examining user profiles, we found their primary research direction was “Management Sciences,” explaining their absence. We conducted a second crawl of all bloggers’ research directions. ScienceNet allows users to report three research directions visible on their “academic cards” .

Although user-reported directions may contain some inaccuracies, they generally represent research interests. We treat the three directions equally regardless of order, referring to them as first-level, second-level, and third-level disciplinary categories. After crawling all directions, we extracted users who listed “Library, Information and Documentation Science” in any of their three directions, yielding 996 target LIS users.

We then crawled these users’ friends, comment targets, and recommendation targets. To construct discipline phylogenetic trees, we also crawled ScienceNet’s disciplinary classification system using a Python script, obtaining 8 first-level categories, 105 second-level categories, and 1,218 third-level categories . “Library, Information and Documentation Science” falls under “Management Sciences,” which contains 22 second-level categories.

4.2 Macro Analysis of LIS Interdisciplinarity

After identifying 996 LIS users, we constructed their discipline phylogenetic tree based on their three self-reported research directions [Figure 3: see original paper]. In [Figure 3: see original paper], “Root” represents the root node, two-digit nodes represent first-level categories, and four-digit nodes represent second-level categories (with the first two digits indicating the first-level code). Codes 01-08 represent: Information Science, Chemical Science, Medical Science, Earth Science, Engineering Materials, Mathematical Science, Life Science, and Management Science. The yellow node “0819” represents “Library, Information and Documentation Science,” while five red nodes represent the most populated other disciplinary branches: “Computer Science,” “Management Science and Engineering,” “Macro Management and Policy,” “Electronics and Information Systems,” and “Business Administration.” The tree shows that beyond LIS itself, users most frequently reported “Management Science and Engineering,” “Macro Management and Policy,” and “Electronics and Information Systems” within management sciences, and “Computer Science” in other branches.

We then constructed three additional discipline phylogenetic trees based on: (a) user friends (8,076 total, including intra- and extra-field friends), (b) recommended objects (4,260 total), and (c) commented objects (4,587 total) [Figure 4: see original paper]. The trees reveal: (1) All three trees show similar structures, with (a) most closely resembling the user self-reported tree, both dominated by management and information science branches; (2) Trees (b) and (c) are most similar to each other, with dominant disciplines in information science (01), earth science (04), and mathematical science (06); (3) All three trees show substantial representation from medical science (03) and life science (07), likely

due to their numerous sub-disciplines.

We calculated Pearson correlations among these trees using their 60 shared disciplinary branches. Results show: (1) Strong correlation between user self-reported trees and friend trees; (2) Extremely strong correlation between recommended object trees and commented object trees; (3) Moderate correlation between friend trees and both recommended/commented object trees. “Computer Science,” “Management Science and Engineering,” “Macro Management and Policy,” “Electronics and Information Systems,” and “Business Administration” show the strongest disciplinary affinities with LIS.

4.3 Micro Analysis of LIS Interdisciplinarity

In biology, species diversity is the core and most direct manifestation of biodiversity. In ecology, it examines species distribution patterns within communities, considering both species count and inter-species relationships [17]. We analyzed individual users’ interdisciplinary characteristics by constructing three discipline phylogenetic trees per user (friends, recommended objects, commented objects) and calculating PSV, PSR, and PSE values. Distribution histograms are shown in [Figure 5: see original paper], [Figure 6: see original paper], and [Figure 7: see original paper].

PSV distributions [Figure 5: see original paper] show: (1) High mean PSV values across all three groups, indicating LIS users engage widely across disciplines; (2) Recommended and commented objects show more users with PSE values around 0.8, suggesting these groups have more extra-field users than friends.

PSR distributions [Figure 6: see original paper] exhibit long-tail patterns, with most users having low PSR and few having high values. Recommended object trees show the highest PSR, while friend trees show the lowest, indicating recommended objects span more disciplines.

PSE distributions [Figure 7: see original paper] reveal: (1) Less disciplinary variation among friends compared to recommended/commented objects; (2) Recommended object trees have higher overall PSE values, suggesting users actively recommend content from outside their primary field.

Mean diversity indices are summarized in : PSV means are 0.8059 (friends), 0.8517 (recommended), and 0.8097 (commented); PSR means are 13.7493, 23.6088, and 16.9865 respectively; PSE means are 0.6809, 0.8137, and 0.7558.

Following L. Bromham et al.’s IDD metric [19], which originates from PSE and measures interdisciplinary degree (higher values indicate more dispersed disciplinary distribution), we identified users with PSV, PSR, and PSE values exceeding overall means as highly interdisciplinary. This yielded 25 such users, with the top three disciplines across their networks being “Computer Science,” “Management Science and Engineering,” and “Macro Management and Policy.”

4.4 Discussion

Our findings show: (1) The primary disciplines interacting with LIS on social media are “Computer Science,” “Management Science and Engineering,” and “Macro Management and Policy,” consistent with conclusions in [4], [6], [8], and [9]; (2) The “Management Science and Engineering” finding aligns with [8] and [9] regarding knowledge similarity; (3) The “Macro Management and Policy” result supports [1]’s finding that science evaluation and scientometrics are the third-largest knowledge contributors to LIS. Minor discrepancies with some studies likely stem from different disciplinary classification systems. Our analysis uses the National Natural Science Foundation’s classification, which differs from journal-based systems. For instance, “Management Science and Engineering,” “Business Administration,” and “Macro Management and Policy” all fall under the “Management Sciences” category in our framework.

5. Conclusion and Future Work

After crawling ScienceNet’s disciplinary classification system and user information (research directions, friend relationships, recommended objects, commented objects), we analyzed LIS interdisciplinarity from macro and micro perspectives. Constructing discipline phylogenetic trees from social relationships and disciplinary classifications was key. Using biodiversity concepts, we found: (1) LIS users exhibit distinct interdisciplinary characteristics on social media; (2) Strong correlations exist between users’ and friends’ discipline phylogenetic trees, and extremely strong correlations between recommended and commented object trees; (3) “Computer Science,” “Management Science and Engineering,” and “Macro Management and Policy” are the most closely related disciplines to LIS on social media.

This study focused solely on LIS interdisciplinarity. Future work will expand to examine interdisciplinary characteristics across the entire disciplinary structure.

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Author Contributions

Wu Xiaolan: Research design, data collection and analysis, manuscript drafting and revision.

Zhang Chengzhi: Research conceptualization, final manuscript revision.

Interdisciplinary Analysis of Library and Information Science Based on Social Media

Wu Xiaolan^{1,2}, Zhang Chengzhi²

¹ School of Journalism and Communication, Nanjing Normal University, Nanjing 210046

² Department of Information Management, School of Economics & Management, Nanjing University of Science and Technology, Nanjing 210094

Abstract: [Purpose/significance] With the development of Web 2.0, informal academic exchanges under social media have become a new field for scholarly communication. Analyzing interdisciplinary characteristics of Library and Information Science (a comprehensively interdisciplinary field) from a social media perspective can supplement traditional academic exchange research. [Method/process] Taking ScienceNet.cn as representative, this paper constructs discipline phylogenetic trees from three aspects—user friendship, comment relationships, and recommendation relationships—then analyzes LIS interdisciplinary characteristics using diversity indices of these trees. [Result/conclusion] The study finds strong correlation between LIS users' discipline phylogenetic trees and their friends' trees, and extremely strong correlation between recommended objects' and commented objects' trees. Additionally, “Computer Science,” “Management Science and Engineering,” and “Macro Management and Policy” are the most closely related disciplines to LIS on social media.

Keywords: discipline phylogenetic tree, interdisciplinary distance, species diversity, ScienceNet.cn blogs

Note: Figure translations are in progress. See original paper for figures.

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