World Academy of Science, Engineering and Technology
International Journal of Social and Business Sciences
Vol:18, No:09, 2024

Centrality and Patent Impact: Coupled Network Analysis of Artificial Intelligence Patents Based on Co-Cited Scientific Papers

Authors : Xingyu Gao, Qiang Wu, Yuanyuan Liu, Yue Yang

Abstract : In the era of the knowledge economy, the relationship between scientific knowledge and patents has garnered significant attention. Understanding the intricate interplay between the foundations of science and technological innovation has emerged as a pivotal challenge for both researchers and policymakers. This study establishes a coupled network of artificial intelligence patents based on co-cited scientific papers. Leveraging centrality metrics from network analysis offers a fresh perspective on understanding the influence of information flow and knowledge sharing within the network on patent impact. The study initially obtained patent numbers for 446,890 granted US AI patents from the United States Patent and Trademark Office's artificial intelligence patent database for the years 2002-2020. Subsequently, specific information regarding these patents was acquired using the Lens patent retrieval platform. Additionally, a search and deduplication process was performed on scientific non-patent references (SNPRs) using the Web of Science database, resulting in the selection of 184,603 patents that cited 37,467 unique SNPRs. Finally, this study constructs a coupled network comprising 59,379 artificial intelligence patents by utilizing scientific papers co-cited in patent backward citations. In this network, nodes represent patents, and if patents reference the same scientific papers, connections are established between them, serving as edges within the network. Nodes and edges collectively constitute the patent coupling network. Structural characteristics such as node degree centrality, betweenness centrality, and closeness centrality are employed to assess the scientific connections between patents, while citation count is utilized as a quantitative metric for patent influence. Finally, a negative binomial model is employed to test the nonlinear relationship between these network structural features and patent influence. The research findings indicate that network structural features such as node degree centrality, betweenness centrality, and closeness centrality exhibit inverted U-shaped relationships with patent influence. Specifically, as these centrality metrics increase, patent influence initially shows an upward trend, but once these features reach a certain threshold, patent influence starts to decline. This discovery suggests that moderate network centrality is beneficial for enhancing patent influence, while excessively high centrality may have a detrimental effect on patent influence. This finding offers crucial insights for policymakers, emphasizing the importance of encouraging moderate knowledge flow and sharing to promote innovation when formulating technology policies. It suggests that in certain situations, data sharing and integration can contribute to innovation. Consequently, policymakers can take measures to promote data-sharing policies, such as open data initiatives, to facilitate the flow of knowledge and the generation of innovation. Additionally, governments and relevant agencies can achieve broader knowledge dissemination by supporting collaborative research projects, adjusting intellectual property policies to enhance flexibility, or nurturing technology entrepreneurship ecosystems.

Keywords : centrality, patent coupling network, patent influence, social network analysis
Conference Title : ICSNAM 2024 : International Conference on Social Network Analysis and Mining
Conference Location : Paris, France
Conference Dates : September 16-17, 2024