Data Science Methods in Social Network Research

Helena Markovic
Montford University School of Business, UK

In the era of digitalization and connectivity, social networks have become an integral part of our lives (Gulati et al., 2009). These networks provide a wealth of data about human interactions, opinions, and behaviors (Simoni et al., 2006). As a result, the field of social network research has witnessed a paradigm shift with the advent of data science methods. Data-driven computational social network science (DD-CSNS) has emerged as a powerful approach to analyze and understand complex social phenomena (Tatarynowicz & Claassen, 2023). This article explores the transformative impact of data science methods on social network research and its implications for the future.

Origin of the Problem

Traditionally, social scientists focused on finding causal explanations and models to understand social phenomena. However, this approach has been criticized for neglecting the predictive abilities of models. The availability of big social data has challenged the traditional approach, as these data cannot be analyzed solely through simulation-based approaches or descriptive models. To address this gap, the integration of big social data with social networks is crucial for creating prediction models and gradually establishing a causal social theory.

Importance of Networks for Social Sciences

Social networks have played a pivotal role in social science research for decades. The study of social networks began with graphical representations of interactions among individuals, providing insights into social circles and groups. Milestones such as Milgram's study on average path length and Granovetter's research on the spread of information demonstrated the significance of social networks in understanding social behavior. The availability of big social data has further propelled the study of social networks, allowing for the analysis of large-scale networks and their structural properties.

Big Social Data

The rise of communication technologies and internet-based services has led to the generation of big social data. Platforms such as social media, blogs, e-commerce sites, and online games capture a vast amount of data about human behavior and interactions. Unlike traditional social science data, these technology-mediated social data provide novel insights into social phenomena. The collection of big social data can be achieved through various methods, including downloading data from repositories, accessing data via APIs, or web scraping.

Network-Based Prediction Models

Prediction models are a crucial component of DD-CSNS. These models utilize social networks and big social data to make accurate predictions about social phenomena. Two types of prediction models can be employed: inferential models and predictive models. Inferential models provide

causal explanations of the data generation process, while predictive models focus on forecasting without providing causal explanations. The coexistence of inferential and predictive models is essential to advance our understanding of social phenomena and gradually build a comprehensive social theory.

DD-CSNS for Theory Discovery

DD-CSNS follows an iterative process of exploration, prediction, and validation to facilitate theory discovery. Social data are analyzed to discover or test hypotheses, and the resulting insights are used to conduct experiments and gather new data. This iterative approach allows for the gradual establishment of a social theory by combining network-informed analyses with empirical testing. Case studies showcasing the application of DD-CSNS in social contagion, psychological targeting, and fake news detection demonstrate its potential for addressing real-world challenges.

Ethical Considerations and Future Directions

While DD-CSNS offers tremendous potential for advancing social network research, ethical considerations must be taken into account. Issues of informed consent, privacy, and the responsible use of big social data require careful attention. Future research should focus on developing guidelines and frameworks to ensure the ethical implementation of DD-CSNS. Additionally, the integration of deep learning networks and network-based methods holds promise for enhancing the interpretability of predictive models and further improving the accuracy of predictions.

Conclusion

Data science methods have revolutionized social network research, enabling a deeper understanding of human interactions and behaviors. DD-CSNS, driven by the integration of big social data and social networks, offers a pragmatic approach to establish a causal social theory. By leveraging predictive and inferential models, researchers can make accurate predictions and gradually build a comprehensive understanding of social phenomena. However, ethical considerations and responsible data use should remain at the forefront of future research endeavors. With ongoing advancements in data science and the increasing availability of big social data, the study of social networks is poised to uncover new insights into human behavior and shape our understanding of society.

References

Gulati, R., M. Stych, and A. Tatarynowicz. "The dynamics of social structure: the emergence and decline of small worlds." *Organization Science Special Issue Conference on Dynamic networks*. 2009.

Simoni, Michele, Adam Tatarynowicz, and Gianluca Vagnani. "The complex dynamics of innovation diffusion and social structure: a simulation study." *Proceedings of WCSS* (2006): 21-25.

Tatarynowicz, Adam and Claassen, Utz. Novus ex Machina: Realise your organisation's creative potential with AI. (2023). Asian Management Insights, 10(3), 38-44.