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Editorial

Special Issue on Artificial Intelligence and Complex Systems

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The late Stephen Hawking referred to our current century as the 'century of complexity'. Today, due to the rapidly growing phenomenon of large datasets being published online and the development of methodologically rigorous tools, such as network analytics and mixed models, it has become possible to conduct deep studies into complex systems across the natural and social sciences. At the same time, the rise of artificial intelligence (AI) methods and architectures, such as deep neural networks and transformer-based language models, has allowed us to not only model and describe complex systems but also predict their evolution and prescribe appropriate interventions (e.g., recommending products via e-commerce customer networks or combating misinformation by exposing a user to the right information at the right time). Indeed, over the last several years alone, the progress in generative AI has been truly astounding, with entire applications, and even new scientific methodologies, now possible when, just five years ago, they could only have been speculated about.

This Special Issue, titled 'Artificial Intelligence and Complex Systems', was created with the goal of collecting the latest research, both foundational and application-orientated, at the intersection of AI and complex systems, ranging across real-world domains as varied as education and fraud detection. The issue contains five papers, all relevant to the core intersectional topic of AI and complex systems. Yu et al. [1] present a novel indoor 'pedestrian counting' approach that protects privacy and does not require as much information (such as the number of groups of people walking in the detection area) as previous methods. This is a pertinent real-world application that can be applied to the study of complex systems that rely on pedestrian counting. Chen et al. [2] consider a completely separate, and also important, domain in their work, namely, how the success of project crowdfunding can be predicted based on the text of online social welfare crowdfunding projects. In their work, they construct a dictionary of sentiments using the corpora of text from Chinese Internet social welfare crowdfunding projects, and their best model is able to achieve an R^2 of more than 97 percent. Zafari et al. [3] present an invaluable social application: the evaluation of high school student performance using machine learning methods. Their best model achieves an accuracy of 78 percent, suggesting that the real-world deployment of solutions for this key task may soon be on the horizon. Sun et al. [4] consider a pressing problem in mobile e-commerce: fraudulent transactions conducted by Internet bots, which, they argue, lower the fairness in markets and can result in financial crises. They consider methods of incorporating prior human knowledge and are significantly able to improve in major performance metrics such as accuracy and recall. The paper presents a novel and clearly important example of how AI can be applied to reduce harm in a complex system (i.e., e-commerce marketplaces, where both bots and humans conduct transactions).

To conclude the issue, Kejriwal [5] offers a perspective on how context will prove critical to building robust artificial general intelligence (AGI) architectures. In particular, I argue that context needs to become a focal point of the conceptual landscape, rather than a vague topic of discussion in AI papers. Context is a fundamentally novel type of information, and only through directly discussing and defining it can we understand its influence (and significance) in AI fields as diverse as representation learning and the

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Semantic Web. To this end, the paper systematically defines some features of a 'theory of context' that is argued to be general, as opposed to being too specific to any given field of AI. The discussion in the paper also suggests that context is fundamentally necessary to understand complex systems using AI methodologies. Such systems are increasingly being used to address problems ranging from 'social good' problems, such as human trafficking [6–8], crisis informatics [9–11], and illicit finance [12–14], to more commercial and industrial problems, such as healthcare and e-commerce [15–19].

The papers within this Special Issue have cumulatively accrued over 11,000 views as of September 2023 and continue to be cited with regularity. Although we are still in the early stages of fully understanding how AI and complex systems can intersect, especially within developing industries and the applications of the future [20], the diverse nature of these papers shows that the potential applications of this research are vast, and that our contributions are truly interdisciplinary. It is our hope that further, similar Special Issues will be created and will be open for submissions in the near future.

Conflicts of Interest: The author declares no conflict of interest.

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Short Biography of Author

Mayank Kejriwal is a research assistant professor and principal scientist at the University of Southern California. He does applied research at the intersection of Artificial Intelligence and complex systems. His work has been published in nearly a hundred peer-reviewed venues, and he is the author of four books, including an MIT Press textbook on knowledge graphs. His research has also received widespread press coverage, including from Popular Science, The BBC, The Guardian, and Big Think.