



181 Longwood Avenue
Boston, Massachusetts 02115-5804

Department of Medicine
Channing Division of Network Medicine

Channing Methods Seminar

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Changjun Fan

College of Systems Engineering
National University of Defense Technology
China

Finding key players in complex networks through deep reinforcement learning

Abstract: Finding an optimal set of nodes, called key players, whose activation (or removal) would maximally enhance (or degrade) certain network functionality, is a fundamental class of problems in network science. Potential applications include network immunization, epidemic control, drug design, and viral marketing. Due to their general NP-hard nature, those problems typically cannot be solved by exact algorithms with polynomial time complexity. Many approximate and heuristic strategies have been proposed to deal with specific application scenarios. Yet, we still lack a unified framework to efficiently solve this class of problems. Here we introduce a deep reinforcement learning framework FINDER, which can be trained purely on small synthetic networks generated by toy models and then applied to a wide spectrum of influencer finding problems. Extensive experiments. Yet, we still lack a unified framework to efficiently under various problem settings demonstrate that FINDER significantly outperforms existing methods in terms of solution quality. Moreover, it is several orders of magnitude faster than existing methods for large networks. The presented framework opens up a new direction of using deep learning techniques to understand the organizing principle of complex networks, which enables us to design more robust networks against both attacks and failures.

Ref: Fan C, Zeng L, Sun Y, Liu Y-Y. Finding key players in complex networks through deep reinforcement learning. *Nature Machine Intelligence* (In Press)

Bio: Changjun Fan is currently a Ph.D candidate in College of Systems Engineering, National University of Defense Technology (NUDT), China. He has been a visiting scholar at the Department of Computer Science, University of California, Los Angeles (UCLA), for two years. His main research interests include deep learning on graphs and network science. During his previous study, he has published a number of refereed journals and conference proceedings, such as *Nature Machine Intelligence*, *Physica A*, *ICLR*, *CIKM* and *ASONAM*. He also served as a reviewer for numerous journals and conferences, such as *Physica A*, *KDD'17*, '18, *WWW'18*, *ICDM'18*, *ICDE'19*, etc.

Hosted by Yang-Yu Liu