**网络社区发现简介**

复杂网络经过多年的发展，也取得了很多重要成果，其中包括平均路径长度(M. E. J. P. r. E. Newman, 2001)、聚集系数(Eggemann & Noble, 2011)、中心性指标(Freeman, Borgatti, & White, 1991; Sabidussi, 1966)、度分布(Yan, Leng, & Zhu, 2016)等网络统计量度量；小世界网络(Watts & Strogatz, 1998)、规则网络、随机网络、无标度网络(Barabási & Albert, 1999)等复杂网络模型；复杂网络上的同步性、鲁棒性和稳定性等网络性质；复杂网络的动力学；社团结构、层次结构、节点分类结构等复杂网络结构以及网络控制等(Ji & Jin, 2016)。由此可见，借助于网络来研究数据内容非常丰富，可以研究个体的性质，也可以通过网络链接来研究个体之间的联系。借助于网络的研究方法在社会各个领域都有广泛的应用，在引文网络(Ji & Jin, 2016)、基于网络的推荐系统(Ying et al., 2018)、流行病传播(Li & Muldowney, 1995)、交通网络(Hensher, 2007)、通讯网络(Gershman, Swaminathan, Meyers, & Fano, 2001)、计算机网络与互联网(Jacoby, 1998)、社交网络(Scott, 1988)等也有诸多成果。

在复杂网络分析中，网络社区发现是其中最重要的研究方向之一。社区是节点的集合，他们在该集合内部连接紧密，但与网络中其余节点连接比较稀疏(Boccaletti, Latora, Moreno, Chavez, & Hwang, 2006; Danon, Diaz-Guilera, Duch, Arenas, & Experiment, 2005; Fortunato, 2010)。网络社区发现的目的是识别此类节点群体，其有助于识别复杂网络中的重要社区。该方法可以应用于许多研究研究领域，例如物理学(Chen & Redner, 2010)，生物学(Girvan & Newman, 2002)，统计学(Ji & Jin, 2016)等。网络社区发现分为静态网络社区发现（CD）和动态网络社区发现（DCD）。静态网络社区发现方法根据网络是否为有向网络可分为两类。针对无向网络很多方法(Clauset, Newman, & Moore, 2004; Duan, Ke, & Wang, 2019; J. Jin, Ke, & Luo, 2017; J. J. T. A. o. S. Jin, 2015; Ke & Wang, 2017; Parés et al., 2017)。针对有向网络目前也有很多方法(Ji & Jin, 2016; Kim, Son, & Jeong, 2010; Leicht & Newman, 2008; M. E. Newman & Leicht, 2007; Ramasco & Mungan, 2008; Rosvall & Bergstrom, 2008)。

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