基本信息

姓名	孙亚辉
出生年月	1990年11月
微信	quick123456
邮箱	yahuisun@outlook.com
语言	普通话, 英语, C++, R, MATLAB
现在的职位	研究人员 (Research fellow), 计算学院 (School of Computing), 新加坡国立大学 (National University of Singapore)

教育与工作经历

2020- **研究人员 (Research fellow), 新加坡国立大学 (National University of Singapore, Singapore)**

2019-2020 **研究人员 (Research fellow), 新加坡南洋理工大学 (Nanyang Technological University, Singapore)**

2018-2019 **博士后 (Postdoctoral fellow), 澳大利亚国立大学 (Australian National University, Australia)**

2014-2018 **博士 (工程学院), 澳大利亚墨尔本大学 (University of Melbourne, Australia)**

论文题目: Classical, prize-collecting and node-weighted Steiner tree problems in graphs

2012-2014 **硕士 (航天工程), 哈尔滨工业大学，哈尔滨 (Harbin Institute of Technology, Harbin)**

2008-2012 **本科 (飞行器设计与工程), 哈尔滨工业大学，哈尔滨 (Harbin Institute of Technology, Harbin)**

研究方向

- 图挖掘 (graph mining) ⊂ 数据挖掘 (data mining) (知识图谱、社交网络、智慧城市等)
- 网络 (networking) (计算机网络、物联网、智慧城市等)

职业概述

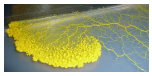
激励于2003年的神舟五号载人航天工程，我在哈尔滨工业大学攻读了飞行器设计与工程专业的本科学位，与航天工程专业的硕士学位。随后，我在澳大利亚墨尔本大学攻读了工程学院的博士学位，研究方向为图论中的Steiner tree优化问题。我现在的研究方向，也就是图计算与图挖掘，源自我博士期间的研究工作。

代表作

Yahui Sun, Jun Luo, Theodoros Lappas, Xiaokui Xiao, and Bin Cui. "Hunting multiple bumps in graphs", **Proceedings of the VLDB Endowment** (2020) (数据库与数据挖掘领域顶会/刊； CCF A类).
[**PDF**]

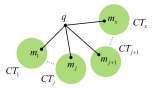
Bump hunting is an emerging graph mining approach. A single bump is hunted in an unweighted graph in the previous work. We extend the previous work by hunting multiple bumps in a weighted graph. We prove that our extended bump hunting problem can be transformed to a recently formulated Prize-Collecting Steiner Forest Problem (PCSFP). We further prove that PCSFP is NP-hard even in trees. Then, we propose a fast approximation algorithm for solving PCSFP in trees. Based on this algorithm, we improve the state-of-the-art approximation algorithm for solving PCSFP in graphs, and prove that the solutions of our improvement are always better than or equal to those of the state-of-the-art algorithm. We collect real datasets to conduct experiments, and show the dominance of our improvement over the state-of-the-art algorithm. Moreover, we explore two applications using real datasets: finding communities of researchers in a DBLP network with 1,094,552 vertices, 6,911,318 edges, and 82,492 keywords; and finding regions with high levels of activity in the Austin city network with 66,200 vertices and 92,707 edges.

Yahui Sun, Daniel Rehfeldt, Marcus Brazil, Doreen Thomas, and Saman Halgamuge. "A Physarum-inspired algorithm for minimum-cost relay node placement in wireless sensor networks", **IEEE/ACM Transactions on Networking** (2020) (计算机网络领域顶刊； CCF A类).
[**PDF**]



Relay node placement, which aims to connect pre-deployed sensor nodes to base stations, is essential in minimizing the costs of wireless sensor networks. In this paper, we formulate a new network optimization problem for minimum-cost relay node placement. By considering the heterogeneous production and placement costs of relay nodes, our formulation extends the previous work that considers the costs of relay nodes to be homogeneous. We conduct some theoretical analyses on the emerging Physarum-inspired algorithms to reveal their potential of computing shortest networks. Based on these analyses, we propose a new Physarum-inspired algorithm for solving the new network optimization problem. We conduct experiments to show that, in comparison to the state-of-the-art algorithms, our Physarum-inspired algorithm can design wireless sensor networks with significantly lower relay costs and similar qualities of service. This indicates the usefulness of our Physarum-inspired algorithm for minimum-cost relay node placement in budget-limited scenarios.

Yahui Sun, Marcus Brazil, Doreen Thomas, and Saman Halgamuge. "The Fast Heuristic Algorithms and Post-Processing Techniques to Design Large and Low-Cost Communication Networks", **IEEE/ACM Transactions on Networking** (2019) (计算机网络领域顶刊； CCF A类).
[**PDF**]



Solving the Prize-Collecting Steiner Tree Problem is useful in various areas, including computer networking, data mining, and signal processing. We propose two fast algorithms for solving the Prize-Collecting Steiner Tree Problem: the first one is a quasilinear-time heuristic algorithm that is faster and consumes less memory than the other algorithms; and the second one is an improvement of a state-of-the-art polynomial-time approximation algorithm that can produce near-optimal solutions at a speed that is only inferior to the first one (we improve the time complexity of the inside pruning algorithm from $O(n^2)$ to $O(n)$, without sacrificing the optimality of solutions). We demonstrate the competitiveness of our algorithms by comparing them with the state-of-the-art ones in large graphs with up to 1,000,000 vertices and 10,000,000 edges. We also propose some post-processing techniques to update the best-known solution for a notoriously difficult benchmark instance.

其他发表文章

Yahui Sun, and Saman Halgamuge. "Minimum-cost heterogeneous node placement in wireless sensor networks", IEEE Access (2019).
[**PDF**]

Yahui Sun, Chenkai Ma, and Saman Halgamuge. "The node-weighted Steiner tree approach to identify elements of cancer-related signaling pathways", International Conference on Bioinformatics (2017).
[**PDF**]

Yahui Sun, Pathima Nusrath Hameed, Karin Verspoor, and Saman Halgamuge. "A physarum-inspired prize-collecting Steiner tree approach to identify subnetworks for drug repositioning", International Conference on Bioinformatics (2016).
[**PDF**]

Yahui Sun, and Saman Halgamuge. "Fast algorithms inspired by physarum polycephalum for node weighted steiner tree problem with multiple terminals", In 2016 IEEE Congress on Evolutionary Computation, pp. 3254-3260. IEEE, (2016).
[**PDF**]

Yahui Sun, Yunhai Geng, and Shuang Wang. "Analysis and calibration of star sensor's image plane displacement", Infrared and Laser Engineering 10 (2014): 26.
[**PDF**]

Yahui Sun, Yingying Xiao, and Yunhai Geng. "On-orbit calibration of star sensor based on a new lens distortion model", In Proceedings of the 32nd Chinese Control Conference, pp. 4989-4994. IEEE, (2013).
[**PDF**]

所获奖项

2014-2018	Melbourne International Research Scholarship, University of Melbourne, Australia (墨尔本大学全奖)
2014-2018	Melbourne International Fee Remission Scholarship, University of Melbourne, Australia (墨尔本大学全奖)
2013	National Scholarship, China (中国国家奖学金)
2008-2014	First-level Scholarship (multiple), Harbin Institute of Technology, China (哈尔滨工业大学奖学金)

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