Basic information

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Languages	Mandarin, English, C++, R, MATLAB
Current position	Research fellow, School of Computer Science and Engineering, Nanyang Technological University

Education and positions

2019-	**Research fellow, Nanyang Technological University, Singapore**
2018-2019	**Postdoctoral fellow, Australian National University, Australia**
2014-2018	**Ph.D. in *Steiner tree problems in graphs*, University of Melbourne, Australia**
	Thesis title: Classical, prize-collecting and node-weighted Steiner tree problems in graphs
2012-2014	**M.S. in *aerospace engineering*, Harbin Institute of Technology, China**
2008-2012	**B.S. in *aerospace engineering*, Harbin Institute of Technology, China**

Research interests

- graph mining $\subset$ data mining (knowledge graphs, social networks, road networks, smart cities, etc.)
- networking (computer networks, Internet of things, smart cities, etc.)

Career profile

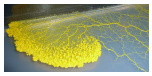
Motivated by China's first crewed space mission in 2003, I studied aerospace engineering for my bachelor and master degrees in the Harbin Institute of Technology. Then, I studied Steiner tree problems in graphs for my PhD degree in the University of Melbourne. My current research interests originated from my PhD study.

Selected publications

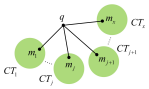
Yahui Sun, Jun Luo, Theodoros Lappas, Xiaokui Xiao, and Bin Cui. "Hunting multiple bumps in graphs", **Proceedings of the VLDB Endowment** (2020).
[**PDF**]

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 accepted).
[coming soon]



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).
[**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 (by improving 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.

The other publications

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**]

Scholarships and awards

2014-2018	Melbourne International Research Scholarship, University of Melbourne, Australia
2014-2018	Melbourne International Fee Remission Scholarship, University of Melbourne, Australia
2013	National Scholarship, China
2008-2014	First-level Scholarship (multiple), Harbin Institute of Technology, China

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