

Reyan Ahmed

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Research Area: Graph Algorithms, Network Visualization, Data Science

Education

2016-2021 Ph.D. in Computer Science (minor in Mathematics) – University of Arizona
Dissertation: Multi-level Graph Spanners
Advisers: Stephen Kobourov, David Glickenstein, Alon Efrat, John Kececioglu
2014-2016 M.Sc. in Computer Science – Bangladesh University of Engineering and Technology
Thesis: Online Algorithms for Facility Assignment Problem
Adviser: Md. Saidur Rahman
2008-2012 Bachelor's in Computer Science – Bangladesh University of Engineering and Technology

Research and Development Experience

July 2021- Visiting Faculty
Current Colgate University

Jan 2020- Graduate Research Associate
May 2021 University of Arizona

Aug 2016- Graduate Research Assistant
Dec 2019 University of Arizona

Summer 2018, Optimization Software Engineer Intern
Summer 2019 Hexagon Mining

Nov 2015 - Web Developer
Jan 2016 Bangladesh University of Engineering and Technology

Feb 2013 - Software Engineer
Mar 2015 Reve Systems, Bangladesh

Teaching Experience

Summer 2021, Instructor, University of Arizona
Summer 2020 Course: Analysis of Discrete Structures (CSc 345)

Summer 2017 Graduate Teaching Assistant
University of Arizona
Instructor: Elon Efrat; Course: Algorithms (CSc 445)

Recent Projects

- *Solving graph problems using GNN:* Neural networks have shown effectiveness in solving different problems related to natural language processing, computer vision, and other domains of artificial

intelligence. A traditional neural network is sequential and does not work well for multi-relational objects like graphs. With this in mind, a special kind of neural network called graph neural network (GNN) has been developed to handle graphs. GNNs have shown promising results for NP-complete problems. We are working on different models of GNNs to solve graph-related problems.

- *Network visualization using maps*: Maps are used in day to day life for visualizing geographic maps e.g. Google Maps. There is a relationship between networks and maps: any planar graph can be converted to a map and vice versa. However, even if the graph is not planar a similar idea can be applied. A network can capture multi-relational data and have a significant impact on data visualization. The goal of this project is to visualize large networks using maps that incorporate semantic zooming as other traditional maps. We are using this visualization currently on research networks.

Journal Publications

- Reyan Ahmed, Patrizio Angelini, Faryad Darabi Sahneh, Alon Efrat, David Glickenstein, Martin Gronemann, Niklas Heinsohn, Stephen G. Kobourov, Richard Spence, Joseph Watkins, and Alexander Wolff. **Multi-level Steiner trees**, *J. Exp. Algorithmics*, 2019.
- Reyan Ahmed, Md. Saidur Rahman, Stephen Kobourov, **Online facility assignment**, *Theoretical Computer Science*, 2019.

Conference Publications

- Reyan Ahmed, Greg Bodwin, Keaton Hamm, Stephen Kobourov, and Richard Spence. **On additive spanners in weighted graphs with local error**, *In Proceedings of the 47th International Workshop on Graph-Theoretic Concepts in Computer Science*, (also arXiv:2103.09731), 2021.
- Reyan Ahmed, Greg Bodwin, Keaton Hamm, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Multi-level Weighted Additive Spanners**, *In Proceedings of the 20th International Symposium on Experimental Algorithms*, (also arXiv:2102.05831), 2021.
- Reyan Ahmed, Felice De Luca, Sabin Devkota, Stephen Kobourov, and Mingwei Li. **Graph Drawing via Gradient Descent, (GD)²**, *In Proceedings of the 28th International Symposium on Graph Drawing and Network Visualization*, (also arXiv:2008.05584), 2020. (**best paper award**)
- Reyan Ahmed, Greg Bodwin, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Weighted Additive Spanners**, *In Proceedings of the 46th International Workshop on Graph-Theoretic Concepts in Computer Science*, (also arXiv:2002.07152), 2020.
- Reyan Ahmed, Keaton Hamm, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Kruskal-based approximation algorithm for the multi-level Steiner tree problem**, *In Proceedings of the 28th Annual European Symposium on Algorithms*, (also arXiv:2002.06421), 2020.
- Sabin Devkota, Reyan Ahmed, Felice De Luca, Kate Isaacs, Stephen Kobourov. **Stress-Plus-X (SPX) Graph Layout**, *In Proceedings of the 27th International Symposium on Graph Drawing and Network Visualization*, (also arXiv:1908.01769), 2019.
- Reyan Ahmed, Keaton Hamm, Mohammad Javad Latifi Jebelli, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Approximation algorithms and an integer program for multi-level graph spanners**, *In Proceedings of the 18th International Symposium on Experimental Algorithms* (also arXiv:1904.01135), 2019.
- Reyan Ahmed, Patrizio Angelini, Faryad Darabi Sahneh, Alon Efrat, David Glickenstein, Martin Gronemann, Niklas Heinsohn, Stephen G. Kobourov, Richard Spence, Joseph Watkins, and Alexander Wolff. **Multi-level Steiner trees**, *In Proceedings of the 17th International Symposium on Experimental Algorithms* (also arXiv:1804.02627), 2018.

- Reyan Ahmed, Md. Saidur Rahman and Stephen Kobourov, **Online Facility Assignment**, *In Proceedings of the 12th International Workshop on Algorithms and Computation*, 2018. (**best paper award**)
- Reyan Ahmed, Md. Mazharul Islam and Md. Saidur Rahman, **On acyclic colorings of graphs**. *In Proceedings of the 15th International Conference on Computer and Information Technology*, 2012.

Other Publications

- Kathryn Gray, Mingwei Li, Reyan Ahmed, Stephen Kobourov, **Visualizing Evolving Trees**, arXiv:2106.08843, 2021.
- Kathryn Gray, Mingwei Li, Reyan Ahmed, Md. Khaledur Rahman, Ariful Azad, Stephen Kobourov, Katy Börner, **Scalable Methods for Readable Tree Layouts**, Submitted to HICSS (available in <https://tiga1231.github.io/zmlt/demo/doc/paper.pdf>), 2021.
- Saad Al Muttakee, Reyan Ahmed, and Md. Saidur Rahman. **New Results and Bounds on Online Facility Assignment Problem**, arXiv:2009.01446, 2020.
- Reyan Ahmed, Greg Bodwin, Keaton Hamm, Mohammad Javad Latifi Jebelli, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Graph Spanners: A Tutorial Review**, *Computer Science Review*, 37, p.100253 (also arXiv:1909.03152), 2020.
- Reyan Ahmed, Keaton Hamm, Mohammad Javad Latifi Jebelli, Stephen Kobourov, Faryad Darabi Sahneh, and Richard Spence. **Multi-Level Graph Sketches via Single-Level Solvers**, arXiv:1905.00536, 2019.
- Reyan Ahmed, Felice De Luca, Sabin Devkota, Alon Efrat, Md Iqbal Hossain, Stephen Kobourov, Jixian Li, Sammi Abida Salma and Eric Welch, **L-Graphs and Monotone L-Graphs**, arXiv:1703.01544, 2017.

Presentations

- Conference presentation in the 20th International Symposium on Experimental Algorithms 2021 (virtual conference). Topic: Multi-level Weighted Additive Spanners.
- Conference presentation in the 28th International Symposium on Graph Drawing and Network Visualization 2020 (virtual conference). Topic: Graph Drawing via Gradient Descent, (GD)².
- Conference presentation in the 28th Annual European Symposium on Algorithms, 2020 (virtual conference). Topic: Kruskal-based approximation algorithm for the multi-level Steiner tree problem.
- Conference presentation in the 46th International Workshop on Graph-Theoretic Concepts in Computer Science, 2020 (virtual conference). Topic: Weighted additive spanners.
- Invited speaker in the SIAM student seminar, the department of mathematics, the University of Arizona, 2020 (virtual presentation). Topic: Multi-level Graph Spanners.
- Poster presentation in TRIPODS conference, 2019. Topic: Approximation algorithms and an integer program for multi-level graph spanners.
- Conference presentation in the 12th International Workshop on Algorithms and Computation, 2018. Topic: Online facility assignment.

Mentoring

- Ahmad Musa, Ph.D. Student, University of Arizona, 2018.
- Kathryn Gray, Ph.D. Student, University of Arizona, 2019.

Teaching Assistants

- Anh Nguyen Phung, undergraduate student, University of Arizona, Summer 2021.
- Hung Tran, undergraduate student, University of Arizona, Summer 2021.
- Hoang Nguyen Hung, Ph.D. Student, University of Arizona, Summer 2020.
- Ash Reed, undergraduate student, University of Arizona, Summer 2020.

Community Engagement

- Volunteer activities in Hack Arizona, 2019.
- Mentored students in TRIPODS Machine Learning Literacy Project, 2020.
- Peer-reviewed 12 conference/journal papers.
- Maintain web pages: gama.cs.arizona.edu, walcom-conference.org

Miscellaneous

- Won 3rd place in the Graph Drawing Competition at the 26th Symposium on Graph Drawing, 2018.
- Placed in 5th position in the Fake News Challenge (in a field of 50 international teams), 2017.

Scholarship and Other Awards

- CS Spring 2021 Graduate Scholarship (Research) Award, University of Arizona, 2021.
- Best paper award, Graph Drawing via Gradient Descent, (GD)², The 28th International Symposium on Graph Drawing and Network Visualization, 2020.
- Galileo Circle Scholarship, University of Arizona, 2020.
- Best paper award, Online Facility Assignment, The 12th International Workshop on Algorithms and Computation, 2018.
- Dean's list award, Bangladesh University of Engineering and Technology, 2012.
- Board Scholarship, Bangladesh University of Engineering and Technology, 2010.
- Gold medal, Secondary school certificate, Bangladesh International School, Jeddah, 2005.