Shaikh M. Arifuzzaman

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Research Interest

Big Data Analytics & Mining, High Performance Computing (HPC), Parallel Algorithms, Network (Graph) Mining, Large-scale Scientific Computation

Research Overview

My research revolves around large-scale data-intensive computing for interdisciplinary problems emerging from network science, biological science, and other data-rich scientific disciplines. I am particularly interested in mining and analyzing large network data (e.g., social/biological/information networks) by designing novel algorithmic and analytical techniques, often for HPC systems. In recent years, I have been working on designing efficient parallel algorithms for counting triangles in massive graphs, characterizing social networks based on local neighborhood, and designing algorithms for scalable community detection. At UNO, I am leading a research group on large-scale data analytics/mining and HPC.

Education

- **Virginia Polytechnic Institute and State University (Virginia Tech)** **Blacksburg, VA**
  Doctor of Philosophy (Ph.D.) in Computer Science *Graduation: Summer 2016*
  Dissertation Title: Parallel Mining and Analysis of Triangles and Communities in Big Networks
  Advisors: Dr. Madhav Marathe and Dr. Maleq Khan

- **Bangladesh University of Engineering and Technology (BUET)** **Dhaka, Bangladesh**
  Bachelor of Science in Computer Science and Engineering *Graduation: Spring 2009*

Employment

- **University of New Orleans** **New Orleans, LA**
  Assistant Professor, Computer Science Department *Fall 2016–Present*
  - Conducting research work on mining and analysis of large-scale social and biological graphs.
  - Teaching both core and advanced courses. Introduced a graduate course on large-scale network analytics.
  - Complementing the existing research efforts in the University by utilizing my expertise on big data analytics.
  - Mentoring both undergraduate and graduate level students. Serving various academic committees.

- **Virginia Polytechnic Institute and State University (Virginia Tech)** **Blacksburg, VA**
  Graduate Research Assistant, Network Dynamics and Simulation Science Lab *Fall 2011–Summer 2016*
  - Designed and developed scalable parallel algorithms for mining and analysis of large-scale graphs.
  - Member of the research and development team of CINET, an HPC-based web application for network analytics.
  - Worked on network representation and visualization, co-developed a web-based network visualization tool.

  Graduate Teaching Assistant, Department of Computer Science *Fall 2011– Spring 2012*
  - Courses Taught: Object Oriented Programming with C++, Computer Organization.

- **Sandia National Laboratories** **Livermore, CA**
  Summer Research Intern, Data Sciences and Cyber Analytics Department *Summer 2014*
  - Conducted an analysis on social and information networks based on common neighbors of pair of nodes.
  - Presented a characterization of networks in terms of modeling behavior and community formation.

- **Prime University** **Dhaka, Bangladesh**
  Ahsanullah University of Science and Technology **Dhaka, Bangladesh**
  Lecturer, Department of Computer Science *Summer 2009– Spring 2011*

– Courses Taught: Algorithms, Data Structures, Object Oriented Programming with C++, Design Patterns.
– Served various academic committee, designed course materials, and engaged in mentoring undergraduate students.

Research Grants

A. Awarded

- **Principal Investigator**, Scalable Community Detection in Big Information and Biological Networks Using Hidden Centrality Measures, Louisiana Board of Regents, RCS program, Duration: June 2017-June 2020. Amount: $\$134,757$.
- **Principal Investigator**, Scalable Mining and Analysis of Protein-Protein Interaction Networks, College of Sciences at the University of New Orleans Internal Grant Program, Duration: Spring 2017. Amount: $\$10,000$.

B. Pending

- **Co-Principal Investigator**, High-resolution Human Connectome Network Analysis (PI: Dr. Elliot Beaton), University of New Orleans Internal Grant Program, Interdisciplinary Research Program, Duration: June 2017-June 2018. Amount: $\$40,013$.

Awards & Honors

- **Pratt Fellowship** (Awarded to extraordinary PhD entrants by Dept. of Computer Science, Virginia Tech).
- **Dean's List Scholarship** and **University Merit Scholarship** (Awarded for top undergraduate performance).
- **Education Board Scholarship** (Awarded for excellence in all major public examinations in Bangladesh).
- **Travel Grant Award** (Awarded to attend HPCC 2015 conference by Computer Science Graduate Council, VT).

Technical Skills

Big data techniques, algorithms, and high performance scalable computing
Parallel computing libraries/systems: MPI, OpenMP, OpenMPI, Hadoop, Giraph, CUDA
Programming languages: C, C++, Python, Perl, Java, Prolog, C#, SQL, PL/SQL, HTML
Application software & tools: MatLab, R, SAS JMP, MS Excel, Mathematica, Oracle, OpenGL, Gephi

- More than 13 years of programming experience in C/C++ and Java.
- 7 years of experience in developing MPI based algorithms for distributed memory parallel systems.
- Solid understanding of MapReduce (Apache Hadoop, Amazon EMR), shared memory, and GPU based systems.
- 10 years of experience in statistical data analysis and relevant tools and software.

Select Publications

- **Shaikh Arifuzzaman**. Parallel Mining and Analysis of Triangles and Communities in Big Networks. *PhD dissertation, Dept. of Computer Science, Virginia Tech*, August 2016.
- Maksudul Alam, **Shaikh Arifuzzaman**, Hasanuzzaman Bhuiyan, Maleq Khan, VS Anil Kumar, and Madhav Marathe. Book chapter: Distributed Memory Parallel Algorithms for Massive Graphs, *Parallel Graph Algorithms*. Ed. David Bader, Chapman & Hall/ CRC Computational Science, 2015.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. Fast Parallel Aglroithms for Counting Triangles in Big Graphs. *ACM Transactions on Knowledge Discovery from Data (TKDD)*, under review, 2016.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. PATRIC: A Parallel Algorithm for Counting Triangles in Massive Networks. In proc. of *the 22nd ACM International Conference on Information and Knowledge Management (CIKM)*, pages 529–538, 2013.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. A Space-efficient Parallel Algorithm for Counting Exact Triangles in Massive Networks. In proc. of *the 17th IEEE International Conference on High Performance Computing and Communications (HPCC)*, pages 527–534, 2015.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. A Fast Parallel Algorithm for Counting Triangles in Graphs using Dynamic Load Balancing. In proc. of *2015 IEEE International Conference on Big Data (BigData)*, pages 1839–1847, 2015.

- **Shaikh Arifuzzaman** and Maleq Khan. A Fast Parallel Conversion of Edge List to Adjacency List for Large-scale Graphs. In proc. of *the 23rd High Performance Computing Symposium (HPC)*, pages 17–24, 2015.
- Sherif Abdelhamid, Maksudul Alam, Richardo Alo, **Shaikh Arifuzzaman**, Peter Beckman, et al. CINET 2.0: A Cyber-Infrastructure for Network Science. In proc. of *the 10th IEEE International Conference on eScience (eScience)*, pages 324–331, 2014.
- Sherif Abdelhamid, Richardo Alo, **Shaikh Arifuzzaman**, Peter Beckman, et al. CINET: A Cyber-Infrastructure for Network Science. In proc. of *the 8th IEEE International Conference on eScience (eScience)*, pages 1–8, 2012.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. Extended Abstract: Parallel Algorithms for Counting Triangles and Computing Clustering Coefficients. In *2012 SC Companion: High Performance Computing, Networking Storage and Analysis (SC12)*, pages 1448–1449, 2012.
- **Shaikh Arifuzzaman**, Maleq Khan, and Madhav Marathe. Poster: Parallel Algorithms for Counting Triangles and Computing Clustering Coefficients. In *2012 SC Companion: High Performance Computing, Networking Storage and Analysis (SC12)*, page 1450, 2012.

Select Research Projects

- **High Performance Graph Algorithm Library (GALib)**
  - Designed and developed efficient sequential algorithms for big graph analytics with *C++* and *Python*.
  - Designed and developed *Message Passing Interface (MPI)* based parallel algorithms for mining massive networks.
  - *Published a book chapter and 4 conference papers. Another 2 articles are in preparation.*
- **Cyber-Infrastructure for Network Science (CINET)**
  - Developed a web-based network visualization tool– implemented network layout algorithms with *Java*.
  - Designed and implemented efficient graph algorithms and CINET meta-algorithms (e.g., network conversion).
  - *Published 2 conference papers. Another article is in preparation.*
- **Scalable Community Detection for Network Big Data**
  - Funded by Louisiana Board of Regents, the project intends to develop new computational tools for scalable community detection in information and biological networks.
  - *A couple of articles are in preparation.*

Courses Taught

- University of New Orleans, USA
  - **Spring 2017:** CSCI 3301 Computer Organization, CSCI 6990 Mining and Analyzing Large Neworks
  - **Fall 2016:** CSCI 1205 Object Oriented Programming with C++
- Virginia Tech, USA
  - **Spring 2012:** Computer Organization II
  - **Fall 2011:** Object Oriented Programming with C++
- PU & AUST, Bangladesh
  - **Summer 2009-Spring 2011:** Design and Analysis of Algorithms, Data Structures, Object Oriented Programming with C++, Design Patterns, Compiler Design, Database, Computer Interfacing

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Students Supervision

- Sanjiv Pradhanag, Spring 2017, College of Sciences Undergraduate Research Program (COSURP) student
- Bikesh Pandey, Spring 2017-Summer 2017, Undergraduate research assistant
- Prakash Joshi, Summer 2017-onward, Undergraduate research student
- Hired two Ph.D. students (graduate research assistant) to start from Fall 2017

Professional Talks/Demonstration

- Parallel Mining and Analysis for Large-scale Network (Graph) Data.
  Invited talk, Pi Talk Series, American Mathematical Society UNO Chapter, March 2017.
- Parallel Mining of Triangles, Triads, and Communities in Big Networks (Graphs) and Related Analytics.
  Invited talk, Department of Computer Science, University of New Orleans, April 2016.
- How Many Friends Does It Take to Make New Friends?
  Summer research talk, Sandia National Laboratories, Summer 2014.
- A Fast Parallel Conversion of Edge List to Adjacency List for Large-scale Graphs.
  Conference talk, High Performance Computing Symposium, April 2015.
- A Space-efficient Parallel Algorithm for Counting Exact Triangles in Massive Networks.
  Conference talk, High Performance Computing and Communication, August 2015.
- A Fast Parallel Conversion of Edge List to Adjacency List for Large-scale Graphs.
  Invited student talk, Virginia Tech NDSSL Seminar Series, Spring 2015.
- On the CINET Granite System: A Cyber-Infrasturcture for Network Science.
  Panel talk, Virginia Tech NDSSL Seminar Series, Spring 2015.
- Parallel Algorithms for Counting Triangles in Networks with Large Degrees.
  Invited student talk, Virginia Tech NDSSL Seminar Series, Spring 2014.
- Parallel Algorithms for Counting Triangles and Computing Clustering Coefficients
  Technical poster demonstration, HPC Day at Virginia Tech, 2014.
- Parallel Algorithms for Analysis of Massive Newotks.
  Invited student talk, Virginia Tech NDSSL Seminar Series, Fall 2012.
- Parallel Algorithms for Counting Triangles and Computing Clustering Coefficients
  Technical poster demonstration, Supercomputing conference (SC12), 2012.
- Interaction Principles of Information Visualization.
  Guest student lecture, Computer Science 5764: Information Visualization, Virginia Tech, Fall 2011.
- Zero is not nothing. (On the significance of zero in sciences.)
  Invited faculty talk, Teachers for Tomorrow Workshop, Prime University, Bangladesh, 2010.

Professional Training/Meeting Attended

- IEEE International Parallel and Distributed Computing Symposium *(IPDPS)*, FL, USA, 2017.
- IEEE International Conference on High Performance Computing and Communications *(HPCC),* NY, USA, 2015.
- High Performance Computing Symposium *(HPC),* VA, USA, 2015.
- IEEE/ACM International Conference on High Performance Computing, Networking, Storage and Analysis *(SC),* Utah, USA, 2012.
- High Performance Computing Day *(HPC@VT),* VA, USA, 2014.
- Virginia Tech Graduate Teaching Assistant Workshop (a multi-session workshop on teaching methodologies and effective communication), VA, USA, 2011.
- Teachers for Tomorrow Workshop (an intensive multi-day hands-on training program for junior-level faculty in a classroom setting), Prime University, Bangladesh, 2010.

Professional Services

- Professional Member, Association for Computing Machinery (ACM), 2017- onward.
- Member of the organizing committee of CINET Workshop 2015 held in Virginia Tech, Blacksburg, VA. The workshop offered technical sessions and tutorials on large-scale network mining and analysis.
- Reviewed articles for IEEE INFOCOM, WWW, ACM/IEEE NSysS conferences.
- Departmental committees served at UNO: Graduate grade appeal committee, undergraduate grade appeal commitee.
- Served MS oral exam committee: Ashwathreddy Ranjol, Anusha Kondam (University of New Orleans).
- Secretary, Computer Science Graduate Council, Virginia Tech, 2014-15.
- Student member, Society for Industrial and Applied Mathematics (SIAM), 2013-2016.
- Student member, Institute of Electrical and Electronics Engineers (IEEE), 2013-2015.

In News/Web Stories

- **Arifuzzaman Brings Skill, Passion for Big Data to Teaching and Research at UNO,** Featured faculty story on my research and teaching, http://www.uno.edu/campus-news/2017/Arifuzzaman_Brings_Skill_Passion_for_Big_Data_to_Teaching_and_Research_at_UNO.aspx.
- **Featured NDSSL@VT alumni,** https://www.bi.vt.edu/ndssl/careers/alumni

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