# MD ABDUL MOTALEB FAYSAL

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## RESEARCH INTEREST

Parallel and Distributed Computing, Machine Architecture, Techniques for HPC Performance Modeling and Simulation, Graph Algorithms, Community Discovery, Scalable Algorithm Design, Big Data Mining

## EDUCATION

**University of Nevada, Las Vegas (UNLV), NV** *Fall 2022 - Present*
Ph.D. Candidate in Computer Science
**Defended Doctoral Thesis** (November 13, 2023)
Expected Graduation: **Fall 2023**

**University of New Orleans (UNO), LA** *Fall 2017 - Summer 2022*
Ph.D. Student in Computer Science
Transferred to UNLV (Fall' 22)

**University of New Orleans (UNO), LA** *Spring 2020*
M.S. in Computer Science
**Thesis:** Accelerating the Information-Theoretic Approach of Community Detection Using Distributed and Hybrid Memory Parallel Schemes

**Bangladesh University of Engineering and Technology (BUET), Bangladesh** *July 2014*
B.Sc. in Computer Science and Engineering
**Thesis:** Content-Based Image Retrieval using Relevance Feedback

## WORK EXPERIENCE

**Graduate Research Assistant, UNLV** *Fall 2022 - Present*
Data-intensive Scalable Computing Group

- Designing parallel algorithm for k-triangle induced local community discovery delivering up to 55× speedup than sequential approach
- Designing scalable algorithms for memory-bound applications capable of processing billion-size sparse network datasets

**Graduate Summer Intern/Affiliate, Berkeley Lab (LBNL)** *Summer '20, '21, '22, '23*

- Fast community detection in graphs with Infomap method using Accelerated Sparse Accumulation delivering 5.6× performance
- Improved 5× speedup of a billion-size graph clustering application
- Validation of performance portability of Kokkos framework in CPU/GPU
- Identified performance bottleneck of the SpGEMM approach
- Performance modeling of compute kernels in HPC platforms
- Software-hardware co-design in heterogeneous architecture

**Graduate Research Assistant, UNO** *Fall 2017 - Spring 2022*
Big Data and Scalable Computing Group

- Distributed-memory parallel community detection using an information-theoretic approach delivering up to 5× speedup
- Comparing network visualization tools and analytics

**Software Engineer** *August 2014 - July 2017*
ReliSource, Bangladesh
**Role:**

- Developed and maintained software solutions for health care management.
- Solved critical software issues hindering throughput in production line
- Developed IoT-based software solution for cold chain management.

## TEACHING, MENTORING

**Guest Lecture, UNLV** *Fall '23, Spring '23, Fall '22*

- Guest lectures on undergraduate course CS302 (Data Structure)
- Guest lecture on graduate course CS789 (Graph Data Mining)
- Conducting quiz and grading programming assignment

**Course Instructor, UNO** *Spring '22, Fall '20, Spring '20*
**Courses taught:**

- Introduction to Programming in C++
- Machine Structure and Assembly Language Programming
- Introduction to Computers

**Teaching Assistant, UNO**

- Course : Machine Structure and Assembly Language Programming

**Mentoring at UNLV and UNO**

- Mentored a UNLV undergrad CS student during summer internship '23 at Berkeley Lab
- Mentored 2 undergrad students in UNO on graph algorithms research

## PUBLICATIONS

- **Md Abdul Motaleb Faysal**, Maximilian Bremer, Cy Chan, John Shalf, and Shaikh Arifuzzaman, "Fast Parallel Index Construction for Efficient K-truss-based Local Community Detection in Large Graphs", International Conference on Parallel Processing (ICPP), 2023
- **Md Abdul Motaleb Faysal**, Maximilian Bremer, Shaikh Arifuzzaman, Doru Popovici, John Shalf and Cy Chan, "Fast Community Detection in Graphs with Infomap Method using Accelerated Sparse Accumulation", Accelerators and Hybrid Emerging Systems (AsHES) in IEEE International Symposium on Parallel and Distributed Processing Workshops (IPDPSW), 2023
- **Md Abdul Motaleb Faysal**, Shaikh Arifuzzaman, Cy Chan, Maximilian Bremer, Doru Popovici and John Shalf, "HyPC-Map: A Hybrid Parallel Community Detection Algorithm Using Information-Theoretic Approach", IEEE High Performance Extreme Computing (HPEC), 2021
- **Md Abdul Motaleb Faysal** and Shaikh Arifuzzaman, "Distributed Community Detection in Large Networks using An Information-Theoretic Approach", In proc. of 2019 IEEE International Conference on BigData (BigData 2019), pages 4773–4782, IEEE, December 2019
- **Md Abdul Motaleb Faysal** and Shaikh Arifuzzaman,"Fast Stochastic Block Partitioning using a Single Commodity Machine", In proc. of 2019 IEEE International Conference on BigData (BigData 2019), pages 3632–3639, IEEE, December 2019
- **Md Abdul Motaleb Faysal** and Shaikh Arifuzzaman, "A Comparative Analysis of Large-scale Network Visualization Tools", In Proceeding of 2018 IEEE International Conference on BigData (BigData 2018), pages 4837–4843, Seattle, WA, USA, IEEE, Dec 2018

- Shaikh Arifuzzaman, Naw Safrin Sattar, **Md Abdul Motaleb Faysal**, "Parallel Algorithms for Mining Large-scale Time-varying (Dynamic) Graphs" Nov 2018, In PDSW-DISCS Workshop in SC'18, Dallas, TX, USA, Nov 2018
- Naw Safrin Sattar, **Md A. M. Faysal**, Minhaz Zibran, Shaikh Arifuzzaman, Md Rakibul Islam, "Data Mining in-IDE Activities: Why Software Developers Fail", ISCA 27th International Conference on Software Engineering and Data Engineering, SEDE 2018

## TECHNICAL SKILLS

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|---|---|
| **Language** | C, C++, Java, C#, LaTeX, Assembly, Python, PHP, Prolog |
| **HPC Frameworks** | MPI, OpenMP, CUDA, TAU, Metis, ZSim, Hadoop |
| **Other Frameworks** | Ant, JavaFX, JUnit, OpenGL, .NET |
| **RDBMS** | MySQL, MSSQL, Oracle |
| **Version Control** | Git, SVN, TFS |
| **Others** | Intel Pin, Vtune, Valgrind, Amazon AWS, Matlab, Weka |

## RELEVANT GRADUATE COURSES

Applied Combinatorics & Graph Theory, Parallel & Sci Computing, Concurrent Programming, Cloud Computing, Machine Learning, Advanced Machine Learning, Big Data Analytics and Systems, Categorical Data Analysis, Network Penetration, Agile Software Engineering

## AWARDS, GRANTS, HONORS

- Received travel award for International Conference on Parallel Processing (ICPP), 2023
- Research poster accepted in the Ph.D. forum in the International Parallel and Distributed Processing Symposium (IPDPS), 2023
- Research proposal accepted and grant awarded for Summer Research Program under Sustainable Horizon Pathways (SRP) program, 2023
- Contributed to research proposal for National Science Foundation (NSF) award (grant#2323533) to work on algorithms for dynamic graph
- Student Volunteer SC'21, and SC'20
- Secretary, Bangladesh Student Association (BSA), UNO, 2021-22

## PROJECT HIGHLIGHTS

**HyPC-Map: A Hybrid Memory Parallel Infomap**

- Uses a random process to discover the communities by using a graph's regularity of information from an information-theoretic formulation.
- Ensures the scalability up to 1280 processing cores while maintaining the accuracy of the sequential approach
- Combines hybrid memory parallelism (MPI + OpenMP) to achieve 25× speedup

**Fast Hash Accumulation: Accelerator Aided Community Discovery**

- Hash accumulation is a major computation in community detection (Infomap, HipMCL, etc.)
- Accelerator aids faster hash accumulation for insertion and search
- Reduces branch misprediction and number of instructions in software hash
- Reduces performance gap in roofline modeling for hash-based graph kernels

**Parallel EquiTruss: A k-truss-based Parallel Index Construction for Local Community Search**

- The formulation breaks down the original graph into k-truss-based indexes
- The indexes are connected through k-triangle connectivity to build supergraph with supernodes and superedges.
- Parallel EquiTruss uses Shiloach-Vishkin and Afforest Connected Components (CC) kernels to construct indexes in parallel