

## Maksudul Alam

2609 Oleander Way, Apt 121, Knoxville, TN 37931

☎ (540) 505-2675 ✉ [alam@ornl.gov](mailto:alam@ornl.gov) 🌐 [maksudsite.appspot.com](https://maksudsite.appspot.com) (Google Scholar)

### EDUCATION

**Ph.D.**, in *Computer Science* October 2016

**Virginia Polytechnic Institute and State University**, Blacksburg, Virginia.

**Dissertation:** *HPC-based Parallel Algorithms for Generating Random Networks and Some Other Network Analysis Problems*

**Supervisors:** [Madhav Marathe](#) and [Maleq Khan](#)

**B.Sc.**, in *Computer Science and Engineering* 2003 – 2007

**Bangladesh University of Engineering and Technology**, Dhaka, Bangladesh.

### RESEARCH INTERESTS

Parallel Algorithms, HPC, GPGPU, Distributed Systems, Deep Learning & Artificial Intelligence, Network Science

### PROFESSIONAL EXPERIENCE

**Postdoctoral Research Associate**, [Oak Ridge National Laboratory](#) December 2016 – Present

- Developed **DeepEx**, a scalable and efficient deep learning tool for large scientific data using modern supercomputer
  - Scales up to 15,000 GPUs in the Summit supercomputer with good strong scaling
  - Exhibits promising converges up to thousands of GPUs for scientific data from material science and biology
- Designed and developed GPU-based algorithms for random network generation and community detection
  - Generated 16 billion edges in just 7 seconds (preferential attachment model) using 4 GPUs
  - Working on a GPU-based community detection algorithm using bipartite Louvain model
- Developed GPU-based algorithms for image registration
  - Developed a novel algorithm to determine the position of a small image inside of a larger image
  - Handles rotations better than the well known algorithms based on normalized mutual information

**Research Intern**, [Oak Ridge National Laboratory](#) Summer, 2015 | Summer, 2016

- Designed and developed **GRT**, a GPU-based efficient index searching algorithm for in-memory databases
  - Lookup throughput of 130 millions key/second for 64M 64B keys in GPU
- Designed and developed a GPU-based epidemic simulator using scalable simulation cloning framework
  - Able to simulate numerous what-if scenarios of epidemic spread in a spatial domain using simulation cloning
  - Able to run up to 350K spatial epidemic simulation clones scalable up to 8K GPUs in Titan supercomputer

**Graduate Research Assistant**, [NDSSL](#), Biocomplexity Institute of Virginia Tech August 2011 – October 2016

- Designed and developed MPI-based parallel algorithms for generating massive scale random networks
- Worked on ENteric Immune Simulator (ENISI), a distributed-memory parallel simulator for enteric diseases
- Working on Spark-based parallel algorithms for network science problems
- Developed web-based network visualization tools

**Senior Member**, R&D, Commlink Info Tech, Dhaka, Bangladesh 2009 – 2011

**Member**, R&D, Commlink Info Tech, Dhaka, Bangladesh 2007 – 2009

- Worked on hardware and software systems including: *WiMAX base station, Bangladesh Automated Cheque Processing System, Mobile Banking Solutions, and Bangladesh Electronic Funds Transfer Network*

### SKILLS

**Programming:** C/C++, Java, C#, Python, JavaScript, Scala

**Parallel Systems:** MPI, CUDA, OpenMP, Map-Reduce, Apache Spark with GraphX

**Frameworks:** Microsoft .NET, J2EE, Django, Google App Engine, GWT

**Miscellaneous:** MATLAB, R, OpenGL, Gephi, VisIt, Web-based graph visualization tools

- 15+ years of programming experience in C/C++ and Java
- 7+ years of experience of MPI-based parallel systems
- 4+ years of GPU programming with CUDA
- 3 years of experience in enterprise software development (C#, JavaScript, Python, ASP.NET, J2EE, GWT)

- Solid knowledge of CUDA and GPU based programming
- Solid understanding of OpenMP, Map-Reduce (Apache Hadoop, Amazon EMR)
- Solid foundation of Deep and Machine Learning fundamentals

## SELECTED RESEARCH PROJECTS

### GPU Based Scalable Deep Learning Framework for Scientific Computing 2017 – Present

- Developed DeepEx, a scalable convolutional neural network on the GPU
- Uses **CUDNN**, **MPI**, and **NCCL** for high performance and scalability through thousands of GPUs
- Implemented image classification, variational auto-encoder with superior results compared to TensorFlow
- Working on large scientific datasets including electron microscope images, protein structures, and image net
- (*Papers to appear that summarize the findings.*)

### GPU Based Algorithms 2015 – Present

- Designed and developed GRT (GPU Radix Tree), a *radix tree*-based index searching algorithm for GPU
- Developed GPU based algorithm for simulation cloning called **CloneX**
- Designed and developed cuPPA, a random network generator on the GPU
- Developing GPU based algorithms for image analytics
- (*Published two conference papers and two technical reports. Another journal to appear.*)

### Massive Random Networks Generators 2012 – Present

- Designed and developed MPI-based parallel algorithms for generating massive random networks using various models including *preferential attachment*, *Chung-Lu*, *small-world*, *stochastic block*, and *block two-level Erdős-Rényi*
- Capable of generating massive networks with hundreds of billion of edges in few minutes
- Developed parallel load balancing and partitioning techniques for these algorithms
- (*Published a book chapter, a journal paper, and three conference papers. Submitted another journal.*)

### ENteric Immunity Simulator (ENISI) 2011 – Present

- Developed ENteric Immunity Simulator (ENISI), an MPI based large scale parallel discrete event simulator of enteric immune systems with  $O(10^7)$  individual cells
- Worked on modeling, optimization, sensitivity analysis, parameter estimation, and visualization
- (*Published a book chapter, three journal papers, and a conference paper.*)

### CINET – Visualization and Graph Algorithms 2013 – 2014

- Developed CINETViz, a visualization tool integrated with **CINET**, a HPC-based network analysis and mining tool, using *Gephi*, *SigmaJS*, and *Apache Tomcat* web server
- Capable of visualizing graphs with  $O(10^4)$  nodes and edges in the web browser
- Developed graph algorithms such as network generators for CINET
- (*Published a conference paper.*)

### Haplotype Reconstruction 2007– 2008

- Designed and developed individual haplotyping algorithms called HMEC
- Reduced the runtime complexity by an order of magnitude
- Very fast haplotype reconstruction with comparable accuracy with the existing tools
- (*Published a journal and two conference papers.*)

## PUBLICATIONS

### Book Chapters

1. **Maksudul Alam**, Vida Abedi, Josep Bassaganya-Riera, Katherine Wendelsdorf, Keith Bisset, Xinwei Deng, Stephen Eubank, Raquel Hontecillas, Stefan Hoops, and Madhav Marathe. “**Computational Immunology: Models and Tools.**” In: Elsevier, 2015. Chap. Agent-Based Modeling and High Performance Computing. DOI: [10.1016/B978-0-12-803697-6.00006-0](https://doi.org/10.1016/B978-0-12-803697-6.00006-0)
2. **Maksudul Alam**, Shaikh Arifuzzaman, Hasanuzzaman Bhuiyan, Maleq Khan, Anil Vullikanti, and Madhav Marathe. “Parallel Graph Algorithms.” In: (*Forthcoming*). CRC Press/Taylor & Francis, 2019. Chap. Distributed Memory Parallel Algorithms for Massive Graphs

## Journals

1. **Maksudul Alam**, Kalyan S. Perumalla, and Peter Sanders. “Novel Parallel Algorithms for Fast Multi-GPU-based Generation of Massive Scale-free Networks.” In: *Data Science and Engineering* (2019). (To Appear)
2. **Maksudul Alam** and Maleq Khan. “Parallel Algorithms for Generating Random Networks with Given Degree Sequences.” In: *International Journal of Parallel Programming* 45.1 (2017), pp. 109–127. DOI: [10.1007/s10766-015-0389-y](https://doi.org/10.1007/s10766-015-0389-y)
3. **Maksudul Alam**, Xinwei Deng, Casandra Philipson, Josep Bassaganya-Riera, Keith Bisset, Adria Carbo, Stephen Eubank, Raquel Hontecillas, Stefan Hoops, Yongguo Mei, Vida Abedi, and Madhav Marathe. “Sensitivity Analysis of an ENteric Immunity Simulator (ENISI)-based Model of Immune Responses to *Helicobacter pylori* Infection.” In: *PLoS ONE* (2015). DOI: [10.1371/journal.pone.0136139](https://doi.org/10.1371/journal.pone.0136139)
4. Adria Carbo, Josep Bassaganya-Riera, Mireia Pedragosa, Monica Viladomiu, Madhav Marathe, Stephen Eubank, Katherine Wendelsdorf, Keith Bisset, Stefan Hoops, Xinwei Deng, **Maksudul Alam**, Barbara Kronsteiner, Yongguo Mei, and Raquel Hontecillas. “Predictive Computational Modeling of the Mucosal Immune Responses during *Helicobacter pylori* Infection.” In: *PLoS ONE* (2013). DOI: [10.1371/journal.pone.0073365](https://doi.org/10.1371/journal.pone.0073365)
5. Md. Shamsuzzoha Bayzid, **Maksudul Alam**, Abdullah Mueen, and Md. Saidur Rahman. “HMEC: A Heuristic Algorithm for Individual Haplotyping with Minimum Error Correction.” In: *ISRN Bioinformatics* (2013). DOI: [10.1155/2013/291741](https://doi.org/10.1155/2013/291741)
6. Katherine Wendelsdorf, **Maksudul Alam**, Josep Bassaganya-Riera, Keith Bisset, Stephen Eubank, Raquel Hontecillas, Stefan Hoops, and Madhav Marathe. “ENteric Immunity Simulator: A Tool for In Silico Study of Gastroenteric Infections.” In: *IEEE Transactions on NanoBioscience* (2012). DOI: [10.1109/tnb.2012.2211891](https://doi.org/10.1109/tnb.2012.2211891)

## Conference Proceedings

1. Srikanth B. Yoginath, **Maksudul Alam**, Arvind Ramanathan, Nouamane Laanait, and Kalyan S. Perumalla. “Towards Native Execution of Deep Learning on a Leadership-Class HPC System.” In: *Scalable Deep Learning over Parallel and Distributed Infrastructures*. (To Appear). 2019
2. **Maksudul Alam** and Kalyan S. Perumalla. “GPU-based parallel algorithm for generating massive scale-free networks using the preferential attachment model.” In: *IEEE International Conference on Big Data (Big Data)*. 2017, pp. 3302–3311. DOI: [10.1109/BigData.2017.8258315](https://doi.org/10.1109/BigData.2017.8258315)
3. **Maksudul Alam**, Srikanth B. Yoginath, and Kalyan S. Perumalla. “Performance of Point and Range Queries for In-memory Databases using Radix Trees on GPUs.” In: *IEEE International Conference on Data Science and Systems*. IEEE. 2016. DOI: [10.1109/hpcc-smartcity-dss.2016.0212](https://doi.org/10.1109/hpcc-smartcity-dss.2016.0212)
4. **Maksudul Alam**, Maleq Khan, Anil Vullikanti, and Madhav Marathe. “An Efficient and Scalable Algorithmic Method for Generating Large-Scale Random Graphs.” In: *Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis (SC)*. **Best Paper Finalist**. 2016. DOI: [10.1109/sc.2016.31](https://doi.org/10.1109/sc.2016.31)
5. **Maksudul Alam** and Maleq Khan. “Parallel Algorithms for Generating Massive Random Networks with Given Expected Degree Sequences.” In: *The 12th Annual IFIP International Conference on Network and Parallel Computing*. 2015
6. Sherif Abdelhamid, **Maksudul Alam**, Richard Alo, Shaikh Arifuzzaman, Pete Beckman, Tirtha Bhattacharjee, Hasanuzzaman Bhuiyan, Keith Bisset, Stephen Eubank, Albert Esterline, Edward Fox, Geoffrey Fox, S M Hasan, Harshal Hayatnagarkar, Maleq Khan, Chris Kuhlman, Madhav Marathe, Natarajan Meghanathan, Henning Mortveit, Judy Qiu, S S Ravi, Zalia Shams, Ongard Sirisaengtaksin, Samarth Swarup, Anil Vullikanti, and Tak-Lon Wu. “CINET 2.0: A CyberInfrastructure for NETWORK Science.” In: *The 10th IEEE International Conference on e-Science*. 2014. DOI: [10.1109/escience.2014.21](https://doi.org/10.1109/escience.2014.21)
7. **Maksudul Alam**, Maleq Khan, and Madhav Marathe. “Distributed-memory Parallel Algorithms for Generating Massive Scale-free Networks Using Preferential Attachment Model.” In: *Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis (SC)*. 2013. DOI: [10.1145/2503210.2503291](https://doi.org/10.1145/2503210.2503291)

8. Keith Bisset, **Maksudul Alam**, Josep Bassaganya-Riera, Adria Carbo, Stephen Eubank, Raquel Hontecillas, Stefan Hoops, Yongguo Mei, Katherine Wendelsdorf, Dawen Xie, Jae-Seung Yeom, and Madhav Marathe. "High-Performance Interaction-Based Simulation of Gut Immunopathologies with ENteric Immunity Simulator (ENISI)." in: *IEEE 26th International Parallel Distributed Processing Symposium (IPDPS)*. 2012. DOI: [10.1109/ipdps.2012.15](https://doi.org/10.1109/ipdps.2012.15)
9. Md. Shamsuzzoha Bayzid, **Maksudul Alam**, and Md. Saidur Rahman. "A Heuristic Algorithm for Minimum Conflict Individual Haplotyping." In: *International Conference on BioMedical Engineering and Informatics*. 2010. DOI: [10.1109/bmei.2010.5639284](https://doi.org/10.1109/bmei.2010.5639284)
10. Abdullah Al Mueen, Md. Shamsuzzoha Bayzid, **Maksudul Alam**, and Md. Saidur Rahman. "A Heuristic Algorithm for Individual Haplotyping with Minimum Error Correction." In: *International Conference on BioMedical Engineering and Informatics*. 2008. DOI: [10.1109/bmei.2008.283](https://doi.org/10.1109/bmei.2008.283)

## Technical Reports

1. **Maksudul Alam** and Kalyan S. Perumalla. *Generating Billion-Edge Scale-Free Networks in Seconds: Performance Study of a Novel GPU-based Preferential Attachment Model*. Tech. rep. ORNL/TM-2017/486. Oak Ridge National Laboratory, 2017. DOI: [10.2172/1399438](https://doi.org/10.2172/1399438)
2. Kalyan S. Perumalla, **Maksudul Alam**, and Devin A. White. *Computational Speed and Matching Quality using an Upper Bound on the Normalized Mutual Information*. Tech. rep. ORNL/TM-2017/87. Oak Ridge National Laboratory (ORNL), 2017
3. **Maksudul Alam** and Maleq Khan. *Efficient Algorithms for Generating Massive Random Networks*. Tech. rep. Technical Report 13-064. NDSSL at Virginia Tech, 2013

## Talks

1. **Maksudul Alam**. *Distributed-memory Parallel Algorithms for Generating Massive Scale-free Networks Using Preferential Attachment Model*. SuperComputing Conference. 2013
2. **Maksudul Alam**. *Parallel Algorithms for Generating Massive Random Networks with Given Expected Degree Sequences*. Network and Parallel Computing Conference. 2015
3. **Maksudul Alam**. *Parallel Algorithms for Generating Large-Scale Random Graphs*. Oak Ridge National Laboratory. 2015
4. **Maksudul Alam**. *Parallel Algorithms for Generating Random Networks with Expected Given Degree Sequences*. NDSSL Seminar Series. 2015
5. **Maksudul Alam**. *Distributed-memory parallel algorithms for Generating Massive Scale-free Networks*. NDSSL Seminar Series. 2014
6. **Maksudul Alam**, Maleq Khan, and Madhav Marathe. *Parallel Algorithms for Generating Massive Random Networks*. Poster presented at Google PhD Summit, February 25, Washington, D.C.. (Poster). 2014
7. **Maksudul Alam**. *Parallel Algorithms for Generating Random Networks and Few Other Network Analysis and Mining Problems using Modern HPC Systems*. PhD Preliminary Examination Presentation (Virginia Tech). 2015

## Posters and Others

1. **Maksudul Alam**, Maleq Khan, and Madhav Marathe. *Parallel Algorithms for Generating Massive Random Networks*. Poster presented at Google PhD Summit, February 25, Washington, D.C.. (Poster). 2014
2. **Maksudul Alam**, SM Arifuzzaman, and Md Hasanuzzaman Bhuiyan. *Large scale network visualization with gephi*. Tech. rep. Virginia Tech, 2012
3. **Maksudul Alam**, Josep Bassaganya-Riera, Keith Bisset, Adria Carbo, Raquel Hontecillas, Stefan Hoops, Yongguo Mei, Katherine Wendelsdorf, Dawen Xie, Jae-Seung Yeom, and Madhav Marathe. *ENteric Immunity Simulator: A Tool for In Silico Study of Mucosal Immune Responses*. Poster presented at the Symposium on Modeling Immune Responses from Complex Data, University of Rochester, NY. (Poster). 2012
4. Md. Shamsuzzoha Bayzid and **Maksudul Alam**. "Graph Modeling for Bioinformatics." (*Undergraduate thesis*). MA thesis. Bangladesh University of Engineering and Technology, 2007

## HONORS & AWARDS

- **Best Paper Award Finalist:** For the SuperComputing conference 2016.
- **Travel Grants:** Awarded for attending two conferences and a summer school
- **Dean's List:** Mentioned for all semesters in *undergraduate* level for academic excellence.
- **University Merit Scholarship:** Awarded in *undergraduate* level for top performances.
- **Government Scholarship:** Awarded in *junior school* level for excellence in public examinations.
- **Perfect Attendance Certificate:** Awarded in *high school* level for attending every class hours.

## OTHER NOTABLE PROJECTS

<b>WiMAX Base Station:</b> <i>Development of WiMAX base station on Intel Glenfield baseband card</i>	2007–2008
<b>WiMAX Remote Radio Unit:</b> <i>Design and simulation of RRU based on Lattice ECP2M FPGA</i>	2007–2009
<b>Bangladesh Electronic Funds Transfer Network:</b> <i>Electronic payment solution for banks</i>	2010–2011
<b>Mobile Banking:</b> <i>Mobile client &amp; server system conforming to <b>BEFTN</b> rules</i>	2008–2011
<b>Bangladesh Automated Cheque Processing System:</b> <i>Image based cheque clearing for banks</i>	2009–2011
<b>Electronic Voting System: Computer Interfacing</b> <i>semester project with AT8951ED2 <math>\mu</math>-controller</i>	2007

## REFERENCES

Available upon request.