# Akshar Varma

*Khoury College of Computer Sciences, Northeastern University*
Email: akshar@ccs.neu.edu
Webpage: `www.aksharvarma.org`

## Research interests

- **Theoretical Computer Science**
  Algorithms, Machine Learning, Computational Complexity
- **Computational Science**
  High Performance Computing, Complex Networks

## Education

- **PhD. in Computer Science** GPA: 3.96/4
  Northeastern University, Boston, USA. (2017—)
  *Advisor: Dr. Ravi Sundaram*
- **B.Tech. (Hons.) in Information and Communication Technology**
  **Minor: Computational Science** GPA: 8.9/10
  DA-IICT, Gandhinagar, India. (2013–2017)
  *Bachelor's Thesis: Reachability Problems and Space Bounds*
  *Advisor: Dr. Nutan Limaye, IIT Bombay*

## Papers, manuscripts, and posters

- **Let's HPC: A web-based platform to aid parallel, distributed and high performance computing education**
  Bhaskar Chaudhury, Akshar Varma, Yashwant Keswani, Yashodhan Bhatnagar and Samarth Parikh.
  *Journal of Parallel and Distributed Computing (2018), https://doi.org/10.1016/j.jpdc.2018.03.001.*
- **Existence of k-ary Trees: Subtree Sizes, Heights and Depths**
  Akshar Varma.
  *arXiv preprint: https://arxiv.org/abs/1510.00958v2.*
- **Parallelizing Union-Find for shared-memory architectures.**
  Joint work with Yashwant Keswani, under the guidance of Prof. Bhaskar Chaudhury.
  *Poster presented @ IEEE International Conference on High Performance Computing, Data, & Analytics, 2016*

## Workshops

- Short talk at the Theoretical Basis of Machine Learning workshop at ICTS Bangalore, India, December 2018.
- Attended the NMI workshop on Complexity Theory at IIT Gandhinagar, India, November 2016.
- Attended the Forum for Information Retrieval Evaluation at DA-IICT, Gandhinagar, India, December 2015.

## Internships

- **Existence of k-ary Trees: Subtree Sizes, Heights and Depths**
  Mentors: Prof. Rahul Muthu, Prof. Srikrishnan Divakaran *(Summer 2015)*
  Obtained several results on the complexity of determining the existence of k-ary trees when a sequence of attributes like subtree sizes, heights or depths (or a combination of these) are given as input.
  arXiv preprint: `https://arxiv.org/abs/1510.00958v2`.
- **Cryptanalysis of Classical Ciphers using Markov Chain Monte Carlo methods**
  Mentor: Prof. Anish Mathuria *(Summer 2016)*
  Studied the effectiveness of using Markov Chain Monte Carlo (MCMC) methods for the purpose of cryptanalysis of classical ciphers. Focused on the cryptanalysis of the Vigenere cipher and showed that MCMC methods are a poor cryptanalysis choice, by comparing against classical cryptanalysis methods, using Python implementations.
- **Latent Space Embeddings for Query Reformulation**
  Mentor: Raju Matta, Amazon and Ravi Sundaram, NEU *(Amazon, May-December 2018)*
  Worked on the problem of generating latent space embeddings of product search queries for the task of reformulating infrequent queries using popular queries. Implemented novel Attention based Deep Neural Networks trained on query-query similarity graph. Also developed a novel quantitative metric for evaluation of the models. Work on analysing the theoretical aspects of the models is ongoing.

## Graduate Coursework

Advanced Algorithms, Theory of Computation, Theoretical Topics in Machine Learning, Cryptography, Introduction to Probabilistic Methods, Machine Learning, Intensive Computer Systems, Compilers.

## Selected course projects

- **Who let the tweets out: Author identification of very short texts**
  Mentor: Prof. Rose Yu. Team Size - 2.
  Studied the problem of author attribution for very short texts, focusing on the feature extraction aspect. Implemented latent space embeddings methods and evaluated their performance against bag of words based approaches on Twitter data. Github: `https://github.com/aksharvarma/who-let-the-tweets-out`.
- **GPUs for HPC: Future directions and challenges**
  Mentor: Prof. Gene Cooperman
  Surveyed the use of GPUs for High Performance Computing applications, focusing on the challenges in using GPUs for HPC in the cloud, in embedded systems and incorporating them using heterogenous computing techniques.
- **On using community detection algorithms for data clustering.**
  Mentor: Prof. Mukesh Tiwari. Team Size - 2.
  Studied feasibility of using community detection algorithm from complex networks analysis for the problem of data set clustering. Ran simulations in Python for comparison with standard clustering algorithms.
- **Parallelizing $k$-means algorithm on a shared-memory architecture.**
  Mentor: Prof. Bhaskar Chaudhury. Team Size - 2.
  A parallel implementation of the $k$-means algorithm using OpenMP library in C to implement thread-based parallelism for shared-memory architectures, which achieved super-linear speedups.

## Programming skills

- Python 3 (Numpy, Scipy, Matplotlib, Pandas libraries for scientific computing)
- C/C++ (Linux/GCC development environment; OpenMP, MPI parallelization libraries; CUDA for GPU programming)

## Teaching

- Teaching Assistant for the High Performance Computing course offered to junior year students (Jul – Nov 2016).
- Teaching Assistant for the Algorithms and Data course offered to undergraduates (Sep – Dec 2017).

## Positions of responsibility

- One of the founding members and head of the student Research Club at my undergraduate university (Jan 2017 – Apr 2017).
- Chief Editor of the College e-magazine in my undergraduate university (Jan 2017 – Apr 2017) and Member of Editorial Board (Apr 2015 – Apr 2017).