ABHEEK GHOSH

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EDUCATION

The University of Texas at Austin, Texas, USA — *August 2018 - Present*
Master of Science, Computer Science. — GPA: 3.94/4.0

Indian Institute of Technology Guwahati, Assam, India — *July 2014 - June 2018*
Bachelor of Technology, Mathematics and Computing. — GPA: 9.74/10.0

EXPERIENCE

The University of Texas at Austin, Texas, USA — *August 2018 - Present*
Research Assistant. Autonomous Systems Group (Fall 2019).
Teaching Assistant. Scientific & Technical Comp. (Fall 2018). Debugging & Verification (Spring 2019).

Amazon, Seattle, WA, USA. — *May 2019 – August 2019*
Software Development Engineer Intern, Intelligent Decisions Team, Alexa-AI.

Tata Institute of Fundamental Research (TIFR), Mumbai, India. — *May 2017 – July 2017*
Student Researcher, Visiting Students Research Programme (VSRP).

PUBLICATIONS

On the welfare of cardinal voting mechanisms.
With Umang Bhaskar. In *Proceedings of the 38th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, pages 27:1–27:22, 2018.

Truthful and near-optimal mechanisms for welfare maximization in multi-winner elections.
With Umang Bhaskar and Varsha Dani. In *Proceedings of the 32nd AAAI Conference on Artificial Intelligence (AAAI)*, pages 925–932, 2018.

ACADEMIC ACHIEVEMENTS

President of India Gold Medal (2018). Awarded to the graduating student with the best academic performance across all majors, one in about 650 students.

Institute Merit Scholarship (2015-2018). Awarded each year to one student in the department with consistently strong academic performance.

Winner of Goldman Sachs Quantify National Challenge (2017). 1st among about 3,500 participants across India. Related to the application of CS, ML, and quantitative skills in finance.

PROJECTS

Welfare of Voting Mechanisms. (Publications I & II) — *May 2017 – May 2018*
With Prof. Umang Bhaskar (TIFR-Mumbai)

- Gave *distortion* lower-bounds of $\Omega(\sqrt{m \log m})$ and $\Omega(\sqrt{m})$ for randomized truthful ordinal and cardinal mechanisms, respectively.
- Gave a class of truthful cardinal mechanisms that has low distortion ($O(\sqrt{m \log m})$) but doesn't follow properties like *localization* and *non-perversity* associated with truthful ordinal mechanisms.
- Gave approximately truthful mechanisms with distortion close to 1.
- For the simple mechanism that selects the alternative that maximizes social welfare (non-truthful), proved that iterative voting dynamics converge to an equilibrium and the price of anarchy is close to 1.

Learning and Active Classification of Markov Decision Processes *October 2019 – Ongoing*
With Prof. Ufuk Topcu (UT-Austin)

- There is a set of MDPs unknown to an agent. In each episode, the agent interacts with one of the MDPs selected randomly and tries to classify it. Over time it wants to learn the MDPs and improve its classification accuracy.
- Gave sample-efficient PAC learning algorithms and proved that they achieve close to optimal classification accuracy.

Modeling Uncertainty in Autonomous Driving using Geometric Brownian Motion
With Prof. Ufuk Topcu (UT-Austin) *October 2019 – Ongoing*

- Modeled the reward of long-term tasks involving high uncertainty using a stochastic process, specifically a path-dependent function over a geometric Brownian motion.
- The expected reward is calculated using techniques from down-and-out barrier option pricing.
- Gave analytical and simulation results for specific tasks like vehicle passing on a two-lane road.

COURSE PROJECTS

Truthful Voting Mechanisms using Adversarial Neural Networks *Spring 2019*
With Prof. Qiang Liu (UT-Austin)

- Obtained truthful welfare-maximizing voting mechanisms using two neural networks that compete with each other in a minimax game, similar to Generative Adversarial Networks.
- The generator network generated the worst-case examples and the mechanism network that models a truthful voting mechanism outputted the probability distribution over candidates.
- Observed that with a very powerful generator network, the learning algorithm didn't converge; with a weaker generator, the algorithm converged and the mechanism empirically optimized for the input distribution of votes.

Doomsday-Threatening Equilibrium Checker [bit.ly/EqCheck] *Fall 2018*
With Prof. Ufuk Topcu (UT-Austin)

- Built a tool that takes input a finite-state multi-player graph model and linear temporal logic specifications of the players and checks for the existence of a 'doomsday-threatening' equilibrium.
- Studied distributed protocols for traffic intersections and proposed one that involves a 'booking' phase and a 'veto' phase before the players cross the road and allows an equilibrium.

Data Migration Algorithms in the Strata File System [bit.ly/StrataFS] *Fall 2018*
With Prof. Simon Peter (UT-Austin)

- Strata efficiently uses multiple storage layers (HDD, SSD, and NVMe) and data migration algorithms to cache files for faster access.
- Improved performance by replacing LRU (least recently used) with algorithms like hybrid LRU+MRU, and segmented LRU. Improved file access latency by 5-19% for various access pattern benchmarks.

SKILLS AND ADDITIONAL COURSES

Skills (proficient): Python, C++, C, R, Matlab, Linux.
Skills (familiar): PyTorch, Tensorflow, MySQL, MongoDB, Neo4j, MPI, CUDA, PHP, JavaScript.

Courses not in transcript (audited or self-read): Algorithmic Game Theory, Algorithmic Mechanism Design, Game Theory (2 Course Sequence), Computational Learning Theory, Reinforcement Learning.

EXTRA-CURRICULAR

Department's representative in IIT-Guwahati's Students' Welfare Board (SWB) (2017-18).

Member of IIT-Guwahati's Students' Mentorship Group. Mentor to freshman students (2016-18).