Amartya Shankha Biswas

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Education and Coursework

Massachussets Institute of Technology — *Cambridge, USA*

PH.D. IN THEORETICAL COMPUTER SCIENCE — *Sep. 2018 - PRESENT*

Massachussets Institute of Technology — *Cambridge, USA*

M.ENG. IN COMPUTER SCIENCE (GPA 5.0/5.0) — *Sep. 2016 - Jan. 2018*

- Randomized Algorithms
- Distributed Algorithms
- Sub-linear Algorithms
- Quantum Complexity Theory
- Randomness & Computation
- Geometric Folding Algorithms: Linkages, Origami, Polyhedra

Massachussets Institute of Technology — *Cambridge, USA*

S.B. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE (GPA 4.8/5.0) — *Sep. 2013 - Jan. 2018*

Computer Science

- Design and Analysis of Algorithms
- Computer and Network Security
- Performance Engineering of Software
- Signals and Systems
- Digital Systems Lab
- Graduate Machine Learning

Physics and Mathematics

- Abstract Algebra I & II
- Theory of Probability
- Nuclear and Particle Physics
- Quantum Mechanics II & III
- Statistical Mechanics
- Experimental Physics

Research

Faster Parallel Algorithms for Graph Spanners [pdf] — **In Submission**

Joint work with: SLOBODAN MITROVIĆ, YASAMIN NAZARI

- Obtained exponential improvement in parallel run-time with slightly sub-optimal stretch
- Investigated **trade-off** between run-time (number of rounds) and stretch

Massively Parallel Algorithms for Counting Triangles in Huge Graphs [pdf] — **In Submission**

Joint work with: TALYA EDEN, QUANQUAN C. LIU, SLOBODAN MITROVIĆ

- Obtained faster algorithms for counting triangles in the Massvely Parallel Computation (similar to MapReduce) model

Local Access to Huge Random Objects Through partial Sampling [pdf] — **ITCS 2020**

Joint work with: RONITT RUBINFELD, ANAK YODPINYANEE

- Implemented **sub-linear time** local access to various types of random objects
  - Undirected graphs with independent edge probabilities: $G(n, p)$, Stochastic Block Model, etc.
  - Random Catalan objects: Dyck Paths, Bracket Expressions, Rooted Trees etc.
  - Random valid coloring of given input graph

Sublinear-Time Algorithms for Counting Star Subgraphs via Edge Sampling [pdf] — **Algorithmica 2018**

Joint work with: MARYAM ALIAKBARPOUR, THEMIS GOULEAKIS, JOHN PEEBLES, RONITT RUBINFELD, ANAK YODPINYANEE

- Introduced new ***edge sampling*** *model* in the context of **graph property testing**
- Formulated new algorithms for counting subgraphs, and deduced stronger lower bounds in this model

Efficient Origami Construction of Orthogonal Terrains [pdf] — **7OSME**

Joint work with: ERIK D. DEMAINE, JASON KU

- Developed novel technique of constructing Origami structures using **time evolving cross-sections**
- Used technique to obtain constant-factor **optimal constructions** of orthogonal terrains, and extruded polyhedra

Common Development of Prisms, Anti-Prisms, Tetrahedra, and Wedges [pdf] — **CCCG 2017**

Joint work with: ERIK D. DEMAINE

- Constructed **common unfoldings** of a large number of convex polyhedra (**largest known** at times of publication)
- Designed first non-trivial **uncountable family** of unfoldings

Aperiodic Bistable Auxetics — *In Progress*

- Designed **bi-stable auxetic linkage** that can be fabricated efficiently from flat material
- Modified linkage to make it **aperiodic** with varying amounts of **area expansion** over space
- Expansion values can be designed to allow transitions from flat state to **any desired 2-dimensional surface**

Work Experience

Kensho Technologies LLC. — *Cambridge, USA*

Software Engineering Intern — *Feb - August 2018*

- Developed **open-source compiler** for generating **optimized queries** to a graph database. **[github link]**
- Developed a **write-ahead log** to provide *atomicity* and *durability* for **graph database** transactions.

D.E. Shaw Research — *New York, USA*

Scientific Associate Intern — *Summer 2016*

- Investigated the problem of characterizing **high dimensional functions** using a very **limited number of samples**.
- Approximated **quantum mechanical** simulation data by fitting **computationally efficient** classical models.

Twitter — *Cambridge, USA*

Software Engineering Intern — *Summer 2014*

- Performed analytics for Twitter video using Pig and Scalding to extract log data
- Improved event scribing across multiple platforms

Teaching

MIT-IIT Robotics Program — *Kharagpur, India*

Organizer and Instructor — *Summer 2017*

- Conceived joint venture between **MIT International Science and Technology Initiatives** and IIT Kharagpur.
- Organized and developed curriculum for workshop on **programming, simulation, & control theory**.
- Obtained $5000 funding from external sources.
- Designed and fabricated 40 lab kits (Ball on Plate Balancing system).

Greatest Hits of 6.006 (Introduction to Algorithms) — *Cambridge, USA*

Organizer and Instructor — *January 2016*

- Conceived month long algorithms course for MIT students.
- Presented lectures and designed lab assignments twice every week.

Design and Analysis of Algorithms (three semesters) — *Cambridge, USA*

Teaching Assistant

- Lectures recorded for MIT OCW (recitations $\{2, 6, 8, 9\}$ available online at `goo.gl/G1vsMB`).
- Taught course in Spring 2015, Spring 2016, and Fall 2017.

Fundamentals of Programming (two semesters) — *Cambridge, USA*

Teaching Assistant

- Taught course in Fall 2016, and Spring 2017.

Middle East Entrepreneurs of Tomorrow — *Jerusalem, Israel*

Instructor

- Taught computer science to Israeli and Palestinian high school students.
- Developed curriculum, and coordinated lab-work.

Honors and Awards

International

2013	**Bronze Medal**, International Olympiad in Informatics	*Brisbane, Australia*
2012	**Bronze Medal**, International Olympiad in Informatics	*Sirmione, Italy*
2009-2012	**Medallist (4 years)**, AMC – Australian Mathematics Competition	

MIT

2018	**Recipient**, MIT Presidential Fellowship
2016	**Third Place**, MakeMIT 2016 hardware hackathon
2015	**First Place**, MakeMIT 2015 hardware hackathon
2014	**Fourth Place**, MIT Visual Recognition through Machine Learning Competition

Domestic (India)

2012	**Ranked 13^{th} in India**, KVPY Fellowship in Basic Sciences
2013	**Ranked in top 0.05%**, Indian Institute of Technology Joint Entrance Examination

Skills

Programming C/C++, Python, JavaScript, HTML/CSS, MATLAB, Mathematica, Verilog, LaTeX

CAD and Prototyping Tools SOLIDWORKS, Laser Cutter, Waterjet

Personal Projects

Full Scale Roller Coaster (goo.gl/4Jq3UU)

Cambridge, USA

Design and Construction Lead — *Summer 2015*

- Designed full-scale roller coaster with $20,000 budget.
- Simulated mechanics to ensure safety of riders
- Led team of ≈ 15 people to complete construction of functioning ride.

Fully Automatic Hot-Dog Maker (goo.gl/2zLYr5)

Cambridge, USA

MakeMIT 2015 — *2015*

- Designed and built fully automatic machine to cook a sausage, toast a bun, and assemble a hot-dog with condiments.

40mph Electric Scooter

Cambridge, USA

Design and Construction — *2016*

- Built a 7kW brushless electric scooter from scratch.