Arghya Bhattacharya

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Summary

I am a fifth-year doctoral candidate with experience in both academic research and industry. My thesis sheds light on how to design cache-friendly algorithms that breed both theoretical and practical advantages. These algorithms are helpful for shared memory and cloud systems. I also design machine-learning advised algorithms for traditional online decision-making problems. I am actively looking for internship positions in applied sciences, specifically, in the field of software engineering and machine learning.

Short Bio

- **Ph.D. Candidate**, Dept. of Computer Science, Stony Brook University
- **Cloud and Networking Intern**, Nokia Bell Labs
- **HS-WISE Mentor**, High School Women in Science and Engineering
- **JBNSTS Senior Scholar'12** Jagadis Bose National Science Talent Search
- **Administrative Member**, JB Scholars Professional Development Forum
- **Hackathon Enthusiast**, Winner of Hack@CEWIT'22, SBUHack'21, etc.

Research Interest

External memory algorithm
Parallel algorithm
Machine learning (ML)
Computer networks
Online algorithm
Filesystem aging

Technical Skills

C++	Python
Shell	Latex
MySQL	Matlab
Keras	PyTorch

Work Experience

- **Nokia Bell Labs**, Network Systems and Security Research Lab, Bell Labs Core Research — Virtual Office, N
  Cloud and Networking Intern, Manager: T. V. Lakshman, Supervisor: Edward Grinshpun, Chuck PayetteJun. 2022 – Aug. 202
  - Designed out-of-band ML-based prediction augmented congestion control algorithms for low-latency, high-volume variable-bitrate applications (such as live video streaming) for 5G wireless network systems.

- **Stony Brook University**, Algorithms Lab, Dept. of Computer Science — Stony Brook,NY
  Research Project Assistant, Advisor: Prof. Michael A. Bender, Collaborator: Rezaul A. Chowdhury Jun. 2019 – Present
  - **Cache-efficient algorithms:** Designed an empirical framework to evaluate when (a, b, c)-regular algorithms (a class of recursive and cache-oblivious algorithms) are **cache-adaptive** for external-memory applications, i.e., do not degrade in the face of memory fluctuations [1]. These dynamic memory fluctuations are common in most modern shared-memory and cloud systems. This work closes the logarithmic I/O-performance gap between (a,b,c)-regularity and cache-adaptivity previously shown in theory. **[code]** The journal version of the work builds an empirical framework to extend the study of the cache-adaptivity of external-memory algorithms in a **multi-threading ecosystem** [Manuscript in preparation]. **[code]**
  - **ML advised algorithms:** Redesigned traditional online algorithms for **rent-or-buy** problems with augmentation by single and multiple ML oracles [2]; the journal version deals with a more generalized version of the problem with an arbitrarily fluctuating discount on the rent of the resource [3]. The follow-up work revisits conventional online decision-making problems, such as secretary selection problems [5], green paging, parallel paging, and list access problem, and design ML-advised algorithms with improved performance [Manuscript in preparation]. **[code]**
  - **Filesystem aging:** Evaluated microbenchmarks and application-level fragmentation benchmarks to measure slowdown in the random read performance for several production filesystems (`ext4`, `btrfs`, `xfs`, `zfs`, and `f2fs`) as well as a B^{ε}-tree based write-optimized in-kernel filesystem `BetrFS` [4]. **[code]**

- **National University of Singapore**, Dept. of ECE — Singapore
  Research Engineer, Advisor: Prof. Dipti Srinivasan — *May. 2018 – Aug. 2018*
  - Reviewed the performance of multi-objective optimization algorithms using evolutionary computation based on decomposition techniques.
- **Pricewaterhouse Coopers (PwC) India Pvt. Ltd.**, Technology Consulting — Kolkata, India
  Consultant, Manager: Sudipto Sarkar — *Jul. 2016 – Sep. 2017*
  - Built a payroll automation system using DotNet technologies using MVC architecture.
  - Implemented the Microsoft Navision enterprise resource planning software (ERP) for finance, procurement, and inventory management.
- **Jadavpur University**, Measurement and Instrumentation Lab, Dept. of Electrical Engg. — Kolkata, India
  Undergraduate Research Intern, Advisor: Prof. Debangshu Dey — *Jun. 2015 – May. 2016*
  - Designed algorithms for affective computing: a study of Bi-dimensional Empirical Mode Decomposition (BEMD) based feature extraction, Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA) based dimensionality reduction, Gray-level Co-occurrence Matrix (GLCM), Histogram of Oriented Gradients (HOG), Local Ternary Pattern (LTP) based feature elimination, and Multi-class Support Vector Machine (MSVM), k-Nearest Neighbor (k-NN) based classification in context of emotion recognition [7] [8].
  - Designed algorithms for biomedical image processing and cancer detection using Optical Colonoscopy videos by cross-wavelet feature extraction [9].
- **Indian Institute Technology, Kharagpur**, Telemedicine Lab, Dept. of Computer Science — Kharagpur, India
  Undergraduate Summer Intern, Advisor: Prof. Jayanta Mukhopadhyay — *Jun. 2014 – Aug. 2014*
  - Designed a portable electronic device for non-invasive continuous measurement of blood pressure by bio-impedance measurement and assessment of cardiac health in larger perspective.

Education

- **Stony Brook University**, Dept. of Computer Science — New York, USA
  Ph.D. Candidate, Advisor: Prof. Michael A. Bender — *Sep. 2018 – Dec. 2023 (expected)*
  - Cumulative GPA 3.78 / 4.0
  - **Graduate Courses:** Analysis of Algorithms, Computer Networks, Discrete Maths, Data Science, Introduction to Computer Vision, Theory of Database Systems, Medical Imaging.
  - **Class Projects:**
    - Optimizing network congestion window using Ricci Curvature.
    - Semantic segmentation using U-Net and instance segmentation of nuclei using Mask R-CNN.
    - Identifying fundraising donors with Logistic Regression, Decision Tree, Random Forest and LightGBM.
- **Jadavpur University**, Dept. of Electrical Engg. — Kolkata, India
  B.E. in Electrical Engineering — *Jul. 2012 – May. 2016*
  - Cumulative GPA: 7.74/10 Total marks: 72.69/100 with First Class
  - Qualified GATE 2016 in Electrical Engineering Score: 45.66 GATE Score: 584/1000 Rank: 3278
  - **Related Coursework**: Advanced Instrumentation-I, Advanced Instrumentation-II, Digital Signal Processing, Numerical Analysis and Computer Programming, Reliability Engineering, Signals and Systems, Circuit Theory, Control System Engineering

Selected Publications & Posters

[1] **Arghya Bhattacharya**, Helen Xu, Abiyaz Chowdhury, Rathish Das, Rezaul A. Chowdhury, Rob Johnson, Rishab Nithyanand, and Michael A. Bender, "When Are Cache-Oblivious Algorithms Cache Adaptive? A Case Study of Matrix Multiplication and Sorting," *30th Annual European Symposium on Algorithms **(ESA '22)***.[**slides**]

[2] **Arghya Bhattacharya**, Rathish Das, "Machine Learning Advised Ski Rental Problem with a Discount," *16th International Conference and Workshops on Algorithms and Computation **(WALCOM'22)***. [**talk**] [**slides**]

[3] **Arghya Bhattacharya**, Rathish Das, "Machine Learning Advised Algorithms for the Ski Rental Problem with a Discount", *Theoretical Computer Science **(TCS)**, Elsevier*.

[4] Alex Conway, Ainesh Bakshi, **Arghya Bhattacharya**, Rory Bennett, Yijheng Jiao, Erik Knorr, Michael A. Bender, Willaim Jannen, Rob Johnson, Bradley C. Kuszmaul, Donald E. Porter, Yang Zhan, and Martin Farach-Colton, "File System Aging," under review in *ACM Transactions on Computer Systems **(TOCS)***.

[5] **Arghya Bhattacharya**, "Single and Multiple Secretary Selection with ML Advice," *Graduate Research Day (2022), Dept. of Computer Science, Stony Brook University*.

[6] **Arghya Bhattacharya**, "Progress Imbalance in Multi-process Performance," *Graduate Research Day (2021), Dept. of Computer Science, Stony Brook University*. [**slides**]

[7] **Arghya Bhattacharya**, Dwaipayan Choudhury, and Debangshu Dey, "Edge-enhanced Bi-dimensional empirical mode decomposition based emotion recognition using fusion of feature set," *Soft Computing, Springer* (2018) 22: 889–903.

[8] **Arghya Bhattacharya**, Dwaipayan Choudhury, and Debangshu Dey, "Emotion Recognition from Facial Image Analysis Using Composite Similarity Measure Aided Bi-dimensional Empirical Mode Decomposition," *First IEEE Conference on Control, Measurement and Instrumentation (CMI'16)*.

[9] Mainak Biswas, **Arghya Bhattacharya**, and Debangshu Dey, "Classification of Various Colon Diseases in Colonoscopy Video using Cross-Wavelet Features," *IEEE International Conference on Wireless Communications Signal Processing and Networking (WiSPNET'16)*.