Provakar Mondal

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Education

Virginia Tech *Blacksburg, Virginia, USA*
PhD in Computer Science *August 2021 - December 2026 (Expected)*
Research Area: Distributed Systems, Software Engineering, System Support for Machine Learning (ML)

Virginia Tech *Blacksburg, Virginia, USA*
MS in Computer Science. *GPA: 3.96/4.0* *August 2021 - December 2023*
Relevant Courses: Advanced Topics in Software Engineering, Distributed Systems, ML

Bangladesh University of Engineering and Technology *Dhaka, Bangladesh*
BS in Computer Science. *GPA: 3.42/4.0* *February 2015 - April 2019*
Relevant Courses: Software Engineering, Algorithms, Data Structures, Databases, AI, ML, Operating Systems

Professional Experience

Virginia Tech, Software Innovations Lab *Blacksburg, Virginia, USA*
Graduate Research Assistant — *Advisor: Dr. Eli Tilevich* *August 2021 - Present*

- Working on system support for replicating domain-specific AI models; aiming to improve user experience and reduce model synchronization latency by prioritizing application utility (Python, TensorFlow, PyTorch).
- Introduced effective integration testing for replicated data libraries (OrbitDB, ReplicaDB, CRDT); increased test coverage by *32%* by optimizing interleaving replay of app-library interaction (Go, Java, JS, Python, C++). Code
- Created comprehensive error handling for replicated data libraries; improved system reliability by *25%* under erroneous updates via distributed error tracing and non-intrusive integration (Python, Go, JS, C#, C++). Code
- Provided multilingual support for replicated data systems; enhanced performance (*54%*) and software quality (*38%*) via a language-agnostic interface for cross-language replica coordination (Go, Java, JS, Python, Protobuf). Code

Virginia Tech, TLOS *Blacksburg, Virginia, USA*
Graduate Application Developer *August 2025 - Present*

- Enhancing the university's Learning Management System (LMS) by creating and integrating a complete AI pipeline.
- Stack: Langflow, Flowise, Voiceflow, React, Docker, etc.

Samsung Research, Mobile Application Group *Dhaka, Bangladesh*
Software Engineer *May 2019 - July 2021*

- Contributed to the successful release of *Samsung Notes* from version *2* to *3* by implementing *six* new features and fixing *100+* bugs, improving app stability and user experience (C#, Java, C++, XAML, ARM64).
- Engineered a delta-data transferable middleware for *Samsung Notes*, reducing synchronization latency by *27%* between *Notes* and *Samsung Cloud*, enhancing data consistency and accessibility across devices (C#, C++).
- Developed a flagship project in collaboration with the Samsung Research, South Korea Team, contributing to the on-time release of a commercial product and demonstrating effective teamwork in a cross-national environment (C#, Java).
- Spearheaded quality assurance activities, including bug fixing, testing, issue reporting, and technical documentation creation, to ensure high-quality software releases in support of project development.

Technical skills

- **Languages:** Python, Go, C++, Java, C#, JavaScript (JS), C, XAML, HTML, CSS, Protobuf, Prolog
- **DBMS:** Oracle, DynamoDB, MySQL, NoSQL, MongoDB, SQLite
- **Frameworks and Libraries:** Node.js, React, Django, AWS, UWP, .NET, NumPy, Matplotlib, TensorFlow, PyTorch
- **DevOps, Deployment, and AI Workflow Platforms:** Git, Perforce, Docker, Vercel, Langflow, Flowise AI, Voiceflow
- **OS and Architectures:** Linux, Windows, Android, ARM64

Publications

- **Mondal, Provakar** and Tilevich, Eli. "ER-π: Exhaustive Interleaving Replay for Testing Replicated Data Library Integration" in **ACM/IFIP Middleware 2025**. An infrastructure to test the integration of replicated data libraries into distributed applications, reproducing *12* bugs, and uncovering *5* misconceptions. Paper Code

- **Mondal**, **Provakar**. "Toward Thorough and Practical Integration Testing of Replicated Data Systems" in **ACM/IFIP Middleware Doctoral Symposium 2025**. A comprehensive integration testing framework for replicated data systems, increasing testing efficacy by *3.58×* through *pruning* and *prioritizing* distributed event interleavings. Paper
- **Mondal**, **Provakar** and Tilevich, Eli. "Understanding Tradeoffs of Replicated Data Library Integration Strategies in Multilingual Environments" in **ACM/IFIP Middleware Demos & Posters 2025**. An empirical evaluation of two replicated data library integration strategies in multilingual distributed systems, revealing performance-implementation tradeoffs and providing insights into cross-language software architecture design. Paper Code
- **Mondal**, **Provakar** and Tilevich, Eli. "Undoing CRDT Operations Automatically" in **IEEE CloudCom 2023**. An automatic undo procedure for CRDT libraries, improving error handling efficiency by *16%*. Paper Code

Selected Engineering Projects

- **Reliable Replicated Data Systems via Trust Management:** Enhanced fault tolerance by *21%* under malicious updates by integrating dynamic trust management and service-level agreement (Go, Python). Report Code
- **Auto-Probability-Java:** Embedded probabilistic reasoning into Java applications, reducing coding effort (*22%*) and boosting query efficiency (*43%*) via auto-generated logic programs from Java annotations (Java, C++, Prolog). Code
- **COVID-19 Twitter Misinformation Lookup**: Identified COVID-19-related misinformation tweets with *71.56%* precision by implementing an Information Retrieval (IR) model using RankNet (Python, TensorFlow). Report Code
- **D-CRDT:** Developed a CRDT library deployed via Docker containers, boosting data replication efficiency by *34%* through seamless cross-OS deployment and Kubernetes-based scalability (Go, Docker, Kubernetes). Report Code
- **Online Flea Market:** Engineered an e-commerce web application for trading pre-owned goods, validated by an in-class user study with *50+* participants emphasizing interface usability and design quality (Python, Django, JS, CSS). Code

Teaching Experience

- **Adjunct Instructor**, Department of Computer Science, Virginia Tech
  - *CS 2064: Intermediate Programming in Python* — Summer 2025
    Topic Covered: Data Structures, Test-Driven Development (TDD), Object-Oriented Programming (OOP), Data Science, Web Data, Web Scraping, Plotting, and ML.
- **Graduate Teaching Assistant**, Department of Computer Science, Virginia Tech
  - *CS 3114: Data Structures and Algorithms* — Summer 2022
  - *CS 3314: Programming Language Theory and Practice* — Fall 2022 & 2023
  - *CS 3304: Comparative Languages* — Spring 2023 & Fall 2024
  - *CS 2505: Introduction to Computer Organization* — Fall 2021, Spring 2022 & Spring 2025
  - *CS 2104: Introduction to Problem Solving in Computer Science* — Winter 2022

Additional Experience and Award

- **Open Source Contributions:** 3 open-source projects: Microsoft UWP App, Soundcloud's Roshi, and Legion.
- **BitShares Fellowship:** Awarded for Research Excellence in *Distributed Consensus and Reliability* (2024 — 2025).
- **External Program Committee:** Served in ICWS 2025, ICCCN 2025, and SPLASH-E 2023.
- **Course Design:** Created programming assignments and exams for a new undergrad Data Science course (Summer 2022).
- **Scholarship:** Bangladesh Government Scholarship during undergrad (2015-2019).

References

- **Dr. Eli Tilevich** (PhD Advisor) — Professor, Computer Science, Virginia Tech
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- **Dr. Muhammad Ali Gulzar** (PhD Committee Member) — Assistant Professor, Computer Science, Virginia Tech
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- **Chris Kovach** (Supervisor) — Solutions Architect, TLOS, Virginia Tech
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