Soneya Binta Hossain

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Leveraging program analysis and AI/ML techniques to enhance the cost-effectiveness of automated program testing, debugging, and repair.

Education

2019 – present **Ph.D., Computer Science,** LESS Lab, University of Virginia
Advisor: Matthew Dwyer
Committee: Sebastian Elbaum, Yangfeng Ji, Matthew Bolton, Antonio Filieri
Thesis title: *Assessing and Improving Critical Properties of Test Oracles for Effective Software Bug Detection.*

2024 **Master of Computer Science (MCS),** University of Virginia.
Project title: *TOGLL: Correct and Strong Test Oracle Generation with LLMs.*

2016 **B.Sc., Computer Science and Engineering,** Bangladesh University of Engineering and Technology (BUET).
Thesis title: *Balanced Coverage in Fault-Tolerant Broadcasting for Wireless Multi-hop Networks.*

Research Publications

8 peer-reviewed papers: 6 published in top-tier software engineering and machine learning conferences (ICSE, FSE, NeurIPS, etc.), including two published artifacts. Three papers are done in collaboration with Amazon Web Services (AWS). 2 papers are currently under submission, one of which is co-authored with an undergraduate mentee.

Published Papers [Peer-Reviewed]:

1. **S. B. Hossain**, N. Jiang, Q. Zhou, X. Li, W.-H. Chiang, Y. Lyu, H. Nguyen, and O. Tripp, "A deep dive into large language models for automated bug localization and repair," **FSE**, vol. 1, Porto de Galinhas, Brazil: Association for Computing Machinery, Jul. 2024. DOI: 10.1145/3660773.

2. **S. B. Hossain**, "Ensuring critical properties of test oracles for effective bug detection," in *Proceedings of the 2024 IEEE/ACM 46th International Conference on Software Engineering: Companion Proceedings*, ser. **ICSE-Companion '24**, Lisbon, Portugal: Association for Computing Machinery, 2024, pp. 176–180, ISBN: 9798400705021. DOI: 10.1145/3639478.3639791.

3. **S. B. Hossain**, A. Filieri, M. B. Dwyer, S. Elbaum, and W. Visser, "Neural-based test oracle generation: A large-scale evaluation and lessons learned," in *Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, ser. **ESEC/FSE 2023**, San Francisco, CA, USA: Association for Computing Machinery, 2023, pp. 120–132, ISBN: 9798400703270. DOI: 10.1145/3611643.3616265.

4. **S. B. Hossain**, M. B. Dwyer, S. Elbaum, and A. Nguyen-Tuong, "Measuring and mitigating gaps in structural testing," in *Proceedings of the 45th International Conference on Software Engineering*, ser. **ICSE '23**, Melbourne, Victoria, Australia: IEEE Press, 2023, pp. 1712–1723, ISBN: 9781665457019. DOI: 10.1109/ICSE48619.2023.00147.

5. **S. B. Hossain** and M. Dwyer, "Togll: Correct and strong test oracle generation with llms," in *Proceedings of the 47th International Conference on Software Engineering* (***ICSE'25***), **(To appear)**, 2025.

6. N. Jiang, X. Li, S. Wang, Q. Zhou, **S. B. Hossain**, B. Ray, V. Kumar, and X. Ma, "Training llms to better self-debug and explain code," in *Proceedings of the 38th Conference on Neural Information Processing Systems* (***NeurIPS***), **(To appear)**, 2024.

Research Artifacts:

1. **S. B. Hossain**, M. Dwyer, S. Elbaum, and A. Nguyen-Tuong, *Artifact: Measuring and mitigating gaps in structural testing*, Proceedings of the 45th International Conference on Software Engineering (ICSE '23), **Artifact available and reusable**, 2023. DOI: 10.6084/m9.figshare.21950552.v14.
2. **S. B. Hossain**, A. Filieri, M. Dwyer, S. Elbaum, and W. Visser, *Artifact: Neural-based test oracle generation: A large-scale evaluation and lessons learned*, Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE '23), **Artifact available**, 2023. DOI: 10.6084/m9.figshare.21973091.v4.

In Submission:

1. **S. B. Hossain**, R. Taylor, and M. Dwyer, "Understanding the impact of javadoc comments on test oracle generation," **(In Submission)**.
2. W. Leeson, **S. B. Hossain**, and M. Dwyer, "Hybrid predictive mutation testing via graph transformer networks," **(In Submission)**.

Awards and Scholarships

Research Awards

2024 — Named **Copenhaver Charitable Trust Bicentennial Fellow** by the UVA School of Engineering & Applied Science for the 2024–2025 academic year. Awarded $12,000.

— **Finalist**, Physical Sciences and Engineering category, UVA Research Computing Exhibition, showcasing research using UVA's high-performance computing resources, Rivanna.

2023 — Received the **John A. Stankovic Outstanding Graduate Research Award**, an annual award given to 2–3 outstanding doctoral students by the UVA CS Department.

— **Student Choice Best Research Award**, CS Research Symposium.

2021 — **Best Research Poster Award**, CS Research Symposium.

2019 — **PhD Fellowship**, Computer Science, University of Virginia.

2016 — **Outstanding Undergraduate Thesis Award**, Department of CSE, BUET.

Service Awards

2022 — **Outstanding Service Award**, CS, University of Virginia.

Travel Grants

2024 — Travel grant to attend the SWE24—the world's largest conference for women in engineering and technology—from October 23–26 in Chicago, IL.

2023 — Travel grant from Computing Research Association (CRA) to attend Grad Cohort, San Francisco, CA.

2020 — Travel grant from CRA to attend Grad Cohort, New Orleans, LA.

2015 — Travel grant from Grace Hopper Celebration of Women in Computing (GHCI), to travel and present my research in Bangalore, India.

Undergraduate Academic Awards

2014 — **Top Ten Database Project Award**, department of CSE, BUET.

2013-2014 — Two-time **University Merit Scholarship**, BUET.

— **Dean's List Award (Level-2)**, BUET.

Teaching and Mentoring

2021 - 2023 **Graduate Teaching Assistant,** Computer Science, University of Virginia.

- Three-time TA for **Undergraduate Compilers (CS 4620)** advised by Matthew Dwyer. **Course website:** `https://matthewbdwyer.github.io/4620/`
- One-time TA for **Graduate-level Compilers (CS 6620)** advised by Matthew Dwyer. **Course website:** `https://matthewbdwyer.github.io/6620/`
- Designed, developed, and tested features for the TIPC compiler `https://github.com/matthewbdwyer/tipc`; graded assignments and final projects for 35–70 students; and assisted students through weekly office hours and by answering questions on Slack, Piazza, and email.

2020 – present **Undergraduate Mentoring**: Mentored more than 10 undergraduate students from five different universities in the USA and Bangladesh. Many students are from underrepresented groups.

- **Raygan Taylor** (DU) and **Javan Mendoza** (UMBC) interned at the UVA LESS lab in Summer 2024; worked on a project that investigates the impact of code documentation quality on automated test oracle generation; a paper is currently under review.
- **Nicki Choquette** and **Kasra Lekan** (CS, UVA). Helped them conducting a thorough replication study of an FSE'22 paper (`https://doi.org/10.1145/3540250.3549086`) in Spring 2023. Their paper *Insight into SEER*, consisting of the replication results is available on arXiv (`https://doi.org/10.48550/arXiv.2311.01164`).
- **Ashley Hart** (CS, UCF) interned at the UVA LESS lab in Summer 2020; as one of her mentors, I helped her learn about graduate school expectations and preparation, assisted in developing a Boolean satisfiability solver, and guided her in technical writing and presentation. She is currently pursuing her PhD at the University of Florida.
- **Srikar Chittari** (CpE, UVA) and **Eric Weng** (CS, UVA): Assisted them in preparing their graduate school application materials. Srikar pursued a master's at UVA, while Eric is continuing his undergraduate studies.
- Mentor at **BWCSE** (Bangladeshi Women in Computer Science and Engineering): Currently mentoring five undergraduate women in research, graduate school preparation, and application development. Most of them are 3rd and 4th year students at BUET, doing their thesis and preparing for graduate school.

Service

2024 **Conference and Journal Reviewer**

- Reviewer of ACM Transactions on Software Engineering and Methodology (TOSEM).
- Program committee (Research Papers) at IEEE International Conference on Software Testing, Verification and Validation (ICST) 2024.

Service (continued)

2023 – 2024 **Conference Volunteer**

- Served as a volunteer recruiter at the SWE Conference in Chicago, IL (Oct 24–26, 2024). Assisted UVA Engineering with booth setup, recruiting during career fair hours, engaging with attendees, and networking with professionals to promote UVA's engineering programs.
- Student volunteer at ESEC/FSE 2023 in San Francisco, CA (Dec 3-9, 2023): Assisted with registration, presentation testing, audio/video setup, badge verification, and room preparation for ceremonies.

2020 – present **CS Department Volunteer**

- Leadership chair (Jan 2020 - Jan 2022), Computer Science Graduate Student Group (CS-GSG). Planned and organized CS Research Symposium in 2020 and 2021; organized events to promote leadership among graduate students.
- Helped CS department with faculty recruitment process and coordinated prospective student visits in the department.

2021 – 2022 **Community Volunteer**

- Social chair, Association of Bangladeshi Students (ABS) at UVA. Helped representing Bangladeshi students at UVA, organized events showcasing Bangladeshi culture and history to foster diversity within the broader community

Research Experience

Graduate Research Assistant, LESS Lab, University of Virginia (2019 - present)

- Advised by Matthew Dwyer
- Conducted research on software testing and verification funded by DARPA, Lockheed Martin Advanced Technology Laboratories and Air Force Office of Scientific Research. Published research papers and reusable artifacts in top-tier software engineering conferences.
- Mentored undergraduate research interns at LESS lab as part of the UVA Leadership Alliance Summer Research Program.

Applied Scientist Intern (summer'23), AWS CodeCatalyst

- Mentored by Qiang Zhou. Conducted research on leveraging LLMs to detect and repair bugs. **This research is accepted at FSE 2024.**
- Collaborated with AWS AI Labs to investigate LLMs' self-debugging and explanation capabilities in code generation. **This work is accepted at NeurIPS 2024.**

Applied Scientist Intern (summer'22), AWS CodeGuru

- Mentored by Antonio Filieri and Willem Visser. Conducted research on assessing state-of-the-art automated test oracle generation methods to evaluate their potential integration with the CodeWhisperer tool. **The research results were published as a full research paper at FSE 2023.**
- Developed MuSlicer, a dynamic program slicing tool using AWS's proprietary MuGraph to extract data and control dependency from dynamic execution trace to compute test oracle coverage.

References

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