Soneya Binta Hossain

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Leveraging program analysis and AI/ML in developing methods for automated software testing, debugging and repair to ensure reliability.

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: *Assessing and Improving Critical Properties of Test Oracles for Effective Bug Detection.*

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

2016 **B.Sc., Computer Science and Engineering,** Bangladesh University of Engineering and Technology (BUET).
Thesis: *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. Six first authored, three 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, **acceptance rate:** 25.5%.

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-Doctoral Symposium (DS) '24**, Lisbon, Portugal: Association for Computing Machinery, 2024, pp. 176–180, ISBN: 9798400705021. DOI: 10.1145/3639478.3639791, **acceptance rate:** 57%.

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, **Artifacts available** at https://doi.org/10.6084/m9.figshare.21973091.v4, **acceptance rate:** 21%.

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, **Artifacts available and reusable** at https://doi.org/10.6084/m9.figshare.21950552, **acceptance rate:** 26%.

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***), 2025. DOI: 10.48550/arXiv.2405.03786.

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***), 2024. DOI: 10.48550/arXiv.2405.18649, **acceptance rate:** 25.8%.

In Submission:

1. **S. B. Hossain**, R. Taylor, and M. Dwyer, "Doc2oracle: Investigating the effect 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 **Copenhaver Charitable Trust Bicentennial Fellow**, UVA School of Engineering & Applied Science (SEAS), goes to only 20-25 outstanding doctoral students in SEAS. Awarded $12,000.

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

2023 **The John A. Stankovic Outstanding Research Award**, UVA CS Department, goes to 2-3 CS Ph.D. students who have demonstrated excellence in research during the academic year. Awarded $500.

Student Choice Best Research Award, UVA CS Research Symposium.

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

2019 **PhD Fellowship**, UVA CS.

2016 **Outstanding Undergraduate Thesis Award**, BUET CSE.

Service Awards

2022 **Outstanding Service Award**, UVA CS. Awarded $500.

Travel Grants

2024 Society of Women Engineers, to attend **SWE24**—the world's largest conference for women in engineering and technology, Chicago, IL.

2023 Computing Research Association **(CRA)**, to attend Grad Cohort, San Francisco, CA.

2020 Computing Research Association **(CRA)**, to attend Grad Cohort, New Orleans, LA.

2015 Grace Hopper Celebration of Women in Computing India **(GHCI)**, to travel and present research, Bangalore, India.

Undergraduate Academic Awards

2013-2014 Two-time **University Merit Award**, BUET.

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

2014 **Top Ten Database Project Award**, CSE, 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.
- Guest lectured at CS 4620 by Matthew Dwyer and CS6888: Program Analysis and its Applications by Sebastian Elbaum.

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.

- **Colin Henry** (CS, UVA). A 3rd year undergrad, working on the LLM-based test oracle generation research.
- **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 with their graduate school applications, Srikar is now pursuing Master's in CS at UVA, Eric is continuing his undergraduate study.
- Mentor at **BWCSE** (Bangladeshi Women in Computer Science and Engineering). Currently mentoring five undergraduate juniors and seniors in research and graduate school preparation.

Service

2024 **Conference and Journal Reviewer**

- **Reviewer**, ACM Transactions on Software Engineering and Methodology (**TOSEM**).
- **Program committee (research track)**, IEEE International Conference on Software Testing, Verification and Validation (**ICST**) 2024.

Service (continued)

2023 – 2024 **Conference Volunteer**

- **Recruiter**, SWE24, Chicago, IL (Oct 24–26, 2024). Assisted UVA Engineering with booth setup, recruiting during career fair, engaging with attendees, and networking with professionals to promote UVA's engineering programs.
- **Student volunteer**, ESEC/FSE 2023, San Francisco, CA (Dec 3-9, 2023). Assisted with registration, badge verification, presentation testing, A/V setup for talks, and event preparation.

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.
- Assisted the CS department with faculty recruitment and coordinated graduate student visits for several years.

2021 – 2022 **Community Volunteer**

- **Social chair**, Association of Bangladeshi Students (ABS) at UVA. Advocated for Bangladeshi students at UVA and coordinated events showcasing their culture and history to promote diversity.

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. Project: Leveraging LLMs to detect and repair bugs. **Published at FSE 2024.**
- Collaborated with AWS AI Labs. Project: Investigating LLMs' self-debugging and explanation capabilities in code generation. **Published at NeurIPS 2024.**

Applied Scientist Intern (summer'22), AWS CodeGuru

- Mentored by Antonio Filieri and Willem Visser. Project: Assessing state-of-the-art automated test oracle generation methods to evaluate their potential integration with the AWS CodeWhisperer tool. **Published at FSE 2023.**
- Project: 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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