

EDUCATION

- **Bachelor of Software Engineering, University of Waterloo** Waterloo, ON
Notable Courses: Machine Learning, AI, Performance, Databases, Operating Systems Sept. 2015 – May 2020

TECHNICAL SKILLS SUMMARY

- **Languages:** Python, SQL, Kusto, C#, C/C++, bash, Powershell, typescript, R, MATLAB, Java, HTML, javascript
- **Libraries/Frameworks:** Azure, Azure Batch, Azure OpenAI, Azure Data Factory (ADF), AzureML, OpenAI APIs, Fairseq, PyTorch, TensorFlow, Keras, scikit-learn, .NET, Docker, git, Grafana, GitHub Actions, OpenGL

WORK EXPERIENCE

- **Microsoft Corporation** Sep. 2020 - Present
Senior Research Scientist Redmond, WA
 - **Agentic AI for Software Engineering:** Built a novel architecture for incorporating reasoning models (OpenAI o1, o1-mini) and search into agentic approaches for software engineering tasks to achieve better performance on SWE-Bench-Lite.
 - **Performance Bug Detection:** Trained an ML model over CPU/Memory profiler traces to detect performance bottlenecks in C# and .NET applications in Azure. Currently in public preview as a feature called Code Optimizations in Application Insights in Azure Portal. Showcased at the VSLive! Conference (2021) and Microsoft Ignite (2023). GA announcement at Microsoft Ignite (2024)
 - **Performance Bug Fixing:** Developed several novel techniques to generate fixes for performance bugs automatically and built extensions and bots for VS Code (showcased at Ignite 2023), GitHub and Azure DevOps:
 - * *Retrieval:* Trained a semi-supervised Random Forest model to gather performance related PRs from Github repos. Used model to collect ~1350 PRs with a wide range of performance improvements. Developed a change recommendation technique by extending Facebook's existing code search technique, Aroma, by adding features capturing performance characteristics of a code snippet. More details in publication ④.
 - * *Finetuning:* Crawled the commit history of all C# repos with >5 stars on Github and generated examples with various file/class level contextual elements (import statements, class attributes, method signatures, etc.). Finetuned and hyperparameter-tuned BART (after pre-training on English & Code) for performance patch generation. More details in publication ②.
 - * *Prompt Engineering & Prompt-tuning:* Developed a novel prompt engineering technique using retrieval augmentation and turning code changes into instructions, to generate fixes targeting API-level performance issues. More details in publication ①.
 - * *Agentic Approaches:* Developed new ways to allow agents to solve performance problems by following the correct high-level trajectory and adding any necessary tools. This was demoed by Satya Nadella at Ignite'2024 during his keynote. (([Demo Video](#))).
 - Worked on a VSCode extension combining bug detection and recommendations in Azure Portal and code-level fixing as a chat experience in the IDE. Demoed at Microsoft //Build (2024) (([Demo Video](#))).
 - Conducted interviews with internal and external customers to validate bug detection and fix models as well as tool experience / UI. Other unpublished modelling work like building models to generate benchmark tests, personalized perf fix text recommendations, etc. for .NET applications.
- **Microsoft Corporation** Sep. 2019 - Dec. 2019
Data Science Intern Redmond, WA
 - **Frequent Snippet Extraction from Telemetry:** Extracted short scripts a.k.a snippets of Azure CLI commands from usage telemetry by splitting it into individual usage sessions and finding frequent n-grams of successful commands, to generate concise and intuitive snippets.
 - **Human Language to Snippet Search:** Used FastText embeddings and Azure documentation to resolve out of vocab (OoV) words, fix typos, perform query expansion, etc. in an incoming query. Developed a novel code search technique using the tree-like hierarchy of Azure CLI commands to translate human language queries to snippets of Azure CLI.

- **Snippets Extension for Visual Studio Code:** Wrote a VS Code extension demonstrating the snippet search approach ([Demo Video](#)) using Python, Flask and typescript; demoed at Microsoft Azure+AI Conference (2019).

• Microsoft Corporation

Jan. 2019 - Apr. 2019

Software Engineer Intern

Redmond, WA

- **Azure CLI Command Example Generation:** Built an AI project to generate examples for Azure-CLI documentation. Generated example templates with the most widely used command and parameter combinations in telemetry. Scraped CLI examples from StackOverflow, GitHub Issues, Blogs, etc. and extracted parameter values to reduce placeholders (instances where we can't generate values for a parameter) in generated examples by >55%.
- **Parameter Type Classifier:** Trained a machine learning model using Random Forest and GloVe embeddings (trained on Azure documentation) to classify command parameters into underlying types (e.g. String, Integer, File-path, IP Address, etc.) and used it to further improve example quality by ensuring type-accurate values are selected during example generation. Pipelined the entire process of data collection, feature engineering and model training and deployment.
- **Automatic Example Submission Pipeline:** Wrote a pipeline to automate example validation and submission of PRs containing new examples to Azure-CLI GitHub repo and Azure Docs. Used this pipeline to add examples to the documentation of high-impact Azure CLI modules that receive >96% global user request share.
- For more details refer to publication ②.

• Microsoft Corporation

May. 2018 - Aug. 2018

Software Development Engineer Intern

Vancouver, BC

- **Streaming Install Feature:** Implemented streaming install for Gears of War 5 on Xbox using C++, Windows Runtime Library and Xbox XDK. This feature allows users to play the game as it installs.
- **DLC Install Pipeline:** Implemented Downloadable Content (DLC) installation pipeline for the game using Concurrency Runtime and Xbox API.

• Capcom Vancouver

Sep. 2017 - Dec. 2017

Software Engineer

Vancouver, BC

- **Remote Build Tool:** Developed a command line tool to trigger remote builds using Python and TeamCity and integrated it into project's build system and Perforce.
- Performed tasks like parallelizing build scripts, writing smoketests and collecting build statistics for analysis.

• Next Level Games Inc.

Jan. 2017 - Apr. 2017

Rendering Programmer

Vancouver, BC

- **Material Editor Tool:** Worked on a material editor tool using C# and .NET. Implemented various features such as the ability to open multiple tabs at once, file search, joystick control within viewport, etc.
- **Graphics Regression Detection Tool:** Built a web-based image comparison tool to visualize game's screenshot comparison data using Mako, Python, HTML and javascript. Implemented a scalable, well-documented solution to enable engineers to easily detect graphics regressions after each build.

PATENTS AND PUBLICATIONS (COMPLETE LIST ON WEBSITE)

- Dhruv Gautam, Spandan Garg, Jinu Jang, Roshanak Zilouchian Moghaddam, Neel Sundaresan. 2023. RefactorBench: Evaluating Stateful Reasoning in Language Agents Through Code. In *Proceedings of the 38th NeurIPS 2024 Workshop Open-World Agents (OWA'2024)*.
- Spandan Garg, Roshanak Zilouchian Moghaddam, and Neel Sundaresan. 2023. RAPGen: An Approach for Fixing Code Inefficiencies in Zero-Shot. <https://doi.org/10.48550/arXiv.2306.17077>. (In Review) ①
- Spandan Garg, Roshanak Zilouchian Moghaddam, Colin B. Clement, Neel Sundaresan and Chen Wu. 2022. DeepDev-PERF: A Deep Learning-Based Approach for Improving Software Performance. In *Proceedings of the 30th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE'2022)*. ②
- Roshanak Zilouchian Moghaddam, Spandan Garg, Colin B. Clement, Yevhen Mohylevskyy, and Neel Sundaresan. 2022. Generating Examples from CLI Usage: Can Transformers Help?. In *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD'2022)*. ③
- Spandan Garg, Colin Clement, Shengyu Fu, Dongjiang You, Roshanak Zilouchian Moghaddam, and Neel Sundaresan. 2023. Customized Prompt Generation Service For Software Engineering Tasks (Patent filed).
- Spandan Garg, Roshanak Zilouchian Moghaddam, and Neel Sundaresan. 2023. Performance Bug Repair Via Retrieval Augmented Neural Code Generation Model (Patent filed).

- Spandan Garg, Paul Harrington, Roshanak Zilouchian Moghaddam, Chen Wu and Neel Sundaresan. 2021. System and Method for Identifying Performance Bottlenecks (Patent filed).
- Spandan Garg, Roshanak Zilouchian Moghaddam, Chen Wu, and Neel Sundaresan. 2021. PerfLens: A Data-driven Performance Bug Detection and Fix Platform. In *Proceedings of the 10th ACM SIGPLAN International Workshop on the State of the Art in Program Analysis (SOAP'2021)*. ④
- Spandan Garg, Paul Harrington, Roshanak Zilouchian Moghaddam, and Chen Wu. 2021. Performance Bug Detection and Code Recommendation (Patent granted: #12135628).
- Spandan Garg, Roshanak Zilouchian Moghaddam, Yevhen Mohylevskyy and Jason Shaver. 2020. Command-line Script Generation with Relevance Search (Patent granted: #11436236).
- Spandan Garg, Roshanak Zilouchian Moghaddam, Jason Shaver and Neel Sundaresan. 2020. Machine Generated Examples of Command-line Commands with Parameter Values (Patent granted: #11640294).

SCHOLARSHIPS AND AWARDS

- **University of Waterloo, Department of Math:** Dean's Honours List
- **University of Waterloo, Department of Engineering:** Graduation with Distinction
- **University of Waterloo, Department of Engineering:** President's Scholarship
- **Alberta Education:** Alexander Rutherford Scholarship

HOBBIES: Sketching ([Link To Artwork](#)), Computer Graphics ([Link To Graphics Demos](#)), Running, Badminton