I would like to work on distributed systems because they present possibly the most difficult, and therefore the most interesting problems in the field of software engineering and system design. I believe that this program would give me an opportunity to contribute to this field under the supervision of highly regarded faculty and to develop my research skills as a result.

Research Background

My research experience started when I participated in the Junior Academy of Science contest for high-school students in Ukraine with a machine learning project that tried to predict the rating of an app in the App Store before its launch. After that, I started learning about Algorithms and Data Structures in depth. I completed 10 programming projects on different algorithmic topics, such as graph algorithms, data compression, and computational geometry.

I wanted to solidify my knowledge in this field and find people who were interested in this topic as well. So, during my first year of university, I started a programming club, where I gave lectures on the algorithms that I had learned before. This was an extremely valuable experience for me, as I realized the importance of communicating my ideas clearly and had an opportunity to practice this skill.

During my second year, I participated in a group project with Prof. Liudmila Omelchuk, where groups of students would develop different versions of an e-learning system. We used genetic algorithms to match students in learning groups based on their skillset and people that they want to be in a group with. I worked on this project as a full-stack developer and was responsible for designing the architecture of the project and the development of the web part of the app. Overall, the project was a success and the final reports were posted on the department's website**.**

I got my first experience with distributed systems while doing an internship at a blockchain company. At the job, I mostly used libraries that allowed me to communicate with blockchains without having to understand the details of how they work under the hood. I was curious about how developers maintain a distributed system where any bug might cause huge financial losses, so I studied software engineering practices that reduce the number of errors in code such as Test-Driven Development (TDD). I even conducted a small study to statistically prove that using TDD is beneficial to the quality of the produced code and did a talk at a local university conference about it.

The complexity of distributed systems intrigued me, and in the summer of 2022, I took part in a Summer Research program at the University of Toronto that gave me a chance to learn more about the theoretical aspects of such systems. I worked with Prof. Faith Ellen on the topic of consensus in distributed systems. Specifically, we focused on Byzantine Agreement, a version of consensus where processors might act maliciously. I’ve been working on this project in the fall term as well by studying the foundations of distributed computing and considering consensus algorithms in different models of computation. The project inspired me

to audit a graduate course called “Introduction to Distributed Computing” to gain even more knowledge about the field. While working on this research project, I’ve realized that besides being clear, it is also important to be extremely precise while defining theoretical models.

As a graduate student, I would like to work on distributed systems. Given my background in algorithms and data structures, software engineering and testing, I would like to work on creating new systems and speeding up existing ones. I’m also excited by the idea of working on security and formal verification of distributed systems. Projects that are related to blockchains and databases are of specific interest to me, although I’m open to working on other distributed systems as well.

Reasons for choosing this program

In my opinion, the University of Toronto’s program presents a great opportunity for me to learn the skills that an independent researcher needs: precisely define the problem that needs to be solved, conduct independent research, and clearly present the information to others. Moreover, from my experience being an exchange student at the University of Toronto, I know that the people here are pleasant to work with, which certainly is an asset for me when it comes to choosing a graduate school.

Given everything that I’ve stated above, I’d like to work with Prof. Fan Long because of his research on blockchain consensus and smart contract security. I’m also captivated by the research of Prof. Niv Dayan on improving the performance of NoSQL databases. Finally, I’d like to work with Prof. Azadeh Farzan because of her work on verification and security of distributed systems. That being said, I’m happy to work with other professors who would be interested in my application.