

Quoc Khanh Tran

Hanoi University of Science and Technology (HUST), Vietnam

Email: khanh.tq190085@sis.hust.edu.vn

Statement of Purpose - MPI-SWS Doctoral Program

I have recently completed my Bachelor's program at Hanoi University of Science and Technology (HUST). As my research experience has solidified my determination to pursue a research career – which originated from my feeling of fascination when gaining insights during my study – I am seeking opportunities for graduate study. I would like to be a researcher who is able to lead research in unexplored areas. With that goal in mind, I am applying for the Doctoral Program at Max Planck Institute for Software Systems (MPI-SWS).

My Bachelor's program at HUST is Data Science and Artificial Intelligence, in which an equivalence of 200 ECTS are Mathematics and Computer Science courses, such as Calculus, Algebra, Data Structures and Algorithms, and Machine Learning. HUST is among the top universities in Vietnam and was ranked 451-500 globally in Computer Science and Information Systems by QS World Ranking by Subject in 2024. Beyond coursework, I always proactively sought opportunities to expand my knowledge and experience. I have engaged in research, worked as a teaching assistant, and participated in a summer school and several seminars. My Bachelor's study extended to five and a half years as I studied one exchange semester at Ostbayerische Technische Hochschule (OTH) Regensburg, Germany, and did a research internship at Singapore Institute of Manufacturing Technology (SIMTech).

At The International Research Center for Artificial Intelligence (BK.AI), HUST, I am currently working as a research student on a computer vision research project, aiming to address the data imbalance in plasmodium development stage classification by employing multi-domain learning methods to take advantage of other public datasets. It was also my Bachelor's thesis, which achieved the highest grade at the Computer Vision Thesis Defense Committee, Winter 2024 Semester. Prior to this research, I had worked as a research intern at SIMTech on modeling Singapore e-waste collection system and recycling behaviors using Agent-Based Modeling. The project resulted in a publication at the 32nd CIRP Conference on Life Cycle Engineering.

Engaging in these research projects has deepened my understanding of the research methodology and has solidified my theoretical foundations with practical application. Previously, I used to struggle with long-term projects, because I often concentrated only on techniques to solve specific tasks while overlooking the importance of having a well-defined plan to guide research. Through hands-on research experience – from problem identification and research planning to findings communication – I have learned to see specific tasks with their connection to the research plan and keep a broad perspective on the project as a whole. Besides, the meaning of theoretical concepts that seemed abstract to fully understand, such as vector and matrix in Algebra, and agent and environment in Reinforcement Learning, became clear to grasp with their practical relevance.

Seeing firsthand how the foundation was applied to the real-world application, I have come to appreciate the importance of having a strong foundational knowledge. Additionally, I found that scientific communication is also an important skill through my research experiences and my role as a teaching assistant. Explaining ideas and concepts to others clarifies my thoughts and deepens my understanding of the subjects. The individually specialized coursework and teaching requirement provided at MPI-SWS is an opportunity to complement my prior knowledge and improve my communication skills.

At this stage, a research area at MPI-SWS that aligns with my interest is the Social and Information System. I am particularly interested in utilizing computational methods to analyze and derive insights from phenomena in complex social systems, such as how knowledge disseminates, social behaviors form, and collective intelligence emerges through individual collaboration and competition. A faculty member at MPI-SWS I find inspiring to work with is Dr. Goran Radanovic, who leads the Multi-Agent System group. Given my research experience working on modeling the e-waste collection system, the idea of considering sequential decision making and environment shifts in complex systems with multiple self-interested agents to enhance overall objectives fascinates me.

While having an initial research interest is essential, engaging in multiple research groups is equally important to assess my initial interest, make a well-informed decision about my research direction, and ensure a good fit with the chosen advisor. Furthermore, given the importance of interdisciplinary collaboration in research, gaining expertise across multiple areas will be invaluable for both my study and future career. The preparatory phase at MPI-SWS allows me to get involved in different research groups to achieve these objectives.

Another reason I would like to pursue graduate study at MPI-SWS is its support system. As a student from a low-income background and the first in my family to pursue graduate study, I understand the challenges underrepresented students have to face in academia, such as financial constraints, lack of mentorship, and limited networking opportunities. Applying for the institute's doctoral program, I seek financial stability to fully concentrate on my studies, along with academic support to shape my academic career path. In addition, the inclusive and vibrant community at MPI-SWS will provide networking opportunities and role models, positively influencing my personal and professional growth.

From my study and research experience, I am aware that graduate study is both a demanding and transformative journey. Yet, I am confident in my ability to complete the Doctoral Program at Max Planck Institute for Software Systems. It is not because I anticipate a straightforward path, but because the qualities I have cultivated through research – the dedication to making meaningful contributions, the patience and self-discipline for steady progress, the perseverance to overcome challenges, and an open mind for new knowledge – will support my academic journey.