I am applying for the computer science master's degree at the University of Bonn to fortify my great interest in Artificial Intelligence and IT-Security through a disciplined research program.

Until July 2023, I am enrolled in the Computer Science Bachelor program at the Islamic University in Lebanon (IUL). In my thesis, I develop a session-based recommendation system to predict the next item to be purchased in online shops. Since the datasets are multilingual, I resort to state-of-the-art papers to learn about the newest techniques used for recommendation systems and transfer learning. Although understanding the first paper was challenging, it turned out that it was a very rewarding task to dissect such complex writing and re-implement useful parts. Thanks to the strong theoretical base offered by the undergraduate curriculum at IUL, I am equipped with the best knowledge to understand the math behind the algorithms.

The undergraduate curriculum at IUL can be split into three parts. First, it familiarizes students with basic mathematics and computer science lectures, such as linear Algebra, probability, and logic design. Second, it focuses on the latest web development frameworks, e.g. React and MongoDB, to meet the market needs in Lebanon. In each of these courses, I deliver individually or within a team at least two projects during the semester. Last and most importantly, the curriculum covers one Machine Learning (ML) and one Artificial Intelligence (AI) module. In those courses, I learned about some ML algorithms and processes. In addition, I worked on hands-on projects, such as implementing an automatic plant watering predictor using sensors. My interest in this area was so big that I took additional online ML courses to broaden my knowledge after the third semester. Moreover, I tracked and attended every single workshop about ML and AI in the whole of Lebanon. Unfortunately, these became a rarity, especially after the Lebanese economic crisis in 2019 and the explosion in 2020, which coincided with Covid19 repercussions. Therefore, the University of Bonn is the optimal place to compensate for this shortage since it offers a myriad of modules in my favorite tracks, Intelligent Systems and Information and Communication Management.

In parallel to my full-time study program, I work part-time (20 hours/week) as a Backend developer at Salem Group, a software company based in Beirut. In this role, I design software engineering diagrams for applications and implement their whole backend using Node.js frameworks. Besides, I am gaining social experience by working with peers on projects, speaking to clients, and enhancing my presentation skills. Although I like my current job, I enjoy working on a research project more because it is more impactful, and mind-challenging. This is why I am applying to a research master's that could merge my passion for research while studying and working through funding projects.

I was introduced to research even before I entered university. A key motivator and role model for me is my uncle who studied medicine 25 years ago at the University of Göttingen, and became a professor of cardiac surgery at the university hospital in Frankfurt am Main in 2019. He moved with his team to the heart center in Siegburg, and later on to the university hospital of Bonn, department of cardiac surgery. In parallel to his operational and clinical work, he teaches at the universities of Bonn, Wuppertal, Witten/Herdecke, and Frankfurt. My uncle is the biggest supporter in the family when it comes to studying, science, and research. Through his research,

he achieved a lower mortality rate especially with patients having greed vessels disease by lowering the body temperature during the operation from 37 to 28 degrees, thus, impacting thousands of people's lives around the world. He also supported my cousin, Siba Mohsen, who studied Bachelor and Master of Computer Science in Germany. Siba completed her master's studies at the University in Bonn (2019-2022). She is since June 2022 a Ph.D. candidate at the TU Dortmund in the AI unit. She has been mentoring me since I entered university by providing me with additional projects, modules, and courses that would make the application-based mode of study in Lebanon qualify to meet the German standards of study. With her guidance, I accomplished several ML projects, the last one being the recommendation system in my thesis. Looking into the lifestyle of my uncle and Siba, I am working on leveling up my own life through education, because I notice that research increased their opportunities in life personally, socially, and in their careers.

Since I am working on recommendation systems, research on tree mining and knowledge graphs are of great concern to me. I nominate Dr. Pascal Welke and M.Sc. Till Schulz within the group of Prof. Wrobel, and M.Sc. Farshad Bakhshandegan Moghaddam within the Smart Data Analytics group, to be potential supervisors. In their paper “Graph Filtration Kernels”, Schultz et. al (2022) introduced a new graph kernel using graph filtrations which consist of preserving the set of vertices in a graph while gradually adding the edges according to a predefined order on links. This stepwise update tracks the appearance of special features, and how many graph filtrations they survive (feature persistence). As a result, checking graph isomorphism can be done sequentially on appearance intervals by calculating Wasserstein distance on filtration histograms rather than counting the node frequency on whole graphs. This property demonstrates expressiveness, especially in the case of the Weisfeiler-Lehman isomorphism check based on which more powerful graph neural networks can be constructed.

I am looking forward to a positive response.

Yours faithfully,

Joumana Makki