In the field of photonics, I see an intricate and fast-growing research field, yet what truly excites me is the opportunity to make a meaningful impact on the world.

Last year, when I worked as Chip Product Engineer at Texas Instruments (TI), I was responsible for the research of next-generation automated validation technologies for Digital Light Processing (DLP) system[1]. The DLP system consists of the DLP controller (DLPC) chip and the Digital Micromirror Device (DMD), widely used in 3D vision inspection, and 3D scanning. To validate and optimize the system, I learned to use a communication monitor to capture and monitor the accuracy and speed of the DLPC digital signals. Additionally, I utilized a spectrometer to analyze the wavelength range of the DMD output light and compare the actual color gamut with the theoretical color gamut defined by the sRGB standard. Due to my excellent work efficiency and performance, I was invited to participate in the in-depth research and development of the new program design in Dallas, U.S with the core design team in TI for about 3 months.

This work made me deeply learn about the systematization of engineering practice and the high requirements in photonic embedded system work. We needed to pay attention to the failure rate to seven decimal places and the strict standards of every test data. The working experience in this leading company in semiconductor provides me with a benchmark for my future study and design. Also, my hands-on skills and scientific research ability have been highly improved. More importantly, I have gained a deep appreciation for the joy of studying photonic systems and made me deeply learn about the systematization of engineering practice and the high requirements through my work. I am fascinated by the near-miraculous ability of even the tiniest DMD to scan and accurately recreate 3D space[2]. This technology holds tremendous promise for transforming not only our daily lives and work but also the field of scientific research. However, due to its high cost and system complexity, there are still limitations and room for improvement in its development.

With the goal of gaining an in-depth understanding of the complex design of photonics embedded system, I have started my master's study at The Hong Kong University of Science and Technology in Electronic and Computing Engineering Department. Through courses such as "Photonics Technology and Applications," I have acquired a profound understanding of the fundamentals of photonics, geometric and wave optics, etc. I have also acquired proficiency in using OSLO to simulate the behavior of optical components and perform system-level optical design. Recognizing the crucial role of algorithms in designing optical control system, I have joined the OPTICS (Optical/Photonic Technology for Interconnected Computing System) Lab under the guidance of Professor Xu Jiang and Professor Zhang Wei. Here, I am focusing on optimizing the algorithm of A* and simulated annealing for integrated circuit system via deep learning toolkits, including simulation algorithms with Pytorch, and minimum spanning tree algorithm. This experience has provided me with a preliminary understanding of embedded systems. More importantly, I have learned to utilize deep learning frameworks to optimize system architecture. I believe that the experiences gained during my previous Master of Science studies will lay a robust foundation for my future research endeavors in the field of photonics.

My dedication to optimizing system and algorithm designs has been unwavering, and I have also conducted research on optimizing RF systems, particularly focusing on the interference caused by passive intermodulation (PIM) in communication systems. During my undergraduate studies at Southwest Jiaotong University, where I majored in Electrical Engineering, I used to head my study group to study the passive intermodulation phenomenon that widely exists in RF communication systems. Following a series of experiments, we came to study the results, summarized the characteristics of existing mathematical models, used Matlab and Origin to analyze the experimental objects and modelled the behavior of passive intermodulation interference. After 184 sorts of modelling and over 1.2 million iterations, we finally obtained two optimal mathematical models suitable for different situations with a recognition accuracy of over 95%[3]. It was a complicated process to put forward new models. Although my director and I experienced many unexpected difficulties, I was so excited that our research paper was accepted by SCI journal and won the Best Graduation Thesis in the school (The only 1 in the major, 2% in the University). This experience enriched my scientific research experience, propelled me to think systematically, and most importantly, improved my ability to deal with complex and refined experimental data.

My previous training and research experiences have prepared me well for my future research studies. I have already published two academic papers and one national patent. Additionally, there is one journal paper and one conference paper currently under review (please refer to my "Qualifications currently being taken" section for details).

However, realizing the need for a stronger foundation in photonics embedded system design, I recognized that pursuing further studies through Master of Research (MRes) would be crucial in realizing my dream of making a profound impact on the world through optoelectronic systems. My first aim in MRes is to deepen my understanding of photonics technologies and electronic engineering, enabling me to excel in the field of optical or photonic system design, development, and optimization. Furthermore, I am also interested in selecting "Integrated photonics for automotive LIDAR" as my experimental project, which would allow me to leverage my prior academic experience about DLPC and machine learning on the subject matter. Until recently, LiDAR systems used rotating optical transmitters and receivers to capture a scene, which limited the imaging frame rate and resolution, and required large physical space [4]. I hope to develop a more intelligent LiDAR system to address this issue with deep learning-based object detection and tracking algorithms. I aspire to continue with the relevant research after the completion of my MRes studies and pursue a 3-year PhD program. My passion for exploring ways to optimize photonics embedded system is what has driven me towards this field and motivates me to continue to deepen my knowledge and skills.

The Centre for Doctoral Training in Photonic and Electronic Systems (CEPS CDT) is my first choice primarily due to its esteemed faculty members. The opportunity to engage in academic discussions and research on integrated photonic system with the most distinguished professors from Cambridge and UCL is truly enticing. The second reason is that I could have a full year to diligently establish a solid foundation in my knowledge of optics, which is crucial for my future research. Besides, I could have the opportunity to conduct experiments using state-of-the-art facilities in cutting-edge laboratories, e.g. the laboratories for optical, high speed, RF and THz measurements. The most important reason I chose CEPS CDT is because I was deeply moved by the words of Professor Cyril Renaud, he said, "If you really want to change the world, then study with us". I hope to have the opportunity to join CEPS CDT and fulfill my aspirations.

After my PhD, I am not sure whether I will go to the industry or academia, but I am convinced that I want to make a difference in the world. Upon graduation, I aim to select the path that enables me to utilize the expertise I have gained and make a positive impact on as many people as possible, striving to contribute to the betterment of society through my work.

[1]. Texas Instruments. (2019). DLPC350 DLP® Digital Controller for DLP4500 and DLP4500NIR DMDs (Rev. F). Retrieved Date, 2019, from https://www.ti.com/lit/gpn/dlpc350

[2]. Texas Instruments. (2022). DLP System Design: Brightness Requirements and Tradeoffs (Rev. C). Retrieved Date, 2022, from https://www.ti.com/lit/pdf/dlpa068

[3]. Song, M., & Jin, Q. (2022). High-precision mathematical modelling of passive intermodulation in connectors. Electronics Letters, 58(15), 585-587.

[4]. Kim, I., Martins, R. J., Jang, J., Badloe, T., Khadir, S., Jung, H. Y., ... & Rho, J. (2021). Nanophotonics for light detection and ranging technology. Nature nanotechnology, 16(5), 508-524.