Lingyu Gong

Binary Hub, Bonham Street, Dublin 08, Ireland

[gongl@tcd.ie](mailto:gongl@tcd.ie)

(+353) 0873323259

28/June/2024

Dr. Rubén Salvador

Inria - IRISA, CentraleSupélec

Rennes, France

Motivation Letter - Application for the PhD Positions on Deep Learning Hardware Security at IETR - IRISA/Inria in Rennes

Dear Dr. Salvador,

Following an exhaustive examination of the description for the "PhD positions on Deep Learning Hardware Security at IETR - IRISA/Inria in Rennes, I am persuaded that this programme aligns well with my academic interests and career objectives, and incites a profound desire for investigation. Thus, the following section provides a detailed account of my accumulated knowledge and skills in FPGA and AI, along with a rationale for my suitability for this programme.

Throughout my undergraduate studies, I acquired a comprehensive understanding of the essential principles and practical applications of FPGA design through the courses *Principles of Computer Composition*, *EDA Understanding and Practice*, and *Digital Logic Circuits*. In the *Principles of Computer Composition* course, I not only designed single-cycle and multi-cycle CPUs but also successfully implemented a pipelined CPU with seven instruction sets in my project. In this process, I was able to demonstrate proficiency in the use of specialized tools, including Logisim and Verilog, which were indicative of a firm grasp of the principles of hardware description language and digital system design. In terms of *EDA Understanding and Practice*, I utilised QuartusII software to bridge the gap between theoretical knowledge and practical application, designing and implementing a comprehensive Snake game. This project tested my ability to programme FPGAs and provided me with an in-depth understanding of the implementation of the VGA interface, which further expanded my technical knowledge. Regarding my studies in *Digital Logic Circuits*, I comprehensively understood the principles governing digital circuits and conducted circuit design simulations utilising NI Multisim software. Additionally, I engaged directly in the practical aspects of circuit board construction and debugging, which significantly enhanced my proficiency in hands-on tasks and problem-solving techniques.

During my master's degree, I undertook a study of the core principles and techniques of deep learning in the course " Deep Learning And It’s Applications". At that time, a series of well-designed experiments, including linear regression, logistic regression, binary classification, multi-classification, feed-forward neural networks for image classification, and convolutional neural networks, among others, enabled me to gradually construct a robust AI knowledge system. In particular, my final project focused on "Tumor Segmentation and Classification", which required the use of ultrasound scan data to identify and locate tumors accurately. To this end, I successfully constructed a model that can accurately predict the type of tumor (benign, malignant, or normal) in the scan results and segment the tumor region in the MRI scan images in the presence of a tumor. This resulted in an F1 score of 0.89, which was a clear indication of my strength and potential in AI applications.

My master's thesis, "Enhancing On-Chip Network Predictions With Advanced AI Techniques", represents a further deepening of my research in the area of combining AI and hardware, driven by my keen interest in AI. The objective is to leverage advanced AI techniques to enhance the precision and efficacy of key parameter prediction in Network-on-Chip (NoC). In this research, I have not only mastered the entire process, from the generation of simulation data to the training and evaluation of models, but I have also examined the significant potential of AI techniques in the design optimization of complex hardware systems through the practical application of linear regression models.

In light of the foregoing, I possess a robust foundation in FPGA design and programming, complemented by extensive learning and practical experience in AI. My research experience in the integration of AI and hardware systems, exemplified by my work on network-on-chip (NoC) technology, renders me an ideal candidate for your PhD programme. Moreover, I am always passionate about exploring the unknown and eager to advance my knowledge in deep learning hardware security, especially innovative research at the intersection of FPGA and AI. I am confident that the excellent research environment at your university will provide me with an ideal setting to pursue these interests.

I select your PhD programme because of its outstanding academic reputation, cutting-edge research facilities, and exceptional faculty. I am aware that your university is at the forefront of research in FPGA and offers a plethora of international collaboration opportunities that will facilitate the expansion of my academic horizons and the enhancement of my research capabilities. Through your PhD programme, I will be able to translate my skills and interests into tangible contributions to advance science and technology. Now, I am eagerly awaiting the opportunity to participate in your PhD programme, where I hope to contribute to the advancement of research in this cutting-edge field.

Thank you for spending time on reading my motivation letter. I am eager to have the chance to further discuss my application and demonstrate why I am an optimal candidate for your programme. Should you require further information or wish to schedule an interview, I would be happy to assist you.

I am grateful for your consideration and look forward to a favorable response.

Yours sincerely,

Lingyu Gong