Shangkun Li

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EDUCATION

Department of Physics, Fudan University, Shanghai, China   Sept. 2020 – Present

➢ B.E. in Physics, **Overall GPA: 3.77/4.0, Ranking: 4/131 (Top 3%),** Major GPA: 3.89/4.0

➢ Courses Taken: Introduction to Algorithms, Digital Design and Computer Architectures, Fundamentals of Digital Electronics, Introduction to Electronic Systems, Optics, Thermodynamics and Statistical Physics, Quantum Mechanics, etc.

Department of Electronic and Computer Engineering, HKUST, Hong Kong SAR, China   July. 2023 – Oct. 2023

➢ Research Intern in the Reconfigurable Computing Systems Lab (RCSL), Supervisor: Prof. Wei ZHANG

PRIZES AND AWARDS

➢ **National Scholarship (Top 1%, Highest honor for undergraduates by the Chinese government),** Academic Year 2021-2022

➢ **Pacemaker to Merit Student (10 out of all undergraduates in Fudan University),** Academic Year 2021-2022

➢ **The First Prize Scholarship (Top 3%),** Academic Year 2020-2021

➢ **Grand Prize** of the 12th China Undergraduate Physics Tournament **(Ranking 2nd in China),** Aug. 2021

➢ Scholarship for Outstanding Academic Performance, Academic Year 2021-2022

➢ Excellent Student Cadre, Academic Year 2020-2021

➢ Merit Student, Academic Year 2020-2021

➢ Third Prize of the 8th China Undergraduate Physics Experiment Competition, Dec. 2022,

RESEARCH EXPERIENCES

Design Space Exploration (DSE) on Coarse-Grained Reconfigurable Arrays (CGRA)   July. 2023 – Nov. 2023

Research Intern, Advisor: Prof. Wei ZHANG, the Reconfigurable Computing Systems Lab, HKUST

➢ Conducted extensive research on CGRA architecture design and proposed a hybrid-granularity CGRA architecture DSE scheme.

➢ Proposed a multi-grained DSE scheme by combining the design of processing elements (PE), interconnections, memory, and the overall layout of the CGRA, aiming to achieve a more efficient and power-efficient CGRA architecture.

Floorplan-Aware Analytical Directive Optimization for HLS Designs on Multi-Die FPGAs   July. 2023 – Nov. 2023

Research Intern, Advisor: Prof. Wei ZHANG, Reconfigurable Computing Systems Lab (RCSL), HKUST

➢ Proposed a scheme to co-optimized the directives and floorplan of HLS designs on multi-die FPGAs, including the directive-floorplan co-search based on bin-packing variants and the iterative optimization flow, which enhanced the timing issues caused by die-boundaries.

➢ Optimized the analytical QoR (quality of result) model and incorporated 5 different BRAM (Block RAM) configuration modes and one URAM (Ultra RAM) configuration mode into the analytical model, resulting in improved resource estimation accuracy and faster execution time (5.73X faster).

➢ Journal under review **(Invited by ACM TRETS)** Linfeng Du, Tingyuan Liang, Xiaofeng Zhou, Jinming Ge, **Shangkun Li**, Sharad Sinha, Jieru Zhao, Zhiyao Xie, and Wei Zhang. 2023. FADO 2.0: Floorplan-Aware Analytical Directive Optimization for High-Level Synthesis Designs on Multi-Die FPGAs

TRAM: An Open-Source Template-based Reconfigurable Architecture Modeling Framework   Jan. 2023 – June. 2023

Research Assistant, Advisor: Prof. Lingli Wang, Deputy Director of EDA Research Institute, Fudan University

➢ Developed a template-based Coarse-Grained Reconfigurable Architecture that seamlessly integrates Chisel-based CGRA modeling, Verilog generation, dataflow graph mapping, simulation and verification. This comprehensive integration empowers agile design for modern CGRAs, enabling higher resource utilization and efficiency.

➢ Optimized the divider in TRAM by combining the Goldschmidt Division Algorithm with pipelining, allowing us to achieve 32-bit division operations within 5 cycles while ensuring accuracy and increasing in throughput.

Enhancing HLS Tool Capabilities for Recursive Semantics based on MLIR　　　　Aug. 2022 – Dec. 2022

Research Assistant, Advisor: Prof. Lingli Wang, Deputy Director of EDA Research Institute, Fudan University

➢ Proposed a scheme to enable HLS tools support recursive semantics. For C/C++, we firstly divide each recursive function into several parts according to the location of the recursive statement, then create a structure, which contains data, state and other variables. Replace the recursive call operation with some stack operations based on the defined structure, and replace the code block before or after the recursive call statement with loop statements and conditional branching statements.

➢ Conducted an investigation on the toolchain, including Clang LibTooling, LLVM and MLIR. Considering scalability and ease of use, we ultimately chose MLIR as the development toolchain.

➢ Completed the iterative unfolding of 3 recursive benchmarks at the MLIR level.

Intelligent Obstacle Avoidance Car based on Raspberry Pi　　　　Mar. 2021 – June. 2021

Team Member, Advisor: Prof. Yajie Qin, School of Information Science and Engineering, Fudan University

➢ Constructed an intelligent obstacle avoidance car based on image recognition.

➢ Took Raspberry Pi as the platform and utilized the Python OpenCV library to capture camera content and process video streams for image feature extraction and analysis. The mobilenet v2 architecture (based on CNN) was employed to train our model, enabling it to recognize objects within the input images. Further, to achieve multi-process parallel computing, we optimized the code using the Python multiprocessing library.

➢ Achieved an intelligent obstacle avoidance by integrating above components with specific control strategies for the car.

Grand Prize of the 12th China Undergraduate Physics Tournament (Ranking 2nd in China)　　July. 2021 – Sept. 2021

Team Member, Advisor: Yongkang Le, Director of Physics Teaching Experiment Center, Fudan University

➢ Designed a ferromagnetic sensor and developed a theoretical model to analyze the parameters influencing the sensor's accuracy. By improving the self-exciting magnetic field and the induction circuits of the sensor, we were able to detect ferromagnetic objects as small as 2mm in size.

➢ Designed a hot wire anemometer for measuring air velocity. Firstly, by analyzing the impacts of heat conduction, convective heat transfer, and thermal radiation on coil cooling, we established a theoretical model that semi-quantitatively described the relationship between coil temperature and the air velocity passing through the coil. Subsequently, we optimized the model based on extensive experiments. As a result, the accuracy of the sensor was achieved within 8%.

LEADERSHIP AND ACTIVITIES

Academic and Innovation Department, Student Union, Department of Physics | **Director**　　　Sept. 2021 – Sept. 2022

➢ Recognized as the Outstanding Student Leadership at Fudan University

➢ Organized the defense of the Xiyuan Project and the Introduction Meeting for the Lab in Physics

➢ Planned and organized scientific software training courses, including MATLAB, Python, Mathematica, and COMSOL

➢ Planned and organized a physics knowledge competition for students

The Science Debate Club | Vice President　　　Sept. 2021 – Sept. 2022

➢ Responsible for organizing various research skills training courses for the Department of Physics

Tengfei School, Fudan University | Teaching Assistant　　　Aug. – Oct. 2021 & Aug. – Oct. 2022 & Aug. – Sept. 2023

➢ Tutoring bachelor students in Mathematical Analysis, C Program Design, and General Physics

SKILLS

➢ Basic program management skills: git

➢ Programming Languages/Software: C/C++, Python, Scala (Chisel), Verilog, LLVM, MLIR, Mathematica, COMSOL, LaTeX

➢ Office Applications: Microsoft Office, Photoshop, Premiere Pro

➢ Languages: Chinese, English