Hao (Mark) Chen

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EDUCATION

Imperial College London
MEng in Computing *Oct 2020 – June 2024*

- **CS Modules**: Custom Computing, Advanced Computer Architecture, Computer Vision, Robotics, Computer System, Operating System, Algorithm Design and Analysis, Compiler, Network and Communication,
- **Math Modules**: Linear Algebra, Probability and Stats, Operation Research
- **GPA**: 87.40%(Year 1), 82.62%(Year 2), 84.60%(Year 3)

RESEARCH

AutoBayes: Fast Uncertainty Estimation using Bayesian Neural Network on FPGA
Imperial College London *July 2022 – Aug 2023*

- Built an automatic tool to transform traditional Neural Networks to Bayesian Neural Networks(BNNs) using Monte-Carlo Dropout(MCD) in Keras framework; extended hls4ml to generate fast and power-efficient Bayesian hardware design for Xilinx FPGA from BNNs
- Developed a transformation framework involving four phases for multi-exit MCD-based BNNs: optimizing architecture, spatial and temporal mapping optimization, algorithm-hardware co-design, and HLS-based hardware accelerator generation; this framework systematically and effectively explores the design space of multi-exit MCD-based BNNs implementation
- Proposed multi-exit MCD-based BayesNNs as a solution to address limitations in both multi-exit and MCD-based approaches; combining the benefits of deep ensembles and MCD methods to achieve improved predictive power and uncertainty quantification, overcoming issues related to calibration and predictive output flexibility
- Implemented multi-exit mask-based Bayesian Neural Network transformation, inspired by Masksembles, to enhance the multi-exit MCD-based Bayesian Neural Network approach; utilizing pre-defined dropout masks on a shared single DNN reduced memory overhead as compared to deep ensembles, and controlled overlap and correlation among masks achieves similar algorithmic performance as traditional deep ensembles

Deep QLearning Scheduler to Enhance Task Placement in Fog Computing
Imperial College London *March 2023 – June 2023*

- Implemented the Deep QLearning Scheduler algorithm for container migration in Fog Computing (FC) environments, proposed by the paper *Migration Modeling and Learning Algorithms for Containers in Fog Computing*
- Integrated the Deep QLearning algorithm into the COSCO (Container Orchestration Using Co-Simulation and Gradient Based Optimization for Fog Computing Environments) framework, enabling intelligent task placement and management in large-scale fog platforms; used the simulator to obtain environmental rewards and make migration decisions

Web-based AI System for Medical Image Segmentation
Imperial College London *Oct 2022 – Jan 2023*

- Implemented a web-based GUI application that seamlessly integrates all necessary components for deep learning workflows, facilitating the automatic segmentation of brain tumors from complex MRI scans; developed RESTful API for machine learning operations like training, evaluation, and inference
- Supported integration with XNAT servers and provided powerful visualization tools for interpreting and characterizing tumor data, promising enhanced tumor characterization and diagnosis in the medical field

PUBLICATION

1. Hongxiang Fan*, **Hao (Mark) Chen***, Liam Castelli, Martin Ferianc, Zehuan Zhang, Wayne Luk. Algorithm and Hardware Co-Design for Multi-Exit Masked Bayesian Deep Ensembles. Manuscript in preparation for *2023 The IEEE TRANSACTIONS ON COMPUTER-AIDED DESIGN OF INTEGRATED CIRCUITS AND SYSTEMS (TCAD).*

2. Hongxiang Fan, **Hao (Mark) Chen**, Liam Castelli, Zhiqiang Que, He Li, Kenneth Long, Wayne Luk. When Monte-Carlo Dropout Meets Multi-Exit: Optimizing Bayesian Neural Networks on FPGA. Accepted by *2023 Design Automation Conference (DAC)*.
3. **Hao (Mark) Chen***, Taowen Liu*, Songyun Hu, Leyang Yu, Yiqi Li, Sihan Tao, Jacqueline Lee, Ahmed E. Fetit. Web-based AI System for Medical Image Segmentation. Accepted by *2023 Medical Image Understanding and Analysis (MIUA)*.

INDUSTRIAL EXPERIENCE

Qube RT
Quantative Technologist Intern, UK *March 2023 – Sep 2023*

- Developed a C++ monitoring system for thread pool performance, utilizing the blink protocol for data serialization and publishing to other services; integrated Prometheus Database and Grafana to visualize and analyze performance statistics.
- Created a service within the low-latency trading platform responsible for aggregating performance statistics and publishing them at regular intervals; achieved persistence of the statistics by utilizing ODB (Object-Relational Mapping library) and PostgreSql database

Huawei Technologies Research & Development
Graphics Modelling Intern, UK *March 2022 – Sep 2022*

- Built an application using Jinja template engine to deserialize specification in xml and json format to C++ structures, functions, and definitions as a part of the graphics api; completed a profile generator to produce valid graphics api profiles from given schema in json format using Python
- Wrote Python scripts to convert between xml and json files used for the API specification; used Flatbuffers to drive glTF sample generation efficiently

Ampere Computing Shanghai, China
Java Software Developer *June 2021 – Sep 2021*

- Developed open-source plugins for Jenkins, a leading CI/CD platform, using JAVA/JELLY; became the maintainer of Lucene Search Plugin, an open search tool plugin; fixed Out Of Memory Exception of Lucene Search Plugin when handling over 100 GB of data
- Improved the indexing speed of Lucene Search Plugin by more than 50% after structure optimization; enriched the searching option and added pagination

Imperial College London London, UK
Undergraduate Teaching Assistant *Oct 2021 – Present*

- Helped first-year undergraduates with their weekly programming tutorials in lab sessions; mainly helped with three programming languages: Haskell, Kotlin, and Java
- Answered questions posted by first-year undergraduates on EdStem regarding the programming course

AWARDS

- **Dean's List(Year 3)**, Imperial College London, July 2023
- **Dean's List(Year 2)**, Imperial College London, Aug 2022
- **Dean's List(Year 1)**, Imperial College London, Aug 2021
- **G-Research Ltd Prize**, G-Research Ltd, Aug 2021
- **Singapore SM1 Scholarship**, Ministry of Education Singapore, June 2015 – Dec 2019

SKILLS

- **Programming:** C++, C, Python, Scala, Java, Swift,Haskell, Bash
- **Tools:** GCC, Jenkins, Github, Docker, Heroku, AWS
- **Framework:** PyTorch, Keras, ODB, Kitura, Lucene, Jinja2
- **Language:** GRE - 333/340 + 5/6 (Verbal 163, Quantitative 170, Analytical Writing 5); TOEFL iBT 113/120 (Reading 30, Listening 29, Speaking 26, Writing 28)