LIANG, Kunchangtai (Rickey) | Mr

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Education

School of Informatics, University of Edinburgh **Edinburgh, UK**
*MSc **with Distinction** in Computer Science. Avg mark: **80.7%** (A=70%)* *Sep 2021 - Nov 2022*

- **Dissertation:** *Re-implementation and Optimization of a Scalable Spike Detection Algorithm for Large-Scale Extracellular Recordings*. Grade: **83% (A2)**. *Computer Science MSc Dissertation Prize*.

School of Electronics Engineering and Computer Science (EECS), Peking University **Beijing, China**
*BSc in Intelligence Science and Technology. Avg mark: **86.0%** (A=85%)* *Sep 2016 - Jul 2020*

- **Thesis:** *Research on Local Feature Extraction and Video Coding for Machines Based on Neural Networks*. Grade: **A**.

Research Interests

Causal Inference · Probabilistic Reasoning · Machine Learning · Explainability · Neuro-symbolic AI

Research & Work Experience

Machine Learning Group, Department of Computer Science, Saarland University **Edinburgh, UK**
Researcher. Topic: Causal inference *Nov 2024 - Present*
Supervisor: Prof Isabel Valera (personal homepage) (lab homepage)

- I've just started as a researcher aiming for a PhD degree, focusing on causal inference.
- The specific topics I plan to explore are discrete data and scalability for causal generative models.

Inst. for Adaptive and Neural Computation, Sch. of Informatics, Univ. of Edinburgh **Edinburgh, UK**
Research Assistant. Topic: Research on tractable probabilistic reasoning *Apr 2023 - May 2024*
Supervisor: Dr Antonio Vergari (personal homepage) (lab homepage)

- The research focused on circuits, a class of structured probabilistic models with constraints. We were interested in the tractability arising from the structural properties. My work was to combine circuits with another class of probabilistic models, energy-based models (EBM), which are more expressive and less tractable. The goal was to explore how tractability helps with EBM training and how structural constraints degrade performance.
- The work also included collaboration on the development of a comprehensive library for circuits. It was expected to include a symbolic representation for circuit transformations and an over-parameterized computational graph for fast and scalable tensorized training/inference. We designed the hierarchy of circuit classes and used PyTorch for tensor computations and training utilities. I was the major contributor of the current version.

IANC, School of Informatics, University of Edinburgh **Edinburgh, UK**
MSc Project. Topic: Spike detection for large-scale recordings *Feb 2022 - Aug 2022*
Supervisor: Prof Matthias H Hennig (personal homepage) (lab homepage)

- The first part of this MSc project aimed to re-implement a scalable spike detection algorithm, Herding Spikes, and integrate it into the modularized toolkit, SpikeInterface (SI). The detection part was split from the whole spike sorting pipeline, with the Python interface re-designed for SI integration. Cython was also used to improve the speed of the Python code and provide an interface for the C++ part.
- The rest of the project addressed optimizing the detection algorithm implementation in C++. Bottlenecks from profiling were eliminated to make full use of the CPU capabilities, and a parallel design was incorporated for multi-core machines, enabling real-time processing of neural recordings with the largest scale to date.

R&D Group, iFLYTEK Co., Ltd. **Hefei, China**
Intern. Topic: Scene text detection and OCR *Aug 2020 - Aug 2021*
Supervisor: Zhiguo Wang (company homepage)

- The internship targeted the detection of text boxes in scene photos, which might include different textures and get deformed due to projection. The focus was to improve an existing single-stage anchor-free method, CornerNet, to handle text boxes in the form of arbitrary quadrilaterals. The concept used in Deformable Convolution was employed to predict the direction of edges at corners, leading to text boxes.
- The internship also involved participation in the ICDAR 2021 Competition on Scientific Literature Parsing, and I was responsible for Document Layout Recognition. The task was treated with an ensemble of different state-of-the-art detection algorithms, followed by specific models for difficult cases. The final result reached the 2nd place.

Wangxuan Institute of Computer Technology, Peking University **Beijing, China**
Undergraduate Research/BSc Project. Topic: Video understanding *Sep 2017 - Jun 2020*
Supervisor: Dr Jiaying Liu (personal homepage) (lab homepage)

- The first part of the undergraduate research was collaboration on a Video Coding for Machine (VCM) algorithm. The algorithm aimed to encode information for human action recognition into the compressed video stream, leading to a higher compression rate. My part was to extract key points from the video frames guided by human skeleton points to capture the motion with U-Nets, and to test the action recognition performance.
- The second part of the work focused on extracting local feature points. The aim was to provide a Neural Network (NN) version of SIFT that could run on accelerators while keeping the explainability of hand-crafted features but could also be fine-tuned to refine the performance on given data. The design followed the structure of SIFT pyramids and used convolutions to reproduce/approximate different operations.

Robotics Research Center, Peng Cheng Laboratory **Shenzhen, China**
Intern. Topic: Underwater vision and control for Remote Operated Vehicle *Jul 2019 - Aug 2019*
Supervisor: Tao Mei (lab homepage)

- This summer internship aimed to develop an end-to-end Deep Learning framework of visual servo for underwater ROV. The framework made use of eye-tracking data to hint at the focus of the human operator, providing clues for target detection. The predicted focus could also serve as an interpretation of the output control signal of the framework.
- The work also included the acquisition of eye-tracking data aligned to ROV video/movement. Implementation details contain eye-tracker calibration before experiments and coordinate projection from the raw result to the video plane.

Teaching Experience

School of Electronics Engineering and Computer Science, Peking University **Beijing, China**
Teaching Assistant. Introduction to Computation (A), 04830041 *Sep 2017 - Jan 2018*
Course organizer: Prof Yafei Dai

- **Duties:** Holding lab sessions & Q/A; marking weekly assignments/final project; invigilation coding exams.
- Appointed as undergraduate TA due to 100/100 mark in the same course, Jan 2017.

Skills

Programming: Python, C/C++, Cython, PyTorch (contribution to PyTorch)

Tools: LaTeX, git/GitHub, Anaconda

Language: Chinese (native), English (MSc in UK)

Publications

- Sifeng Xia*, Kunchangtai Liang*, Wenhan Yang, Ling-Yu Duan and Jiaying Liu, "An Emerging Coding Paradigm VCM: A Scalable Coding Approach Beyond Feature And Signal," *2020 IEEE International Conference on Multimedia and Expo (ICME)*, 2020. *Conference Paper* **Equal contribution*

- Kunchangtai Liang, Dezhao Wang, Yuzhang Hu, Sifeng Xia, Wenhan Yang and Jiaying Liu, "AI M1243: Local Feature Point Detector based on CNN," *10th Meeting of AI Standard Group, Artificial Intelligence Industry Technology Innovation Strategic Alliance*, 2020. *Standard Proposal*

Awards and Honors

- Computer Science MSc Dissertation Prize, University of Edinburgh (awarded 1 each year) *Nov 2022*
- Award for Scientific Research, Peking University *Dec 2018*
- Award for Community or Public Service, Peking University *Dec 2017*

- Third prize, Schlumberger Cup programming competition, Peking University *Jun 2017*
- Mayor's Award for Adolescents Science & Technology Innovation, Hefei *Nov 2014*
- Third prize, 14th Awarding Program for Future Scientists, China *Oct 2014*

Hobbies

Animation · Light Novel · Electronics DIY · Baseball

Extra-curricular Activities

- Volunteer at the Peking University Recruitment/Admissions Group, Anhui Province *Y2017, Y2021*
- Volunteer at the Youth Volunteers Association of EECS, Peking University *Sep 2016 - Nov 2019*
  - Deputy Secretary *Nov 2018 - Nov 2019*
- Member of the EECS Baseball Team, Peking University *Sep 2016 - Aug 2018*