Xiangrui(Jerry) Zhao

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EDUCATION

University of Edinburgh **Edinburgh, UK**
Master of Informatics with Honours (Integrated Master) *Sep 2018 – May 2022*
Academic Accolades: 2:1
Core courses: Reinforcement Learning, Deep Learning, Natural Language Processing, Computer Vision and Robotics, Applied Machine Learning, Blockchain and Distributed Ledges

TECHNICAL SKILLS

Programming Languages: Python, C, C++, Java, Java Script, MATLAB, Kotlin, Swift, C#, SQL, Solidity, Lisp, Scheme
Framework and Libraries: PyTorch, TensorFlow, CoreML, Django, ROS, Scikit-Learn, MangoDB, AWS

WORK EXPERIENCE **Edinburgh, UK**

Cadence Design Systems *May 2023 – current*
Software Engineer II

- Developed and maintained **software validation tools** for complex **Process Design Kits** (PDKs) in **Cadence Virtuoso** using **C++** and SKILL, enhancing IC design processes by ensuring high-quality **PDK validation and migration** through robust, integrated solutions within the design environment.
- Enhanced tool performance and customer experience by creating user-friendly **UI features**, streamlining **batch operations** with **foundational APIs**, and implementing robust testing frameworks; resolved critical customer-reported issues, increasing efficiency and reducing errors.
- Leveraged AI, machine learning, and **data-driven methods** to generalize PDK validation systems and automate PCell code generation, resulting in reduced test patterns and faster quality analysis without compromising overall quality.
- Collaborated closely with customers to implement **product enhancements** and fix development bugs; aligned system designs with customer needs, improved software quality and maintainability, and addressed challenges in PDK migration and readiness across various Cadence Virtuoso products.

Zonda *Feb 2023 – May 2023*
Machine Learning Intern

- Developed high-fidelity **text-to-3D object generation models** using **GANs and Stable Diffusion**. Implemented and optimized state-of-the-art diffusion-based neural network to generate accurate, textured 3D objects from text and images.
- Integrated advanced techniques from Stable-Dreamfusion, ControlNet, OpenAI's Point-E, and Pixel2Mesh models to enhance performance and output quality.
- Optimized training efficiency and model convergence through **hyperparameter tuning** using custom accuracy metrics. Resolved instability issues by employing prompt engineering techniques with ChatGPT to design effective text prompts, leading to faster inference times and more accurate results.
- Developed a web interface for 3D object generation using AWS EC2 and integrated cloud storage with S3. Deployed models on **AWS SageMaker** using **Docker containers** and custom training scripts, automating resource allocation and training pipelines, which streamlined the workflow and improved scalability.

RESEARCH EXPERIENCE **Edinburgh, UK**

Self-organizing Deep Recurrent Neural Network for Robot Behaviour Control *Sep 2021 – May 2022*

- Developed a framework for the control of self-organizing robots based on **multi-layer neural network** architecture, which would offer better controllability and scalability, plus introduce the ability for systematic exploration and self-evaluation.
- Proposed algorithms and evaluation metrics to study on balancing the exploration and exploitation in self-organizing robot in a structured way, which is also interpretable to humans in exploration of plausible robot behaviours at a high level.
- Proved by the simulation and experiment that the deep neural architecture is effective and practical in **self-organizing robot control**, in the way that it helps generate activities for complex systems which relates to physics, body and environment.

Self-organization in Brain-inspired Robot Control *Sep 2020 – May 2021*

- Proposed the **DIAMOND model** which used **deep recurrent neural network** to model the flow of information among neural assemblies in brain and achieved guided self-organization in a top-down manner.
- Tested the **self-organizing algorithms** based on deep neural network model in simulations and real robotic applications to show that the deeper controller model generates complex solutions for difficult task and increases exploration.
- Implemented our autonomous learning algorithms within the proposed **deep homeokinesis model**, which simulated the creativity and curiosity factors in the context of generating novel self-exploratory behaviours for self-organizing robots.

IPAB Research Internship: Hierarchical Control Based on Differential Extrinsic Plasticity *Jun 2021 – Sep 2021*

- Proposed a hierarchical control scheme that is based on a neural synaptic rule useful in generating periodic behaviour.
- Proved that our novel mechanism (**DIAMOND-DEP**) is biologically plausible in nature and can lead to a new understanding of the emergence and convergence of the periodic behaviours in evolution.
- Achieved evolutionary autonomous development presented by periodic behaviours by a brain equipped with **DNN**.

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ACADEMIC PROJECTS — Edinburgh, UK

Scalable Cooperative Multi-Agent Reinforcement Learning for Autonomous Driving *Feb 2022 – May 2022*

- Developed a **multi-agent deep reinforcement learning** model in the CARLA simulator by training a **shared global value** function to parameterize individual agent policies. Agents could learn **cooperative behaviors**, navigate safely towards a **collective reward**, and significantly reduce collisions and self-interested behaviors compared to single-agent baselines.
- Implemented and compared **single-agent baseline models** using policy gradient methods—including **TRPO, PPO, DDPG**, and **A2C**—as a foundation for the multi-agent extension. Addressed challenges of **non-stationary environments** and **partial observability** by exploring both centralized and decentralized reinforcement learning methods.

Inverse Reinforcement Learning for Robotic Self-learning *Jan 2022 – Mar 2022*

- Developed a **sample-efficient IRL** algorithm based on **maximum entropy** which achieved similar rewards as original **MaxEnt algorithm** but with less demonstrations from the expert and helped agents learn from themselves or other agents.

AI Paper Search Engine *Dec 2021 – Feb 2022*

- Developed a web-based search engine for AI research papers using **JavaScript** and **PostgreSQL**, designed as a **full-stack project** that integrates both front-end and back-end technologies, with **NLP algorithms** implemented in the backend for **keyword extraction**, **grammar correction**, and **query completion prediction**.

Decentralized chess on the Ethereum blockchain *Nov 2021 – Jan 2022*

- Developed a decentralized chess game leveraging **Solidity** smart contracts and deployed it on the **Ethereum blockchain**, ensuring a tamper-proof and transparent game experience.
- Modeled the game to strictly adhere to **real-world chess rules**, with features such as move validation, turn-based logic, and special chess moves like castling, en passant, and pawn promotion, all coded into the smart contract.

Android and IOS app Development for Human Activity Recognition *Sep 2021 – Dec 2021*

- Developed **Android and iOS apps** for classifying live human activities using **on-device machine learning**.
- Deployed the functionality of **live prediction**, **cloud data collection** and **on-device learning** with a Respeck IoT sensor.
- Tested that the live human activity data could be accurately predicted at **85%** with a hierarchy of different **NN models**.

Sentiment Classification on Movie Reviews *Jan 2021 – Mar 2021*

- Developed a **sentiment analysis classifier** for 10k+ movie reviews by fine-tuning a **pre-trained RoBERTa transformer** with a **multi-head self-attention mechanism**, achieving **87%** accuracy in binary classification.
- Enhanced model performance and **generalization** through **layer normalization**, **dropout**, and **hyperparameter optimization**, surpassing traditional methods such as Bag of Words, TF-IDF, Logistic Regression, and SVM.