

# XIANGYU ZHAO

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## EDUCATION

### PhD in Electrical and Electronic Engineering

January 2023 – Present

Imperial College London, United Kingdom

Research topic: self-supervised learning on complex hypergraphs via adversarial collaboration

Supervisor: Dr Yiren Zhao

Award: Electrical and Electronic Engineering PhD Scholarship

Expected graduation: January 2027

### BA & MEng (Hons) in Computer Science

October 2018 – June 2022

Trinity College, University of Cambridge, United Kingdom

BA final year result: 2.i (Overall: 70.5%; Units: 86%; Dissertation: 81%)

MEng result: Distinction (Overall: 81.2%; Modules: 79.7%; Dissertation: 83%; Ranking: 7/25)

Awards: Senior Scholarship; Exam Prize 2022

## WORK EXPERIENCE

### Department of Computer Science and Technology, University of Cambridge

January 2023 – Present

Visiting Student

Cambridge, United Kingdom

- Undertake research work for the PhD in EEE at Imperial College London, co-supervised by Prof Pietro Liò;
- Role: Teaching Assistant for Algorithms 1 (2022–2023).

### Department of Computer Science and Technology, University of Cambridge

June – September 2022

Undergraduate Research Opportunities Programme (UIROP) – Research Intern

Cambridge, United Kingdom

- Research project: long and short-range attentions for complex hypergraph data;
- Supervisors: Dr Yiren Zhao, Prof Robert Mullins.

### ByteDance

June – September 2021

Algorithm Engineer Intern

Beijing, China

- Trained a model based on causal forest and double ML for TikTok Lite's user growth campaign;
- Increased per-user successful invitation count by 43.9% while decreasing its cost by 56.1%.

## PUBLICATIONS

- **Xiangyu Zhao**, Hannes Stärk, Dominique Beaini, Yiren Zhao, and Pietro Liò (2023). Task-Agnostic Graph Neural Network Evaluation via Adversarial Collaboration. *11th International Conference on Learning Representations (ICLR 2023) Machine Learning for Drug Discovery Workshop*.
- **Xiangyu Zhao** and Sean B. Holden (2022). Towards a Competitive 3-Player Mahjong AI using Deep Reinforcement Learning. In *2022 IEEE Conference on Games (CoG)*.
- **Xiangyu Zhao** and Sean B. Holden (2022). Building a 3-Player Mahjong AI using Deep Reinforcement Learning. *arXiv preprint arXiv:2202.12847*.

## PROJECT EXPERIENCE

### Task-Agnostic Graph Neural Network Evaluation via Adversarial Collaboration

November 2021 – May 2022

MEng Dissertation

- Developed a conceptually novel, principled, task-agnostic, and stable framework for evaluating GNNs through contrastive self-supervision, without needing handcrafted augmentations;
- Distinguish GNNs of different expressiveness by having them directly compete against each other on unlabelled graphs, and ensures that more expressive GNNs can win by producing more informative graph embeddings.
- Paper accepted at the ICLR 2023 Machine Learning for Drug Discovery (MLDD) Workshop.
- Source code: <https://github.com/VictorZXY/GraphAC>
- Publication: <https://arxiv.org/abs/2301.11517>

### **Improving Graph Generative Models via Expressive Graph Neural Networks**

March – April 2022

*MEng Representation Learning on Graphs and Networks Mini-Project*

- Investigated the expressiveness of GNNs under the context of molecular graph generation;
- Replaced R-GCN in GCPN with GIN, PNA and GSN, and significantly improved GCPN's performance.
- Source code: <https://github.com/VictorZXY/expressive-graph-gen>

### **Multi-Agent Deep Q-Learning for the Berry Poisoning Game**

February – March 2022

*MEng Advanced Topics in Machine Learning Coursework (Reinforcement Learning)*

- Performed a multi-agent DQN method on the Berry Poisoning Games, and investigated on the agent performance with respect to different game environment parameters;
- Successfully trained agents for the game, with high transferability across different game environment parameters.
- Source code: <https://github.com/VictorZXY/dqn-berry-poisoning>

### **Function Autoencoders: A Neural Network Approach to Gaussian Processes**

November 2021 – January 2022

*MEng Probabilistic Machine Learning Investigative Project*

- Investigated a neural network alternative to Gaussian processes, and introduced the function autoencoders that preserve GPs' own advantages and avoid their weaknesses with NNs' benefits;
- Models successfully learnt distributions over random functions, and performed decently on a 1-d regression task.
- Source code: <https://github.com/VictorZXY/function-autoencoder>

### **Building a Simulator and Emulator for Traffic Signaling**

November 2021 – January 2022

*MEng Machine Learning and the Physical World Group Project*

- Carried out simulation of an urban traffic signalling system, and built an emulator to search for optimal traffic signal scheduling using Bayesian optimisation;
- Introduced multiple scheduling schemes to overcome the problem of exploding search space, without sacrificing flexibility or descriptiveness.
- Source code: <https://github.com/VictorZXY/traffic-sim>

### **A Neural Network Approach to Named Entity Recognition on Noisy User-Generated Texts**

*MEng Natural Language Processing Final Assignment*

November – December 2021

- Investigated a bidirectional LSTM structure for named-entity recognition on social media texts, and explored various data-processing techniques in order to improve the model's performance;
- Model trained with data-processing techniques applied achieved significant improvements on prediction accuracy on the W-NUT 2017 shared task, compared to the same model trained without any data optimisation.
- Source code: <https://github.com/VictorZXY/nlp-assignments-ner>

### **Deep Reinforcement Learning for Mahjong**

October 2020 – May 2021

*BA Dissertation*

- Designed an informative and compact data structure for encoding observable Mahjong states, built an AI for Mahjong by pre-training CNN models for each action, and improved the major action's model with self-play RL;
- Models achieved near state-of-the-art level, and RL significantly improved the agent's win rate from SL;
- Paper published at the 2022 IEEE Conference on Games (CoG).
- Source code: <https://github.com/VictorZXY/meowjong>
- Publication: <https://ieeexplore.ieee.org/document/9893576>

### **Investigating Adversarial Examples for Deep Residual Networks**

February – March 2021

*Third Year Deep Neural Networks Mini-Project*

- Investigated on targeted/black-box adversarial attacks on ResNets using one-shot/iterative FGSM algorithms, and experimented the transferability of each FGSM attack to other image inputs and neural networks.
- Source code: <https://github.com/VictorZXY/dnn-assignments>

### **An Analysis of Clickstream Data for Online Shopping**

November – December 2020

*Third Year Data Science Final Practical*

- Analysed a clickstream dataset on an online shopping website, trained various ML models to predict the users' potential willingness to pay a premium price, and identified the most important features for ML prediction.
- Source code: <https://github.com/VictorZXY/datasci-pnp-final-practical>

## AWARDS

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Google Hash Code	2020	Team ranked 1331/10724 globally
LeetCode Programming Contest (LCCUP)	2020	Team ranked 127/2575
UK & Ireland Programming Contest (UKIEPC)	2019	Team ranked 54/191
British Informatics Olympiad (BIO)	2017	National finalist (top 15)
British Physics Olympiad (BPhO)	2017	Gold Medal
British Chemistry Olympiad (BChO)	2017	Gold Medal
British Mathematics Olympiad (BMO)	2016, 2017	Distinction
Senior Team Mathematics Challenge (STMC)	2017	Team won regional 2nd place
Senior Mathematics Challenge (SMC)	2016, 2017	Gold Medal (Full marks)
American Mathematics Contest (AMC12)	2016	Distinction (Global top 1%)
American Mathematics Contest (AMC10)	2015	Distinction (Global top 1%)
National Olympiad in Informatics (NOI)	2014	2nd Place

## SKILLS

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Languages	Chinese (Native), English (Fluent, IELTS Band 8.0)
Programming	Python, Java, C, C++, C#, OCaml, StandardML, Prolog, SQL, Cypher, Verilog, $\LaTeX$ , Swift
ML Libraries	PyTorch, TensorFlow, Keras, Scikit-learn, PyG, DGL, TorchDrug, GPy, GPyOpt, EconML
Music	Clarinet (Grade 10, soloist of the Cambridge University Chinese Orchestra Society)
Sports	Kendo (University team), Football (High school team), Badminton