# 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
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;
- Roles: Teaching Assistant for Algorithms (2022–2023).

**Department of Computer Science and Technology, University of Cambridge** *June – September 2022*
*Undergraduate Research Opportunities Programme (UROP) – 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** 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

**Long and Short-Range Attentions for Complex Hypergraph Data** *June 2022 – Present*
*UROP Project*

- Build benchmark hypergraph datasets from large-scale real-world data;
- Design new attention mechanisms for GNNs to operate on hypergraph data.

**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 expressivity 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.
- Source code: https://github.com/VictorZXY/GraphAC

**Improving Graph Generative Models via Expressive Graph Neural Networks** *March – April 2022*
*MEng Representation Learning on Graphs and Networks Mini-Project*

- Investigated the expressivity 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 presented at the 2022 IEEE Conference on Games (CoG).
- Source code: `https://github.com/VictorZXY/meowjong`
  Related publication: `https://arxiv.org/abs/2202.12847`

**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 costumers' 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`

**Trading Assistant for IMC** *January – March 2020*
*Second Year Group Project*

- This is a web service which holds market data and responds to queries on demand in a human-like manner, by automating the trader side of the process using speech recognition and NLP;
- Responsible for writing speech-to-text and text-to-speech libraries;
- Efficiently built the libraries with high accuracies, and provided clean interfaces that were used conveniently by the NLP and back-end teammates, improving the system's overall performance.

## 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 |