

Zhuo Cai

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Education

- 2021 – Ongoing **Hong Kong University of Science and Technology, Hong Kong**
Master of Philosophy in Computer Science and Engineering
Supervisor: Amir Goharshady
Research Interest: Theoretical Computer Science, Blockchain, Cryptography, Game Theory
GPA: 3.93/4.3
- 2017 – 2021 **Tsinghua University, Beijing**
Bachelor of Automation
GPA(first 3 years): 3.81/4, GPA Ranking: 17/168
- 2019 Fall **National University of Singapore, Singapore**
Undergraduate Exchange
GPA: 4.0/4

Research Publications





Conference Proceedings

- 1 He, X., Cai, Z., Wei, W., Zhang, Y., Mou, L., Xing, E., & Xie, P. (2021). Towards visual question answering on pathology images. In *Proceedings of the 59th annual meeting of the association for computational linguistics and the 11th international joint conference on natural language processing (volume 2: Short papers)* (pp. 708–718). doi:10.18653/v1/2021.acl-short.90

Research Projects

- Sept 2021 – Oct 2022 **Trustless and Bias-resistant Game-theoretic Distributed Randomness**
Independent Researcher, supervised by Assistant Professor Amir Goharshady
Department of Computer Science and Engineering, the Hong Kong University of Science and Technology
Under review in SAC'2023.
- Proposed a game-theoretically incentivized mechanism for random number generation. Proved the existence and uniqueness of strong Nash equilibrium of the uniformly random strategy profile.
- Proposed proof-of-stake blockchain protocols with novel game-theoretic randomness.


Research Projects (continued)

- Apr 2022 – Ongoing  **Gas Cost Estimation of Public Function Calls in Ethereum Smart Contracts**
Research Assistant, supervised by Assistant Professor Amir Goharshady
Department of Computer Science and Engineering, the Hong Kong University of Science and Technology
- Designed algorithms to estimate linear or polynomial upper bounds of gas cost of public function calls in Ethereum smart contracts, based on Farkas' lemma, Putinar's Positivstellensatz and Hilbert's Strong Nullstellensatz.
- Implemented the algorithm that generates upper bounds of opcode gas costs when given solidity source files, compiled representations and invariants as inputs.
- Aug 2019 – Dec 2019  **Unsupervised Group Anomaly Detection**
Independent Research, supervised by Assistant Professor Bryan Hooi
School of Computing, National University of Singapore
- Developed a novel indirect embedding method in which embeddings are parameters jointly learned to optimize an autoregressive model. The embedding technique can incorporate complex temporal information. With embeddings, autoregressive model can better accommodate multimodal data.
- Showed that Noise Contrastive Estimation is effective on individual samples, but not on segments due to difficulty of injecting reasonable noises to time series; Showed that existing generative models including GANs and Flows are not strong enough when applied to group anomaly detection.
- June 2020 – Oct 2020  **Towards Visual Question Answering on Pathology Images**
Research Assistant, Supervised by Assistant Professor Pengtao Xie
Department of Electrical and Computer Engineering, University of California, San Diego
Published in ACL'2021.
- Implemented visual question answering algorithms on our Pathology VQA dataset.
- Designed new cross-modality self-supervised learning tasks and implemented them in VQA models; Evaluated how different self-supervised pre-training improve downstream VQA performance in extensive experiments.
- Aug 2018 – Jan 2019  **Collaborative SLAM of Multiple Unmanned Aerial Vehicles**
Research Assistant, supervised by Associate Researcher Yipeng Li
Department of Automation, Tsinghua University
- Designed and implemented a practical collaborative SLAM system based on visual SLAM, Lidar SLAM.
- Implemented fast visual SLAM based on video interpolation. Video interpolation generates intermediate frames, which facilitate matching of consecutive frames in visual SLAM.

Teaching

- 2022 Spring & Fall, TA  **Hong Kong University of Science and Technology**
COMP 2012: Object-Oriented Programming and Data Structures

Skills




- Languages  Native in Mandarin Chinese, proficient in English (TOEFL:106, GRE:158+170).

Skills (continued)



Coding  C/C++, Python, MATLAB, JAVA, PyTorch, HTML, \LaTeX , ...

Miscellaneous Experience

Awards and Achievements

- 2019  **Honor of Academic Excellency**, Tsinghua University.
- 2018  **Honor of Academic Excellency**, Tsinghua University.
- 2016  **1st Level in National High School Mathematics League**, the Chinese Mathematical Society.

Extracurricular Experience

- Dec 2019 - May 2021  President of iOS Club, Tsinghua University.
- Aug 2018 - Aug 2019  Leader of the Students' Association of Science and Technology (Competition Branch), Department of Automation, Tsinghua University.