YU Tingyang (Yist)

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RESEARCH INTEREST

1) Develop novel machine learning methods and graph algorithms with solid theoretical guarantee that can tackle practical computational challenges.

2) Intersection of machine learning, classical information theory, and network coding theory. I am extremely passionate on researching the capability of neural networks by classical theories (i.e., bottleneck analysis of nns).

EDUCATION

The Chinese University of Hong Kong (CUHK) Sep. 2019 – Sep. 2023 (expected)
Bachelor of Science in Mathematics and Information Engineering (MIEG) Hong Kong SAR, China

- Cumulative GPA: **3.741**/4.000; Information Engineering Major GPA: **3.937**/4.000.
- Ranked among the **top 3** students among MIEG students admitted in 2019-20. (Exact rank is unavailable for students)
- **Winter semester exchange program in Faculty of Applied Science & Engineering, University of Toronto (UoT), 2021-22.**
- Ranked **top 0.4% among 163,000 science students** in the National College Entrance Exam.
- Relevant courses:
  - *Mathematics:* Linear Algebra (A), Probability Theory (A), Ordinary Differential Equation (UoT, A), Discrete Mathematics (A), Multivariable Calculus (A), Algebraic Structures (A-).
  - *Computer Science and Informatics:* Introduction to AI (UoT, A-), Algorithms & Data Structure (A-), Signals and Systems (A), Computer Networks (A), Introduction to Systems Programming (A), Network Coding Theory (Postgraduate, A-), Multi-media Coding (Ongoing), Applied Cryptography (Postgraduate, Ongoing).

RESEARCH EXPERIENCE

Subgraph Augmentation for Graph Neural Networks Sep. 2022 – Present
Final year project supervised by Professor Irwin King (CUHK) Hong Kong SAR, China

- Proposed subgraph sampling strategies based on Weisfeiler-Lehman similarity and subtree kernel for equivariant subgraph aggregation network to improve the expressive power and scalability of the network. [thesis]
- Conducted thorough experiments which showed that this strategy outperformed state-of-the-art sampling strategies published at ICLR 2022 on graph classification by 3% on TU datasets. It further reduced the space complexity up to 55% on dataset IMDB-MULTI and 10-20% training time on dataset NCI1 compared to the second best strategy.

Projection Robust Unbalanced Optimal Transport Feb. 2022 – Present
Research Assistant to Professor Ma Shiqian (University of California, Davis) California, USA

- Presented a new model called projection robust unbalanced optimal transport (PRUOT) to alleviate the curse of dimensionality for computing the Wasserstein distance between unbalanced distributions.
- Illustrated a Riemannian optimization algorithm RGAS-UOT for solving this new model and proved its non-trivial finite-time convergence guarantee to obtain the stationary point. Numerical experiments were given to demonstrate the advantages of the PRUOT model in high-dimensional cases. **The work was presented in Preprint [4]**

Single-cell Multi-omics Integration with Random Walk and Graph Neural Network April, 2021 – Present
Research Assistant to Professor Li Yu (CUHK) Hong Kong SAR, China

- Presented *scMinerva*, an unsupervised Graph Convolutional Network framework for single-cell multi-omics integration, which featured a novel algorithm *omics2vec* that enabled random walk algorithm for heterogeneous graphs.
- scMinerva achieved superior classification performance among 7 state-of-the-art methods on 6 real-world datasets and improved classification accuracy up to 20% on dataset GSE128639 when classifying to 27 classes.
- Won the Best Project Award for Summer Research Internship of CUHK, 2020-21 **(Top 10% out of 46 projects)**.

Zyablov Bound on General Adversarial Various Channels June, 2020 – Sep. 2020
Research Asistant to Professor Sidharth Jaggi (CUHK) Hong Kong SAR, China

- Worked on extending Zyablov Bound which is based on concetenated code to the general adversarial various channels.
- Revisited the basic assumptions for classic Zyablov Bound from coding theory and information theory and examined them from classic channels to general adversarial various channels, which are more practical in real-life transmissions.

ACADEMIC AWARDS AND SCHOLARSHIPS

Professor Charles K. Kao Exchange Scholarship (50,000 HKD), 2021-22;	*The Charles K. Kao Foundation*
Dean's List (Top 10%) of 2019-20, 2020-21;	*University*
ELITE Stream Scholarship (20,000 HKD) of 2019-20, 2020-21;	*ELITE Stream*
IE Award for Academic Exchange (30,000 HKD), 2021-22;	*Dept. of Information Engineering*
Best Project Award for Summer Research Internship of CUHK, 2020-21;	*Faculty of Engineering*
Second Prize of Hua Xia Cup Mathematical Olympiad, 2018-19;	*Asia Maths Alliance*
Second Prize in National Physics Competition for Senior High, 2018-19;	*National Physics Competition Committee*
Second Prize in National Mathematics Competition for Senior High, 2018-19.	*Chinese Mathematics Society*

PREPRINTS

1. **scMinerva: an Unsupervised Graph Learning Framework with Label-efficient Fine-tuning for Single-cell Multi-omics Integrative Analysis** [paper]
   Tingyang Yu, Yongshuo Zong, Yixuan Wang, Xuesong Wang, Yu Li.
   bioRxiv Preprint 2021 (***Submitted to Nature Communications***)
2. **Contrastive Cycle Adversarial Autoencoders for Single-cell Multiomics Alignment and Integration** [paper]
   Xuesong Wang, Zhihang Hu, Tingyang YU, Ruijie Wang, Yumeng Wei, Juan Shu, Jianzhu Ma, Yu Li
   Bioinformatics (IF: 6.93)
3. **conST: an interpretable multi-modal contrastive learning framework for spatial transcriptomics** [paper]
   Yongshuo Zong, Tingyang YU, Xuesong Wang, Yixuan Wang, Zhihang Hu, Yu Li
   *bioRxiv Preprint 2021 (**Major revision at Nucleic Acids Research (IF: 16.97)**)*
4. **Projection Robust Optimal Transport Between Unbalanced Distributions** [paper]
   Tingyang Yu*, Yuxuan Wan*, Shiqian Ma. *Preprint 2022*

LEADERSHIP EXPERIENCE

Mandarin Debate Team of CUHK Sep. 2019 – May, 2021
Captain and Team Member Hong Kong SAR, China

- Prepared over 9 hours of weekly debate training material for 120+ team members and handled logistics for team registration and participation in 10+ international competitions.
- Launched the team PR group to advertise the competition results and liaise with other parties for collaborations. Fund-raised over 30,000 CNY from corporate sponsors for international competition trips and debate visits.

Exemplar Tournament Freshman Mandarin Debate Competition Mar. 2021 – May, 2021
Founder and Contributor Hong Kong SAR, China

- Founded the "Exemplar Tournament" Freshman Mandarin Debate Competition as the first international Mandarin debate competition initiated by CUHK. The competition received more than 14,000 HKD as funding from CUHK.
- Drafted the Tournament Regulations, resolved multiple emergencies during the 2-month competition period, and organized team registration for more than 50 universities and debate clubs all over the world.

COMMUNITY CONTRIBUTIONS

Hong Kong Dog Rescue Jan. 2023 - Present
Part-time Volunteer Hong Kong SAR, China

- Clean the dog kennels, attend to dogs with health issues, invigorate and promote socialization among the 600 dogs of the Tai Po Homing Center for over 40 hours.
- Help to facilitate Homing Center visits and advertise the work of HKDR with the objective of enhancing the understanding of dogs in Hong Kong and reducing the instances of pet abandonment.

"WOMEN US" Girl Empowerment Project Feb. 2021 – Present
Founder and Contributor Mainland, China

- Initiated the "WOMEN US" Girl Empowerment project, a mainland China based non-profit self-empowerment project for female high school students that provides reading material on the power of women to broaden their horizons.
- Collaborated with Fudan University's iGEM team to introduce their projects to the students of No.1 Middle School in Qinghai Province to introduce the story of female scientists and germinate youth interest in STEM.
- Developed a WeChat mini-program to connect high-school students with undergraduates from diverse disciplines.

SANGCHU Marmots Youth Hostel June, 2021 – July, 2021
Full-time Volunteer Gannan Tibetan Autonomous Prefecture

- Worked on the daily affairs of the hostel, including cleaning, cooking, and social media advertisements.
- Participated in marmot protection activities, infectious diseases management and population control. Provided local and social culture immersion tours for international tourists.

EXTRA-CURRICULUM AWARDS

2020 HANGZHOU Mandarin Debate Grand Prix (256 teams) Jan. 2020 - Mar. 2020
"Best Debater Award Among All the Teams" in Hong Kong area. Virtual

The 1st FENGYE Cup Mandarin Debate Competition (32 teams) Mar. 2020 - May, 2020
Champion; "Best Debater Award for the Competition". Virtual

The Thirteenth XINWEI-HUAXIA Mandarin Debate World Cup (48 teams) Sep. 2020
"Best Debater Award for the Competition". The University of New South Wales

SKILLS & MISC.

- *Language* English (IELTS overall 7.5, Speaking 7.5), Mandarin (native), Cantonese (fluent).
- *Programming* Matlab, Java, C, R, Python {Pytorch, Tensorflow, NetworkX, Pandas, Numpy, sklearn}.
- *Tools* LaTeX, Linux, Anaconda, Git, MongoDB, Docker, WanDB, Abode Illustrator.
- *Hobbies* Writing, songwriting, swimming, running, bodybuilding, *etc.*