Guangyuan Hao

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Education

Hong Kong University of Science and Technology — *Hong Kong*

Master of Philosophy (MPhil) in Individualized Interdisciplinary Program (Artificial Intelligence) — *Sept. 2020 - Sept. 2022*

- Collaborated closely with Prof. Hao Wang (Rutgers University).
- Overall GPA: $3.95/4.30$; Major GPA: $4.05/4.30$
- Received a full two-year scholarship.

University of Electronic Science and Technology of China — *Chengdu, China*

Bachelor of Engineering (B.E.) in Information Display and Optoelectronic Technology — *Sept. 2012 - Jul. 2016*

- GPA: $3.97/4.00, 91.3/100$; Ranking: $1^{st}/184$
- GPA for 21 mathematics and theoretical physics coursework: $4.00/4.00, 94.0/100$

Experience

Research Assistant under the guidance of Prof. Kun Zhang (CMU & MBZUAI) and Prof. Jiji Zhang (CUHK). — *Hong Kong & Abu Dhabi*

Nov. 2022-Now

- Engaged in extensive research in the fields of causal inference and causal discovery.
- Began collaboration with Prof. Yuanzhi Li (CMU) recently, focusing on the physics of LLMs.

Research Intern, Speech and Language Processing Group, Noah's Ark Lab. — *Hong Kong*

Nov. 2020-Jan. 2021

- Carried out a research project about sequence labeling, resulting in a paper published in EMNLP 2021. The method in the paper was successfully integrated into smartphone speech applications.

Papers

Natural Counterfactuals With Necessary Backtracking — *Hong Kong & Abu Dhabi*

Guang-Yuan Hao*, Jiji Zhang*, Biwei Huang, Hao Wang, Kun Zhang (* indices equal contribution); **Fortieth International Conference on Machine Learning (ICML 2023)** Workshop on Counterfactuals in Minds and Machines (Oral Presentation); Submitted to Twelfth International Conference on Learning Representations (ICLR 2024) — *Dec. 2022 - Sept. 2023*

- Developed a general framework of what we call natural counterfactuals, which are both more flexible and more realistic than the standard framework.
- Proposed a novel optimization framework for generating natural counterfactuals. By combining a naturalness constraint with a principle of minimal change that discourages unnecessary backtracking, we seek to strike the best balance between natural and non-backtracking counterfactuals.
- Presented a detailed method in the general framework and tested it empirically. The empirical results, on both simulated and real data, demonstrate the efficacy of our method in contrast to non-backtracking counterfactuals.
- See details at https://sites.google.com/view/counterfactuals-icml/accepted-papers.

Composite Active Learning: Towards Multi-Domain Active Learning with Theoretical Guarantees — *Hong Kong*

Guang-Yuan Hao, Hengguan Huang, Haotian Wang, Jie Gao, Hao Wang; **Thirty-Eighth AAAI Conference on Artificial Intelligence (AAAI 2024)** — *Dec. 2021 - May 2023*

- Identified the problem of multi-domain active learning. Proposed Composite Active Learning (CAL) as the first general deep AL method for addressing the problem of multi-domain active learning.
- Provided theoretical guarantees that CAL with our budget assignment strategy achieves a lower generalization error bound than existing AL methods.
- Conducted experiments on both synthetic and real-world datasets with detailed ablation studies, showing that CAL significantly improves performance over the state of the art for multi-domain active learning.
- See details at https://guangyuanhao.github.io/file/CAL-AAAI2024.pdf.

Taxonomy-Structured Domain Adaptation

Hong Kong

Tianyi Liu*, Zihao Xu*, Hao He, **Guang-Yuan Hao**, Guang-He Lee, Hao Wang (***** indices equal contribution);

Nov. 2022 - May 2023

Fortieth International Conference on Machine Learning (ICML 2023)

- Identified the problem of domain adaptation (DA) across taxonomy-structured domains and developed taxonomy-structured domain adaptation (TSDA) as the first general DA method to address this problem.
- Built on the classic adversarial framework and introduced a novel taxonomist, which competes with the adversarial discriminator to preserve the taxonomy information.
- Autonomously formulated a core theory to identify conditions under which data features retain taxonomy information.
- See details at https://proceedings.mlr.press/v202/liu23ap/liu23ap.pdf and https://github.com/wang-ML-Lab/TSDA.

Domain-Indexing Variational Bayes: Interpretable Domain Index for Domain Adaptation

Hong Kong

Zihao Xu*****, **Guang-Yuan Hao***, Hao He, Hao Wang (***** indices equal contribution); **Eleventh International Conference on Learning Representations (ICLR 2023)** (Spotlight Presentation)

Dec. 2021 - Sept. 2022

- Identified the problem of inferring domain indices as latent variables in domain adaptation.
- Provided a rigorous definition of "domain index", and developed the first general method, dubbed variational domain indexing (VDI), for inferring such domain indices.
- Provided theoretical guarantees that VDI's final objective function is equivalent to inferring the optimal domain indices.
- Conducted experiments on synthetic and real-world datasets, showing that VDI can infer non-trivial domain indices, significantly improving performance over state-of-the-art domain adaptation methods.
- See details at https://openreview.net/pdf?id=pxStyaf2oJ5 and https://github.com/wang-ML-Lab/VDI.

DyLex: Incorporating Dynamic Lexicons into BERT for Sequence Labeling

Hong Kong

Baojun Wang*, Zhao Zhang*, Kun Xu*, **Guang-Yuan Hao**, Yuyang Zhang, Lifeng Shang, Linlin Li, Xiao Chen, Xin Jiang, Qun Liu (* indicates equal contribution); **2021 Conference on Empirical Methods in Natural Language Processing (EMNLP 2021), Long Paper**

Nov. 2020 - Jan. 2021

- Improved sequence labeling of BERT by combining existing lexicons.
- Proposed a general framework for effectively introducing external lexical knowledge into sequence labeling tasks, and devised a novel knowledge denoising module to fully use large-scale lexicons.
- Our framework outperforms strong baselines and achieves SOTA results on multiple sequence labeling tasks. Our framework has already supported dynamic updates of lexicons to facilitate industrial deployment.
- Achieved the majority of the experiments outlined in this paper and conducted a comprehensive analysis of the experimental results.
- See details at https://aclanthology.org/2021.emnlp-main.211.pdf and https://github.com/huawei-noah/noah-research/tree/master/NLP/dylex.

MIXGAN: Learning Concepts from Different Domains for Mixture Generation

Guangzhou, China

Guang-Yuan Hao, Hongxing Yu, Weishi Zheng; **27th International Joint Conference on Artificial Intelligence (IJCAI 2018)** (Oral Presentation)

Oct. 2017 - Feb. 2018

- Made an interesting attempt on mixture generation, i.e., absorbing different image concepts (e.g., content and style) from different domains, and thus generating a new domain which the proposed model never observes in the training stage.
- Proposed an unsupervised method to generate new domains by learning and mixing different concepts from different domains. The experimental results demonstrate the effectiveness of MIXGAN, while the related state-of-the-art models fail to generate new domains.
- Other Applications: image-to-image translation and learning a joint distribution of two domains.
- See details at https://www.ijcai.org/proceedings/2018/0306.pdf and https://github.com/GuangyuanHao/MIXGAN.

Honors & Awards

2020-2022	**Postgraduate Studentship**, 220,200 HKD per year, Hong Kong University of Science and Technology
2015	**China National Scholarship**, 1%, 8,000 CNY, the Ministry of Education, China
2015	**Outstanding Graduates**, 1%, University of Electronic Science and Technology of China
2014	**Sekorm First-class Scholarship**, 2%, 8,000 CNY, SEKORM LIMITED
2013	**People's First-class Scholarship**, 10%, 3,000 CNY, University of Electronic Science and Technology of China

Profession & Skills

Peer Reviewer: ICCV 2023, NeurIPS 2023

Programming and Related: Linux, Python, PyTorch, TensorFlow, LaTeX , MATLAB, VHDL, ABAQUS

Hobbies: Long-distance running, meditation, boxing, reading