

# 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
- 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; Ranking: 1<sup>st</sup>/184
- GPA for mathematics and theoretical physics coursework: 95/100

## 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**

Dec. 2021 - Sept. 2022

### Conference on Learning Representations (ICLR 2023) (Spotlight Presentation)

- 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**

Nov. 2020 - Jan. 2021

### Language Processing (EMNLP 2021), Long Paper

- 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**

Oct. 2017 - Feb. 2018

### Intelligence (IJCAI 2018) (Oral Presentation)

- 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,  $\text{\LaTeX}$ , MATLAB, VHDL, ABAQUS

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