

# Guangyuan Hao

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## Education

### Hong Kong University of Science and Technology

Hong Kong

Master of Philosophy (MPhil) in 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<sup>st</sup>/184
- GPA for mathematics and theoretical physics courses: 4.00/4.00

## Experience

### Research Assistant at MBZUAI.

Abu Dhabi

Apr. 2023-Now.

- Engaged in extensive research in the fields of causal inference and causal discovery under the Guidance of Prof. Kun Zhang (MBZUAI & CMU) and Prof. Jiji Zhang (CUHK).
- I am of Chinese nationality and physically working in Abu Dhabi.

### 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

Dec. 2022 - Sept. 2023

Machines (**Oral Presentation**); Submitted to NeurIPS 2024

- 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.

### A Conditional Independence Test in the Presence of Discretization

Abu Dhabi

Boyang Sun, Yu Yao, **Guang-Yuan Hao**, Yumou Qiu, Kun Zhang; Submitted to NeurIPS 2024

Oct. 2023 - Feb. 2024

- Developed a CI test for ensuring accurate analysis in scenarios where data has been discretized, which are common due to limitations in data collection or measurement techniques, such as in financial analysis and healthcare.
- Our CI test can handle various scenarios including 1). Both variables are discretized 2). Both variables are continuous 3). One of the variables is discretized.

### 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**

Dec. 2021 - May 2023

**Artificial Intelligence (AAAI 2024)**

- 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://github.com/Wang-ML-Lab/multi-domain-active-learning>.

## 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://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, ICML 2024

**Programming and Related:** Linux, Python, PyTorch, TensorFlow,  $\text{\LaTeX}$ , MATLAB

**Hobbies:** Long-Distance Running, Walking, Meditation