

# Donghong Cai

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🌐 <https://ilikevegetable.github.io>

## EDUCATION

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### Washington University in St. Louis

*Ph.D. in Computer Science*

- **Research Directions:** Machine Learning and Data Mining, LLMs

St. Louis, Missouri

*Aug 2024 – present*

### Zhejiang University

*M.S. in Software Engineering; GPA: 3.84/4.00*

- **Research Directions:** Time Series and Graph Data Mining
- **Advisor:** Dr. Yang Yang

Hangzhou, China

*Sep 2020 – Mar 2023*

### Huazhong University of Science and Technology

*B.S. in Software Engineering; GPA: 3.67/4.00*

Wuhan, China

*Sep 2016 – Jun 2020*

## PROFESSIONAL EXPERIENCE

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### Alibaba Group

*Machine Learning Engineer*

- Conducted research and developed multiple recommendation algorithms for sellers' promotional tools, including Flexi Combo (buy more, save more), New Buyer Voucher, Regular Voucher, etc. These algorithms boosted stores' GMV and Units Ordered by an average of **8.28%** and **6.55%**.
- Designed a novel same-store identification algorithm to search potential identical sellers on competing e-commerce platform, resulting in a cost savings of **\$73,000** for the BD team during the 3rd quarter of 2023.
- Presented a transformer-based time series forecasting model for predicting monthly GMV and order volume for stores on an e-commerce platform. Performance increased by **21.7%** and **36.8%** respectively, compared with the experience-based manual settings.

Shenzhen, China

*Apr 2023 – Jul 2024*

### Zhejiang University

*Graduate Research Assistant, AINet Lab*

- Conducted research in the fields of **time series classification**, **self-supervised learning**, and **domain adaptation** on multi-channel brain signals data, resulting in a conference paper in **KDD'23** research track.
- Researched on a pre-training framework that more effectively integrates and aligns **image**, **text**, and **graph** modalities in multi-modal learning, resulting in a paper for submission.
- Built an experimental pipeline for studying large-scale SEEG brain signal data, implemented the integration of various specialized models (classification model, pre-training model, and domain generalization model), and used it for clinical trial applications of epilepsy detection.

Hangzhou, China

*Mar 2021 – Sep 2022*

## PUBLICATIONS

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1. **Donghong Cai**, Junru Chen, Yang Yang, Teng Liu, and Yafeng Li. 2023. MBrain: A Multi-channel Self-Supervised Learning Framework for Brain Signals. *In Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD '23)*.

## RESEARCH EXPERIENCE

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### Epileptic Wave Detection Using Hierarchical Graph Diffusion Learning

*Graduate Research Assistant*

- Formulated and studied the epileptic wave detection problem for SEEG data using an automatic end-to-end data-driven method.
- Proposed **BrainNet** to simultaneously learn the dynamic diffusion graphs and model the brain wave diffusion patterns thereon in a hierarchical fashion to achieve accurate epileptic wave detection under conditions of imbalanced labels and severe noise.
- Conducted comprehensive experiments on a large-scale real-world SEEG dataset across multiple patients. The experimental results validated the effectiveness of **BrainNet** on epileptic wave detection and its superiority in capturing the diffusion process. In the channel-level epileptic wave detection task, **BrainNet** outperforms all baselines on  $F_2$ -score with an increase of **36.66%**.

Zhejiang University

*Mar 2021 – May 2021*

## Pre-training Framework for Brain Signals

Zhejiang University

Graduate Research Assistant

Jun 2021 – Feb 2022

- Designed a generalized self-supervised learning framework *MBrain* consisting of three well-designed tasks, which can be applied to pre-train both EEG and SEEG brain signals.
- Proposed multi-channel CPC (Contrastive Predictive Coding) and theoretically proved that optimizing the goal of multi-channel CPC can lead to a better predictive representation. Based on the multi-channel CPC, three self-supervised learning tasks were designed to explicitly capture the spatial and temporal correlations of brain signals to learn informative representations for downstream tasks.
- Validated the superior effectiveness and clinical value of the proposed framework through extensive experiments of seizure detection on large-scale real-world EEG and SEEG datasets. In subject independent seizure detection experiment which meet practical clinical needs, *MBrain* outperforms all baselines on  $F_2$ -score with an increase of **9.23%** and **27.83%** in EEG and SEEG datasets.

## Multimodal Learning with Graph Alignment

Zhejiang University

Graduate Research Assistant

Mar 2022 – Sep 2022

- Introduced the graph modality into the realm of multi-modal fusion and proposed a graph alignment task to effectively combine multiple modalities.
- Proposed **MMGA** (Multi-Modal learning with Graph Alignment), an innovative pre-training framework designed to unify information from graph (social network), image, and text modalities on social media platforms to enhance user representation learning.
- Constructed the first multi-modal social media dataset containing image, text, and graph modalities, including over 2 million posts, a million-scale graph, and labeled user/post tags.

## Multiple Treatments Uplift Modeling for Voucher Recommendation

Alibaba Group

Machine Learning Engineer

Apr 2023 – May 2023

- Researched and designed the store promotional voucher recommendation algorithm on the LAZADA e-commerce platform from the perspective of **individual treatment effect estimation** in the **causal inference** domain.
- Defined a new multiple treatments uplift modeling problem in this scenario and proposed a deep learning-based model M-DESCN to address it. Conducted experiments on the dataset sampled and generated from the stores' historical voucher data, demonstrating the effectiveness of the method from the experimental results on the offline verification set.
- Summarized the deficiencies in the current generated dataset and methodology, and contemplated potential solutions for further optimization in the future.

## HONORS & AWARDS

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Award of Honor for Graduate

Dec 2021

Outstanding Graduate of Huazhong University of Science and Technology

Jun 2020

Academic Excellence Scholarship

Sep 2018

Individual Scholarship

Sep 2018, Sep 2019

## LANGUAGES & SKILLS

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**Languages:** Chinese (Native), English (Fluent)

**Programming:** C, C++, Java, JavaScript, Python, MATLAB, MySQL

**Professional Skills:** SKlearn, PyTorch, Markdown, LaTeX, Shell Script

**Interests:** Basketball, Football, Travelling, Photography