Zhihan Yang

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Github: **https://github.com/zhihanyang2022**
PDF of my papers: **https://shorturl.at/dFJOV**

Education

2018.9 ~ 2023.6 **Carleton College** — Northfield, Minnesota, USA
B.A. (with honors) in Mathematics and Statistics (double major), GPA 3.88 / 4.00 (Cum Laude)
Thesis in Mathematics: Frequentist and Bayesian Inference for Markov and Hidden Markov Models
Thesis in Statistics: An Analysis of Minneapolis Policing Practices through the Log Gaussian Cox Process

Representative coursework (selected): Real Analysis, Complex Analysis, Time-series Analysis, Bayesian Statistics, Advanced Statistical Modeling, Algorithms, Parallel and Distributed Computing, Social Computing, Audio Programming

Honors and awards

2023 3rd Prize, Undergraduate Statistics Research Project, *American Statistical Association & Consortium for the Advancement of Undergraduate Statistics Education* (Paper: County-Level & Point-Level Analysis Of The Relationship Between Political Inclination & Frequency Of Electric-Vehicle Charging Stations In New England)
2022 Awardee, Outstanding Undergraduate Researcher Award, *Computing Research Association*
2021 Kolenkow-Reitz Fellowship, *Carleton College*

Peer-reviewed publications

2022 Adversarial bandits for drawing generalizable conclusions in non-adversarial experiments: an empirical study
Yang Zhi-Han, Shiyue Zhang, Anna Rafferty
International Conference on Educational Data Mining (EDM) — 30%

2022 Hierarchical Reinforcement Learning under Mixed Observability
Hai Nguyen*, Zhihan Yang*, Andrea Baisero, Xiao Ma, Robert Platt†, Christopher Amato†
International Workshop on the Algorithmic Foundations of Robotics (WAFR) — 56%

2021 Recurrent Off-policy Baselines for Memory-based Continuous Control
Zhihan Yang*, Hai Nguyen*
Deep Reinforcement Learning Workshop, Conference on Neural Information Processing Systems (NeurIPS) — 50+ stars on GitHub

2020 Game Level Clustering and Generation using Gaussian Mixture Variational Autoencoders
Zhihan Yang, Anurag Sarkar, Seth Cooper
AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) — 25% (selected for oral presentation)

Tutorial papers

2022 Training Latent Variable Models with Auto-encoding Variational Bayes: A Tutorial
Yang Zhi-Han
arXiv preprint

Research talks

Paper presentation at EDM 2022 on adversarial bandits
Paper presentation at WAFR 2022 on hierarchical reinforcement learning
Poster presentation at DeepRL Workshop at NeurIPS 2021 on recurrent off-policy RL algorithms
Paper presentation at AIIDE 2020 on Gaussian Mixture VAE

Research experience (in reverse chronological order)

2022.6 ~ 2022.8 **Probabilistic programming — for conducting Bayesian inference with Markov-chain Monte Carlo in R**
With Prof. Adam Loy, Department of Mathematics & Statistics, Carleton College, MN, USA

- Implemented unconditional models, linear regression models, generalized linear models and hierarchical (i.e., mixed-effect) models using popular MCMC packages in R: rjags, runjags, RStan, rstanarm, brms, NIMBLE and greta
- Created visualizations of MCMC samples (e.g., prior/posterior predictives, trace, ACF) via ggplot2 and bayesplot
- Summarized pros and cons and created example workflows of each package; journal manuscript under preparation

2021.3 ~ 2022.3 **Deep reinforcement learning — for efficiently solving partially observable tasks in robotics**
With Prof. Christopher Amato, Lab for Learning & Planning in Robotics, Northeastern University, MA, USA

- Implemented DeepMind's Recurrent Deterministic Policy Gradient in PyTorch, and greatly improved its learning stability by incorporating two recent advances in controlling value over-estimation; paper accepted at Deep RL workshop at NeurIPS 2021
- Open-sourced one of the first baselines of recurrent off-policy deep RL algorithms; gained 50+ stars on Github
- Proposed hierarchical algorithms for a subclass of partially observable problems that explore better and are more sample-efficient than baselines; constructed optimality proof; paper accepted at WAFR 2022
- Vectorized a nested recurrent architecture in which two LSTM modules operate at different time scales

2020.9 ~ 2022.8 **Multi-armed bandit algorithms — for personalized education & adaptive experimental design**
With Prof. Anna N. Rafferty, Department of Computer Science, Carleton College, MN, USA

- Initiated an investigation on whether regularization can lead to better exploration for contextual bandits based on Bayesian logistic regression; results helped discover a crucial bug in legacy code
- Provided a mathematical analysis of the aforementioned bug to understand its consequences and proposed a new bandit update rule, though it did not have better performance empirically
- Implemented adversarial bandits; studied their statistical consequences for experimental design; designed and ran experiments on synthetic and real-world datasets; wrote code for statistical testing and visualization; paper accepted at EDM 2022

2019.6 ~ 2020.8 **Deep generative models — for procedural content generation of video game levels**
With Prof. Seth Cooper, Game Lab, Northeastern University, MA, USA

- Learned PyTorch and led the development of PyTorch codebases for deep generative models (GAN, VAE-GAN and conditional VAE); trained models using GPUs on 2D game corpus of Super Mario Bros and Kid Icarus
- Performed exploratory analysis of trained models such as between-game blending and finding latent vector via CMA-ES evolutionary strategy to generate levels with desired properties; results accepted as workshop papers at AIIDE 2019 and AIIDE 2020
- Proposed to use Gaussian Mixture VAE for unsupervised learning of semantically meaningful and disentangled clusters of game levels that can be re-targeted for conditional generation; paper accepted at AIIDE 2020 as oral

Industry experience

2022.1 ~ 2022.3 Natural language processing (NLP) with deep learning
Data Ignition Center of KPMG (Klynveld Peat Marwick Goerdeler), Nanjing, Jiangsu, China

NLP for Chinese spelling correction: I surveyed recent papers on this topic and gave weekly presentations to the AI team. I identified the SOTA, but pointed out to the team that it is highly dataset-dependent (e.g., can't correct unseen names, which is common in contracts). I gained in-depth knowledge on seq2seq, attention, and large language models.

Teaching experience

2023.7 ~ Instructor for Cambridge AS & A Level Mathematics and International Baccalaureate (IB) Mathematics
New Channel International Education Group, Suzhou, Jiangsu, China

Open-source projects (selected)

alpha-zero. Minimal AlphaZero in PyTorch, trained on Connect4 on a 6x6 board.
cnnvis. A Python library for visualizing convolutional neural networks.
off-policy-continuous-control. Official PyTorch code for my Deep RL Workshop paper at NeurIPS 2021.
pytorch-ppo. Minimal proximal policy gradient (clipped version) in PyTorch.
tmixfit. Vectorized Expectation Maximization for Student-t mixture models in PyTorch.
vi-with-normalizing-flow. Unofficial PyTorch implementation of the paper "Variational Inference with Normalizing Flows".

Independent studies

Bayesian deep learning. Summer 2022 with Prof. Anna N. Rafferty at Carleton College
AlphaGo & AlphaZero. Summer 2021 with Prof. Anna N. Rafferty at Carleton College
Tabular reinforcement learning. Summer 2020 with Prof. Anna N. Rafferty at Carleton College
Tabular reinforcement learning. Fall 2019 with Prof. Joshua R. Davis at Carleton College
Recurrent neural networks. Fall 2019 with Prof. Dave Musicant at Carleton College

Community service

2023 Journal reviewer for IEEE Transactions on Games
2023 Data consultant for Confluence Studio
Assisting a non-profit social group in Minneapolis to understand how community characteristics predict policing frequency & practices
2023 Data consultant for Northfield Curbside Compost
Assisting a non-profit composting company in Northfield, Minnesota to improve its business strategies and get new clients