

# Yushu Pan

+1-626-318-5125 | [yp2602@columbia.edu](mailto:yp2602@columbia.edu) | 560 Riverside Drive, APT 1S, NY, 10027 | [Personal Website](#)

## RESEARCH INTEREST

Causal inference and machine learning, with a focus on **causal generative models** and **causal representation learning**.

## EDUCATION

- **Columbia University** Sep 2021 - Expected Jun 2026  
*Ph.D. Research Scientist in Computer Science* New York, United States
  - GPA: 4.0/4.0    Advisor: [Prof. Elias Bareinboim](#)
- **California Institute of Technology** Sep 2019 - Jun 2021  
*Master of Science in Electrical Engineering* Pasadena, United States
  - GPA: 4.2/4.3    Advisor: [Prof. Yisong Yue](#)
- **Beijing Institute of Technology** Sep 2015 - Jun 2019  
*Bachelor of Science in Electrical Engineering* Beijing, China
  - GPA: 93/100    Ranking: 1/425    Advisor: [Prof. Yuantao Gu](#)
- **Peking University** Sep 2017 - Jun 2019  
*Bachelor of Economics* Beijing, China
  - GPA: 3.7/4

## PUBLICATIONS

- [1] [Pan, Y\\*](#), [Li, A\\*](#), Bareinboim, E. "[Disentangled Representation Learning in Non-Markovian Causal Systems](#)", In 38th Conference on Neural Information Processing Systems (NeurIPS), 2024.  
*\*Contributed equally, Author names in alphabetical order*
- [2] [Pan, Y.](#) and Bareinboim, E. "[Counterfactual Image Editing](#)", In Proceedings of International Conference on Machine Learning (ICML), 2024.
- [3] Xia, K., [Pan, Y.](#), Bareinboim, E. "[Neural Causal Models for Counterfactual Identification and Estimation](#)", In International Conference on Learning Representations, (ICLR), 2023.
- [4] [Pan, Y.](#), Jiao, Y., Li, T., Gu, Y. "[An efficient algorithm for hyperspectral image clustering](#)", IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2019.

## SELECTED RESEARCH PROJECTS

- **Causal Image Editing with Large Generative Models** Mar 2023 - present  
*Advisor: [Prof. Elias Bareinboim](#), Columbia University*
  - Developed causal theory and neural network models to realistically edit images. Proved that current state-of-the-art models (e.g. DALL-E, StableDiffusion) cannot provide causal reliability for image editing tasks.
  - Proposed '**counterfactual(ctf)-consistent estimators**' that ensure causal consistency between the features users prioritize for practical applications. Developed an algorithm called **Augmented Neural Causal Model (ANCM)** that efficiently estimates counterfactuals, and generates high-fidelity realistic images.
  - (Ongoing) Incorporate '**ctf-consistent estimators**' with **text-to-image** pre-trained models (e.g., StableDiffusion, Latent Diffusion Model) to perform causal image editing using text prompts.
- **Causal Disentangled Representation Learning** Oct 2023 - present  
*Advisor: [Prof. Elias Bareinboim](#), Columbia University*

- Formalized a general version of the causal representation learning problem and developed graphical criteria and an algorithm (**CRID**) to determine whether representations are identifiable, leading to robust downstream tasks
- Developed a VAE and normalizing flow algorithm to perform realistic image generation and robust downstream classification tasks without annotations.
- **Causal Neural Networks for Counterfactual Identification and Estimation** Sep 2022 - May 2023  
*Advisor: Prof. Elias Bareinboim, Columbia University*
  - Theoretically proved that deep models are incapable of making causal inferences when trained solely on observational data. Developed a class of causal models using neural networks, called **Neural Causal Models (NCMs)**, for counterfactual identification and estimation.
  - Developed a causal GAN (a practical version of NCM) and conducted experiments to demonstrate causal GANs are able to estimate causal queries more efficiently and accurately than existing baselines.
- **Data-Driven Optimization for ML Algorithms** Jan 2020 - Sep 2021  
*Advisor: Prof. Yisong Yue, Caltech*
  - Developed a data-driven optimization approach incorporating meta-learning and reinforcement learning techniques to achieve auto-hyperparameter tuning for structure learning methods (e.g., NOTEARS). Conduct experiments to show that the designed method provides more robust results in synthetic and real datasets.
- **Subspace Methods and Hyperspectral Images Clustering** Mar 2018 - Jun 2019  
*Advisor: Prof. Yuantao Gu, Tsinghua University*
  - Designed a highly accurate clustering algorithm for hyperspectral images that is more efficient than existing subspace algorithms, and applied successfully on medical and satellite imagery.

## INDUSTRIAL EXPERIENCE

---

- **Pulmonary Nodules Detection in CT Images** Dec 2017 - Mar 2018  
*Advisor: Prof. Yi Zhang, West China Hospital*
  - Implemented and optimized 3D-convolutional neural networks, and 3D-region proposal U-nets in PyTorch leading to 2x improved lung nodule detection with West China Hospital's CT scans.



## HONORS AND AWARDS

---

- **Greenwoods Fellowship** Oct 2021  
*Fu Foundation of Engineering and Applied Science at Columbia University*
- **Xu Te Li Scholarship (awarded to top 0.1% of undergraduates)** May 2019  
*Beijing Institute of Technology*
- **National Scholarship** Dec 2017  
*Chinese Ministry of Education*
- **Grand prize in the Excellence 9 Mathematical Competition of China** Oct 2016  
*Excellence League*

## TEACHING

---

- TA, CS 4775, Causal Inference I, Columbia University, Fall 2023 / Fall 2024. 
- TA, CS 4995, Causal Inference II, Columbia University, Spring 2023.
- TA, ACM 116, Introduction to Probability Models, Caltech, Fall 2020. 

## SKILLS

---

- **Programming Languages:** Python, C, Verilog, VHDL, Matlab, CAD
- **Packages:** Numpy, Scipy, Pandas, SQL, Lightning, Git, Docker
- **ML:** Causal Inference, Diffusion, Transformers, LLMs, Subspace