Xinyu **Yang**

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Education

Shanghai Jiao Tong University — *Shanghai, China*

Bachelor of Engineering in Computer Science, ACM Honors Class — *Sept. 2019 - Present*

- **ACM Honors Class** is an elite CS program for students ranked in the top 5% with aspirations in research.
- Overall GPA: **91.39 / 100**, Ranking: **1 / 30**
- Honored **national scholarship twice**

Research Interests

Machine Learning, Out-of-Distribution Robustness, Computation-Efficient 3D Point Cloud Perception, Data-Efficient Learning.

Publications

** indicates equal contributions*

Variational Inference for Training Graph Neural Networks in Low-Data Regime through Joint Structure-Label Estimation — *KDD 2022*

Danning Lao, **Xinyu Yang***, Qitian Wu and Junchi Yan*

Relational Out-of-Distribution Generalization — *Preprint*

Xinyu Yang, Huaxiu Yao*, Xinyi Pan, Shengchao Liu, Pang Wei Koh and Chelsea Finn*

FlatFormer: Flattened Window Attention for Efficient Point Cloud Transformer — *Under Review*

Zhijian Liu, **Xinyu Yang***, Haotian Tang, Shang Yang and Song Han*

Multi-domain Long-Tailed Learning By Augmenting Disentangled Representations — *Under Review*

Huaxiu Yao, **Xinyu Yang***, Allan Zhou and Chelsea Finn*

BEVFusion: Multi-Task Multi-Sensor Fusion with Unified Bird's-Eye View Representation — *Under Review*

Zhijian Liu, Haotian Tang*, Alexander Amini, **Xinyu Yang**, Huizi Mao, Daniela Rus and Song Han*

Honors & Awards

National Scholarship of P.R. China **(Top 0.2%, nationwide)** — *2021, 2022*

SenseTime Scholarship **(Top 30 undergraduate in the field of AI, nationwide)** — *2021*

Han-Ying-Ju-Hua Scholarship **(15 winners each year, Shanghai Jiao Tong University)** — *2021*

Fan Hsu-Chi Scholarship **(10 winners each year, Shanghai Jiao Tong University)** — *2020*

Academic Excellence Scholarship **(Top 5%, Shanghai Jiao Tong University)** — *2020, 2021, 2022*

Zhiyuan Honorary Scholarship — *2019, 2020, 2021*

Research Experience

Stanford University — *Stanford, CA, USA*

Research Intern at IRIS, advised by Prof. Chelsea Finn — *Mar. 2022 - Present*

- **Multi-Domain Long-Tailed Learning**
  Real-world data often involves multiple domains with distinct imbalanced class distributions. We study this multi-domain long-tailed learning problem and introduce **TALLY** that generalizes well across all domains and classes. **TALLY** empowers augmentation to balance examples over domains and classes by decomposing and reassembling example pairs. This work led to a **co-first-authored submission to ICLR 2023**.
- **Relational Out-of-Distribution Generalization**
  In distribution shifts, some test domains only correlate with a few training domains. In this work, we introduce ROOG to harness the power of domain relations derived from domain meta-data. ROOG tailors the generalization process to each test domain by reweighting the training domains according to the given domain relation. The work led to **a co-first-authored workshop publication at DistShift in NeurIPS 2022**.
- **Out-of-Distribution Type Detection**
  Out-of-distribution detection is critical to ensuring the reliability of machine learning systems. However, prior works only focus on detecting semantic shifts, ignoring other shift types. In this work, we aim to develop an end-to-end framework that detects semantic/covariate/concept shifts and further adapts pre-trained models to changing environments by selectively fine-tuning according to the detected shift types.

Massachusettes Institute of Technology

Cambridge, MA, USA

Research Intern at HanLab, advised by Prof. Song Han — *Nov. 2021 - Present*

- **Efficient Point Cloud Transformer**
  For 3D point cloud transformers, their latency lags behind sparse convolutional models though achieving on-par performance. In this work, we present **FlatFormer** to close this latency gap by trading spatial proximity for better computational regularity. FlatFormer delivers **SOTA** results on Waymo Open Dataset with **4.6**× speedup over (transformer-based) SST and **1.4**× speedup over (sparse convolutional) CenterPoint. It is the **first** point cloud transformer achieving real-time inference on edge GPUs. This work led to **a co-first-authored submission to CVPR 2023**.
- **Multi-Sensor Fusion in Autonomous Driving System**
  Multi-sensor fusion is essential in autonomous driving system. In this work, we propose **BEVFusion**, an efficient multi-task multi-sensor fusion framework that unifies multi-modal features in the shared BEV representation space. On nuScenes, It achieves **1.3%** higher mAP on 3D object detection and **13.6%** higher mIoU on BEV map segmentation, with **1.9**× lower computation cost. This work led to **a submission to ICRA 2023**.
- **3D Panoptic Segmentation**
  In this project, we apply SPVCNN to panoptic segmentation with an instance branch predicting the offsets to the instance center. Built upon the MeanShift clustering algorithm, SPVCNN++-Panoptic regresses the instance centers of 'things' points to predict instance labels. It won **2nd** place in nuScenes panoptic challenge while achieving **SOTA** panoptic quality in two particle reconstruction tasks in physics with data from HGCAL.
- **3D BEV Map Segmentation Benchmark**
  In most autonomous drive benchmarks (e.g. nuScenes), their official split is specific for detection task, where training and test scenes may include same regions from distinct timestamps. This leads to data leakage in 3D BEV map segmentation task. Therefore, we re-split scenes for this task and propose a unified and easy-to-use BEV map segmentation benchmark on nuScenes.

Shanghai Jiao Tong University

Shanghai, China

Undergraduate Researcher at ThinkLab, advised by Prof. Junchi Yan — *Jun. 2021 - Aug. 2022*

- **Data-Efficient Graph Learning through Structure-Label Joint Estimation**
  In real-world scenarios where complete input graph structure and sufficient node labels may not be achieved easily, GNN models encounter severe performance degradation. To address this problem, we propose **WSGNN**, a flexible probabilistic generative framework which harnesses variational inference to solve weakly supervised graph learning in a label-structure joint estimation manner. WSGNN achieves **SOTA** results on both node classification and link prediction over real-world benchmarks. This work led to a **co-first-authored publication in KDD 2022**.

Selected Projects

Mx* Compiler

Java

Assembly Language, Code Generation and Optimization, LLVM IR, ANTLR — *Jan. 2021 - Jun. 2021*

- Developed a compiler for C-and-Java-like language (Mx*) to NASM with **10k+ lines of codes**, which performance is **close to GCC-O2**.
- Implemented optimization algorithms such as sparse conditional constant propagation, function inline and static single assignment

Traffic Signal Controller

Python

Reinforcement Learning, DQN, City-scale Road Network — *Jan. 2021 - Jun. 2021*

- Coursework of "Machine Learning" (31st place in *KDD CUP 2021 - City Brain Challenge*)
- Designed an agent that coordinates the traffic signals to maximize number of vehicles served while maintaining an acceptable delay.

RISC-V CPU

Verilog

Computer Architecture, Tomasulo, FPGA Programming — *Nov. 2020 - Dec. 2020*

- Designed a RISC-V CPU that supports RV32I Base Integer Instruction Set V2.0 (2.1-2.7).
- Implemented a **Tomasulo** algorithm with load/store buffer that is more efficient than a five-stage pipelined one.

Teaching Experience

Teaching Assistant	*Compiler Design and Implementation*	*Fall 2021*
Teaching Assistant	*Principle and Practice of Computer Algorithms*	*Summer 2021*
Teaching Assistant	*Data Structures*	*Spring 2021*

Skills

Programming	*Python, C++, JAVA, Golang, Verilog*
Tools and Frameworks	*Git, PyTorch, TensorFlow, Docker, Vivado, Markdown, LaTeX*
Languages	*Mandarin (native), English (TOEFL: 109)*