

Hao(Alex) Xiao

San Diego, CA

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Summary

- Senior research engineer with 5 years of computer vision and machine learning related working experiences
- Professional skills in autonomous driving with various project experiences, including perception & prediction & planning
- Experienced in developing and implementing project initiatives, and led junior engineers and interns to accomplish various projects
- Familiar with multiple programming languages and development tools, self-motivated and hard-working

Education

M.S. in Electrical & Computer Engineering, University of Washington (UW)

Sep. 2017 - Dec. 2018, Seattle

- GPA: 3.90/4.0, Member of Information Processing Lab, Advisor: Prof. Jenq-Neng Hwang (IEEE Fellow)

B.S. in Electrical & Computer Engineering, Shanghai Jiao Tong University (SJTU)

Sep. 2013 - Jun. 2017, Shanghai

- GPA: 3.70/4.0, Member of Image, Video, and Multimedia Communication Lab, Advisor: Prof. Weiyao Lin, Outstanding Graduate
- Thesis: Group Re-Identification by Leveraging and Integrating Multi-Grain Information

Skills

Expertise : Computer Vision, Machine Learning, Deep Learning, Autonomous Driving, Perception & Prediction & Planning

Languages : C/C++, Python **Tools** : Linux, OpenCV, TensorFlow, PyTorch

Work Experiences

Senior Research Engineer in Autonomy Brain Team @ TuSimple Inc.

Mar. 2019 - Present, San Diego

PREDICTION

- Built the motion prediction system as the first employee in prediction team, which includes data pipeline, modeling, deployment and regression testing, from scratch to a stable system and accomplished **the world's first "driver out" pilot program** [Link]
- Built a **transformer based motion prediction** architecture for highway scenarios by using **vectorized representation**
- Built a **CNN based motion prediction** model for local intersections by using **rasterized representation** to encode environment
- Applied anchor based decoder to generate **multi-modal trajectories** with covariance matrix to represent the prediction **uncertainty**
- Designed and implemented an **automated data pipeline and benchmark system** for continuous model improvement
- Achieved **the 1st place** of **2023 waymo open challenge** by integrating **Lidar point cloud** data as an additional input source for motion prediction. Method name: **MGTR_ens** (Our ensemble model) & **MGTR** (Our single model) [Challenge leaderboard]

PLANNING

- Reduced number of disengagements for **interaction handling** at merge scenario by predicting agent trajectories, planning decision and planning reference trajectory in the same time by a **joint prediction & planning model**
- Built an image based model to handle motion planning for **unprotected intersections** where the AV doesn't have the right-of-way
- Designed a **CVAE based model** which can automatically produce adverse **simulation** scenarios to test the planning software

PERCEPTION

- Proposed a new paradigm that jointly tackle **3d object detection** tasks via both **BEV (bird's eye view)** and **PV (perspective view)** feature representation and achieved the state-of-the-art results on both 3D object detection and map segmentation benchmarks.
- Developed **multi-camera unified pre-training framework** by using unlabeled image LiDAR pairs through Occupancy prediction and 3d reconstruction, improved 2% mAP for BEV detection algorithm such as BEVFormer and BEVDet.
- Maintained the **depth estimation** module which includes general projection, monocular depth estimation, stereo depth estimation.

Research Intern in Perception Team @ TuSimple Inc.

Jun. 2018 - Sep. 2018, San Diego

- Built an online **multi-sensor tracking** algorithm for an autonomous truck, incorporating Lidar and cameras, that operates in real-time
- Developed a learning-based similarity calculation module for better tracking association and improved tracking performance
- Created a regression test pipeline for better analyzing tracking results of different versions of tracking algorithm

Research & Projects

Research Assistant @ Information Processing Lab (IPL), UW

Sep. 2017 - Jun. 2017, Seattle

- Realized a **single-camera vehicle tracking** algorithm, and achieved 3D speed estimation based on the camera calibration [Demo]
- Designed and implemented **license plate detection** algorithm and **multi-camera vehicle re-identification** algorithm that based on the fusion of adaptive appearance feature, semantic feature and the comparison of license plates [Demo]
- Achieved **first place** in both Track 1: Traffic Flow Analysis and Track 3: Multi-camera Vehicle Detection & Reidentification of **NVIDIA AI City challenge 2018**, which held as a workshop at **CVPR 2018**. [Source code] [Challenge leaderboard] [UW spotlight]

Research Assistant @ Image, Video, and Multimedia Communication (IVM) Lab, SJTU

Sep. 2016 - Sep. 2017, Shanghai

- Collected two challenging group re-identification datasets by applying social constraint structure learning to detect groups [Link]
- Developed a **multi-grain group re-identification** process to re-identify groups of people in different camera views, which derives features for multi-grain objects and iteratively evaluates their importance to handle interferences from group dynamics
- Proposed a **multi-order matching process** by a personalized random walk scheme through a multi-order association graph, which integrates multi-grain information to obtain more reliable group matching results
- Achieved a real-time **YOLO** based object detection system and developed multiple object tracking algorithm by graph matching
- Implemented a **real-time UAV-based intelligent tracking system** on video stream by combining detection and tracking algorithm

Publications

Multi-Granular Transformer for Motion Prediction with LiDAR

Hao Xiao, Yiqian Gan, Yizhe Zhao, Ethan Zhang, Zhe Huang, Xin Ye, Lingting Ge
Submitted to IEEE ICRA 2024. 2023

DuoSpaceNet: Leveraging Both Bird’s-Eye-View and Perspective View Representations for 3D Object Detection

Zhe Huang, Yizhe Zhao, **Hao Xiao**, Lingting Ge
Submitted to IEEE AAAI 2024. 2023

SAPI: Surroundings-Aware Vehicle Trajectory Prediction at Intersections

Ethan Zhang, **Hao Xiao**, Yiqian Gan, Lei Wang
arXiv preprint arXiv:2306.01812. 2023

Group re-identification with multigrained matching and integration

Weiyao Lin, Yuxi Li, **Hao Xiao**, John See, Junni Zou, Hongkai Xiong, Jingdong Wang, Tao Mei
IEEE transactions on cybernetics pp. 1478–1492. IEEE, 2019

Group re-identification: Leveraging and integrating multi-grain information

Hao Xiao, Weiyao Lin, Bin Sheng, Ke Lu, Junchi Yan, Jingdong Wang, Errui Ding, Yihao Zhang, Hongkai Xiong
Proceedings of the 26th ACM international conference on Multimedia, 2018

Single-camera and inter-camera vehicle tracking and 3D speed estimation based on fusion of visual and semantic features

Zheng Tang, Gaoang Wang, **Hao Xiao**, Aotian Zheng, Jenq-Neng Hwang
Proceedings of the IEEE conference on computer vision and pattern recognition workshops, 2018

Patents

Agent behavior generation system for autonomous driving simulation

Hao Xiao, Yiqian Gan, Xin Ye, Calvin Miao, Lingting Ge
U.S. Patent Application (Pending). 2023

Transformer framework for trajectory prediction

Hao Xiao, Yiqian Gan, Ethan Zhang, Xin Ye, Yizhe Zhao, Zhe Huang, Lingting Ge
U.S. Patent Application No. 18/501,362 (Pending). 2023

Surrounding aware trajectory prediction

Ethan Zhang, **Hao Xiao**, Yiqian Gan, Yizhe Zhao, Zhe Huang, Lingting Ge
U.S. Patent Application No. 63/579,614 (Pending). 2023

Merge window recommendation

Ethan Zhang, Zhiqian Qiao, Calvin Miao, Yufei Zhao, Yiqian Gan, **Hao Xiao**, Weiyang Zhang, Lingting Ge
U.S. Patent Application (Pending). 2023

Method for constructing and visualizing heterogeneous thematic network based on text network

Junxian He, Ying Huang, Jiaming Shen, Changfeng Liu, Yuting Jia, **Hao Xiao**, Weijie Tang, Lingkun Kong, Tianheng Hu, Luoyi Fu, Xinbing Wang
CN Patent CN106372147A. 2020

Honors

Student Travel Grant , ACM Multimedia 2018 conference, funded by US National Science Foundation(NSF)	Aug. 2018
Winner Team , Track 1 & Track 3 at the NVIDIA AI City Challenge Workshop at CVPR 2018	Jun. 2018
Academic Excellence Scholarship & Xin Dong Scholarship , SJTU	2013-2017
First Prize , Chinese Mathematical Olympiad & China Undergraduate Mathematical Contest in Modeling	2012-2013

Professional Services

Reviewer : ETRI 2018, CVPR 2018-2019, TCSVT 2023

Attendance : CVPR 2018 (Salt Lake City, USA), CVPR 2019 (Long Beach, USA), ICCV 2019 (Seoul, Korea), CVPR 2022 (New Orleans, USA)