Yifei Liu

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EDUCATION

University of Zurich **Zurich, CH**
MSc in Informatics: Data Science (with highest distinction) Sept 2020 – Sept 2023
University of Science and Technology of China **Anhui, CN**
BSc in Mathematics and Applied Mathematics Sept 2016 – Sept 2020

RESEARCH EXPERIENCES

Exploring sparse computation with Vision Transformers **University of Zurich & ETH**
Advised by Prof. Davide Scaramuzza Sept 2022 – Present

- Derived a method to divide tokens into sub-tokens and re-merge them into new tokens along the network, extracted local information inside and between tokens and improved the ability of Vision Transformers to learn from scratch.
- Designed a training strategy that can back-propagate gradients through both used and unused tokens based on Gumbel Softmax.
- Combined a dynamic pruning ratio and a method of reusing pruned tokens on object detection and instance segmentation, and showed for the first time that token pruning can work well on dense tasks.
- Designed a variety of token pruning baselines from prior works based on classification and adapting them to instance segmentation and object detection tasks.

An offline python SLAM using COLMAP **ETH**
Advised by Paul-Edouard Sarlin and Prof. Marc Pollefeys March 2022 – Jun 2022

- Extended the colmap python bindings to have more control over the reconstruction process, and built a python SLAM that leveraged the advantages of both COLMAP and ORB-SLAM using monocular camera, including keyframe selection, covisibility graph, bundle adjustment and loop closure.
- Benchmarked on TUM-RGBD and KITTI datasets and showed ours achieves faster reconstruction speed than COLMAP and better reconstruction results than ORB-SLAM2.

Efficient spatio-temporal processing of event data **University of Zurich & ETH**
Advised by Prof. Davide Scaramuzza Sept 2021 – Feb 2022

- Explored effectiveness of three methods to explore spatial-temporal information for event camera data, including point-based, voxel-based and point-voxel based neural networks.
- Fused voxel features and point features through efficient CUDA implementation, adjusted the model structure for event data and improved model performance in classification on N-Caltech 101 dataset and optical flow on DSEC dataset for event cameras.

Detecting non-recurrent traffic anomalies in Beijing City **Chinese Academy of Science**
Advised by Prof. Xingwu Wang Jul 2019 – Aug 2019

- Led a group of four students and established a traffic model by data cleaning, k-means clustering and non-negative matrix factorization, with all the algorithms implemented from scratch without using open source libraries.

COURSE PROJECT EXPERIENCES

Control for Spacecraft Rendezvous **ETH**
In Course: Model Predictive Control Apr 2022 – May 2022

• Implemented the system modeling of a spacecraft, an unconstrained optimal controller (LQR), a model predictive controller with theoretical closed-loop guarantees and soft constraints, and a robust MPC controller under model mismatch and unmodeled disturbances.

Control a lunar lander with reinforcement learning **ETH**

In Course: Probabilistic Artificial Intelligence Nov 2021 – Dec 2021

• Implemented vanilla policy gradients REINFORCE with rewards-to-go, and then implemented and compared with generalized advantage estimation (GAE) which further reduce policy gradient variance.

Multi-task learning for autonomous driving **ETH**

In Course: Deep Learning for Autonomous Driving Mar 2021 – July 2021

• Adopted DeepLabv3+ model and tried three architectures for multi-task learning (MTL) models to do semantic segmentation and monocular depth estimation jointly, including a shared head, branched heads and branched heads with cross-attention.

• Built a 2-stage 3D object detector to detect vehicles in autonomous driving scenes based on lidar points, and won the 2nd place in the lidar 3D object detection competition.

TEACHING EXPERIENCES

Teaching Assistant **University of Science and Technology of China**

Computer Programming A Sept 2019 – Jan 2020

• Guided students through weekly lab sessions, providing assistance and answering related questions.

• Graded assignments and participated in marking the final exam to assess student performance.

• Assisted in the preparation and organization of course materials, including lab exercises and exams.

AWARDS

Outstanding Student Scholarship of USTC Oct 2019

Advancement Scholarship of USTC Nov 2018

Outstanding Student Scholarship of USTC Oct 2018

Outstanding Freshman Scholarship of USTC Oct 2016

SKILLS

Languages Python, Pytorch, C/C++, MATLAB

Others Latex, Github, Markdown