Yujie HE

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EDUCATION

École polytechnique fédérale de Lausanne (EPFL), Switzerland *Sep. 2020 - Present*

- Major in Robotics
- Semester Research Student at Laboratory of Intelligent Systems (LIS)
- Enroll as special student (Fachstudierende) at ETH Zürich

Tongji University, Shanghai, China *Sep. 2015 - Jul. 2020*

- BEng in Mechanical Engineering; GPA: 4.57/5; Ranking: 4/114
- Awarded Excellent Graduates of Shanghai and Tongji University Outstanding Scholarship

RESEARCH INTERESTS

Robotic Perception, Mobile Robotics, Unmanned Aerial Vehicle (UAV), Visual Object Tracking, 3D Vision

PROJECT EXPERIENCES

Multi-modal pedestrian behavior analysis for Qolo navigation in crowd *Oct. 2021 - Present*
Research Assistant at Learning algorithms and systems Laboratory (LASA), EPFL
Supervisor: Dr. Diego Paez-Granados and Prof. Aude Billard

- Worked under EU Crowdbot project – safe navigation of robot in crowd, and compiled the dataset of robot navigation around pedestrians from experiments conducting in Lausanne center.
- Developed the toolkit for sensor data extraction and processing (filtering and sampling), multi-modal pedestrian detection and tracking, crowd density characteristics and control performance evaluation, and data visualization.

Autonmous Navigation and Artifact Detection & Mapping in Cluttered Environment *Jul. 2021*
Participant of ETH Robotics Summer School

- Highly competitive program with less than 7% acceptance ratio for students outside ETHz.
- Integrated the existing ROS software stack with MissionPlanner to enable autonomous navigation and localization of the SuperMegaBot in the training facility at Wangen an der Aare, designed to simulate complex search/rescue scenarios.
- Developed post-processing toolkit to analyze the detected artifacts from the recorded rosbag, and utilize DBSCAN to cluster duplicate instances generated by YOLO3.

Development of Vision Based Algorithms to a Window/Balcony Drone Delivery *Feb. 2021 - Aug. 2021*
Semester Research Student at Laboratory of Intelligent Systems (LIS), EPFL
Supervisor: Valentin Wüest, Dr. Przemyslaw Mariusz Kornatowski, and Prof. Dario Floreano

- Conducted literature survey on marker-based autonomous drone navigation applications and investigated the suitable **fiducial visual marker for last-cm delivery** with in-depth evaluation.
- Based on the **PackDrone** developed at LIS, distance sensor (TFMINI Plus) and camera (MYNTEYE S1030) is utilized for **collision prevention** and **marker-based navigation**.
- Indoor tests with OptiTrack system as reference are currently underway to verify the accuracy and robustness of overall pipeline in **window/balcony drone delivery scenarios** with obstacles.

Real2CAD: Shape Matching of Real 3D Object Data to Synthetic 3D CADs *Feb. 2021 - Jul. 2021*
Semester Research Student in 3D Vision provided by Computer Vision and Geometry Group, ETH Zürich
Supervisor: Dr. Iro Armeni and Shengyu Huang (PhD student)

- Proposed a novel end-to-end scan to CAD retrieval neural network based on **joint embedding**, where noisy 3D object scan can be separated from the background cluttering and further completed into a CAD-like representation.
- Applied the mixed strategy of offline triplet sampling to learn a **rotation-aware joint embedding** of scan and CAD to enable the fine-grained CAD retrieval with the approximate rotation.
- Evaluated on the **scan and CAD similarity** and **Scan2CAD** benchmark, which demonstrates the state-of-art performance compared to the baseline in both retrieval accuracy and alignment accuracy.

LiDAR-Based High-Definition Map Development for V2X Applications *Jun. 2020 - Aug. 2020*
Perception Algorithm Development Intern at Hesai
Referee: Dr. Kai Sun (Chairman & Chief Scientist of Hesai Technology)

- Conducted a survey on high-definition maps and V2X applications from scratch, including mainstream data formats (such as OpenDRIVE, lanelet, NDS), production pipeline & tools, major global suppliers, and related datasets & simulators.
- Participated in the **road test for Hesai's latest 128-line LiDAR Pandar128**, and applied image processing and point cloud registration & matching algorithms to build a **semi-automated workflow from point clouds to high-definition maps** (related work has been accepted by *ICRA 2021* [1]).
- Developed the **HDMap SDK** (alpha version) based on OpenDRIVE1.6 for V2X scenarios, including **data I/O, coordinate projection, retrieval, visualization**, which provided support for downstream perception algorithms (3D object detection & tracking).

Online Visual Object Tracking for UAV in Dynamic Environments *Sep. 2018 - Aug. 2020*
Undergraduate Research Assistant at Vision4Robotics Group, Tongji University
Supervisor: Prof. Changhong Fu; *Co-advisor*: Prof. Peng Lu (Director of ArcLab, HKU)

- Investigated correlation filter (CF)-based **visual object tracking** for UAV and improved overall tracking performance in challenging scenarios with real-time operational capability. Related work has been published in top conferences and journals.
- Proposed a lightweight and generalizable **triple attention strategy** on CF-based framework by exploiting mutual independence of the appearance model and feature responses to implement real-time tracking for UAV (accepted by *IROS 2020* as **first author** [3]).
- Employed the adaptive **GMSD-based context analysis** and **dynamic weighted filters** for utilizing both contextual and historical information, and leveraged **convolution features** to efficiently raise the tracking robustness (accepted by *Neural Computing and Applications* as **first student author** [2]).
- Exploited the inter-frame information between prediction and backtracking phases, and further incorporated the **bidirectional incongruity error** into the CF learning (accepted by *ICRA 2020* and extended version in TCSVT [2]).
- Realized **nonsingleton fuzzy logic controllers** for unmanned aerial manipulators, reducing error rate by 20% compared to PID controllers in six types of trajectories.

Tongji University Design & Innovation College *Sep. 2018 - Jan. 2019*
Teaching Assistant in Open Source Hardware and Programming
Supervisor: Prof. Xiaohua Sun (Director of Center for Digital Innovation)

- Designed three sets of **serial electromechanical modules** for Industrial Design first-year students
- Delivered lectures on basic mechanical theory cooperating with Arduino hardware and programming as well as the advanced lecture on RGBD sensors for the course project [video]

Tongji University DIAN Racing Formula Student Electric Team *Sep. 2016 - Dec. 2018*
Powertrain Group Leader
Referee: Prof. Dr.-Ing. Tong Zhang (Director of the Clean Energy Automotive Engineering Center)

- Designed and optimized the overall powertrain system for **China's first leading four-wheel-drive Formula Student Racecar**, achieving 8% higher efficiency and 10% more lightweight.

- Participated FSEC 2017 - 2018 and SFJ 2018 as **Chief Powertrain Engineer** and reported at open-house Design Final Event, contributing to DIAN Racing's win in First Place in Engineering Design and Efficiency Prize, and Best Powertrain Award. [video]

SLAM and Autonomous Navigation for Skid Steer Wheel Robot *Jul. 2018 - Aug. 2018*
Robotics Algorithm Development Intern at Hesai
Referee: Dr. Kai Sun (Chairman & Chief Scientist of Hesai Technology)

- Implemented sensor fusion between **40-channel LiDAR (Pandar40)** and **gyroscope**, achieving a 5% accuracy improvements on advanced SLAM framework and 3D point cloud **mapping of Tongji University Jiading Campus**.
- Deployed control, decision, and communication ROS nodes for the self-developed **skid steer wheel robot**, realizing autonomous navigation and obstacle avoidance in a $300m^2$ workspace.

Tongji University Super Power Robot Team *Oct. 2016 - Jun. 2018*
Project Manager & *Mechanical Development Leader*
Supervisor: Dr. Jiong Zhao (Senior Engineer Staff Member at Tongji University)

- Led main robots design for national mobile robot competition, RoboMaster, achieving lightweight and stability of the **chassis** and **3DOF pan-tilt mechanism** for **multi-robot interaction**.

FEATURED PUBLICATION

† indicates corresponding author(s)

[1] Y. Pan, P. Xiao, **Y. He**, Z. Shao†, and Z. Li, "MULLS: Versatile LiDAR SLAM via Multi-metric Linear Least Square," in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2021. [paper] [code] [demo].

[2] C. Fu†, **Y. He**, F. Lin, and W. Xiong, "Robust multi-kernelized correlators for UAV tracking with adaptive context analysis and dynamic weighted filters," *Neural Computing and Applications*, vol. 32, no. 16, pp. 12 591–12 607, Aug. 2020. [paper] [code] [demo].

[3] **Y. He**, C. Fu†, F. Lin, Y. Li, and P. Lu, "Towards Robust Visual Tracking for Unmanned Aerial Vehicle with Tri-Attentional Correlation Filters," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2020, pp. 1575–1582. [paper] [code] [talk] [demo].

[4] F. Lin, C. Fu†, **Y. He**, F. Guo, and Q. Tang, "BiCF: Learning Bidirectional Incongruity-Aware Correlation Filter for Efficient UAV Object Tracking," in *IEEE International Conference on Robotics and Automation (ICRA)*, May 2020, pp. 2365–2371. [paper] [code] [demo].

SELECTED HONORS

- **Excellent Graduates of Shanghai** (top 3% students from all majors, provincial) *Jun. 2020*
- **Best Poster Award** of IROS Workshop (top 3 papers) *Nov. 2019*
- **Tongji Scholarship of Excellence** (top 5%, departmental) *Dec. 2016 - Dec. 2018*
- **Best Powertrain Award & First Prize** in Formula Student China (top 5%) *Nov. 2017 - Nov. 2018*
- **Overall Runner-up of EV class** in Student Formula Japan (highest level in Asia) *Sep. 2018*
- **Second Prize** in RoboMaster National College Student Robot Contest (top 10%) *Jun. 2018*

SERVICE

- **Reviewer** for IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS): 2020, 2021
- **Reviewer** for IEEE International Conference on Advanced Robotics and Mechatronics (ARM): 2019

SKILLS

Programming	MATLAB, Python, C/C++, LaTeX
Libraries	PX4, ROS, OpenCV, PCL
Hardware	Arduino, Raspberry Pi, Pixhawk
Design	AutoCAD, SolidWorks
Language	Chinese (Native), English (C1), Deutsch (B1), Français (A1)
English	IELTS (7.0, 7.5R/7.5L/6.0W/6.0S), GRE (152V, 170Q, 3.5AW)