

En Xu (Thomas) Li

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Research Interests

Autonomous Vehicle, Object Detection and Recognition, LiDAR Semantic and Instance Segmentation, LiDAR Panoptic Tracking, Motion Prediction, Point Cloud Semi-supervised and Unsupervised Learning, 2D and 3D Scene Understanding, Video Understanding

Education

Sep 2017 – Apr 2022 | **Bachelor of Applied Science in Engineering Science**, University of Toronto
Robotics Major, Artificial Intelligence Minor, Engineering Business Minor
Major GPA: 3.98/4.00, cGPA: 3.86/4.00
University of Toronto Scholar, NSERC Undergrad Student Research Award, Daisy Intelligence Scholarship, Dean's Honour List

Experience

Sep 2021 - Ongoing | **University of Toronto Institute of Aerospace Studies** | Undergraduate Thesis Student
Supervised by Prof. Steven Waslander, Toronto Robotics and Artificial Intelligence Laboratory

- Researching 4D Panoptic LiDAR Segmentation for Autonomous Vehicles
- Designing and investigating LiDAR segmentation networks that could provide, 1) semantics of both static and dynamic environment, 2) shapes of the surrounding objects, and 3) past trajectories / tracks of the dynamic instances. Paper in preparation.

May 2020 - Aug 2021 | **Noah's Ark Lab, Huawei Canada** | 3D Perception Research Intern
Supervised by Dr. Bingbing Liu, Cognitive IoV Perception Team

- Built a custom PyTorch training pipeline for panoptic segmentation with LiDAR inputs
- Led a research project on real-time deployable panoptic segmentation networks using LiDAR point cloud as inputs. First author of *CPSeg* and *SMAC-Seg*, state-of-the-art methods on SemanticKITTI panoptic segmentation benchmarks. Three Patents pending (as the main inventor), two paper (as the leading author) under review
- Designed and supported the development of high-performance perception models. Co-author of *AF2-S3net* (accepted at *CVPR 2021*) and *GP-S3net* (accepted at *ICCV 2021*). The two models are top ranked on SemanticKITTI and nuScenes semantic segmentation and panoptic segmentation challenges upon publication

May 2019 - Aug 2019 | **Department of ECE, University of Toronto** | Summer Student Researcher
Supervised by Prof. Roman Genov, Intelligent Sensory Microsystems Laboratory

- Designed FSMs and Programmed the FPGA board (Opal Kelly XEM7310) to control 3D imaging cameras with CMOS sensors using Verilog and Python
- Refined the PC-FPGA communication and memory interfacing to allow faster data process by replacing sequential read/write to all-freedom DDR3 memory address mapping

Honors

2020 | **Daisy Intelligence Scholarship**

- Awarded for being the top-ranked robotics engineering student in the 3rd year

2019	NSERC USRA <ul style="list-style-type: none"> Undergraduate Student Research Award by Natural Sciences and Engineering Research Council of Canada (NSERC) ESROP-U of T Fellowship [<i>declined</i>] <ul style="list-style-type: none"> Awarded by Engineering Science Research Opportunities Program to pursue a paid summer research internship at University of Toronto ESROP-Global Fellowship [<i>declined</i>] <ul style="list-style-type: none"> Awarded by Engineering Science Research Opportunities Program to pursue a paid summer research internship at National University of Singapore
2017	University of Toronto Scholar The Murray Calder Hendry Scholarship

Publications

2022	[1] E. Li , R. Razani, Y. Xu, B. Liu, "SMAC-Seg: LiDAR Panoptic Segmentation via Sparse Multi-directional Clustering," to appear at ICRA , 2022.
2021	[1] R. Razani*, R. Cheng*, E. Li , E. Tagahvi, Y. Ren, B. Liu, "GP-S3Net: <u>G</u> raph-based <u>P</u> anoptic <u>S</u> parse <u>S</u> emantic <u>S</u> egmentation Network," ICCV 2021 [2] R. Cheng, R. Razani, E. Tagahvi, E. Li , B. Liu, " $(AF)^2$ -S3Net: <u>A</u> ttentive <u>F</u> eature Fusion with <u>A</u> ddaptive <u>F</u> eature Selection for <u>S</u> parse <u>S</u> emantic <u>S</u> egmentation Network," CVPR 2021

Preprints Under Review

2021	[1] E. Li , R. Razani, Y. Xu, B. Liu, "CPSeg: Cluster-free Panoptic Segmentation Network of LiDAR Point Clouds," <i>arXiv preprint arXiv:2111.01723</i> , 2021.
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Patents

2021	[1] E. Li , R. Razani, Y. Ren, B. Liu, "Methods and Systems for Deterministic Calculation of Surface Normal Vectors for Sparse Point Clouds," <i>US Patent Application No. 63/242,000</i> [2] E. Li , R. Razani, B. Liu, "System and Method for Panoptic Segmentation System of Point Clouds," <i>US Patent Application No. 63/238,759</i> [3] E. Li , R. Razani, B. Liu, "System and Method for Proposal-free and Cluster-free Panoptic Segmentation System of Point Clouds," <i>US Patent Application No. 63/241,986</i>
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