

Runfa(Blark) Li

Email: rul002@ucsd.edu

Tel: +1 858-263-9368

Add: 9500 Gilman Dr, La Jolla, CA 92093

Website: <https://blarklee.github.io/>

Linkedin: <https://www.linkedin.com/in/runfa-li-261747151/>

Github: <https://github.com/BlarkLee>

PUBLICATIONS

- ✓ **Runfa Li**, Truong Nguyen. MonoPLFlowNet: Permutohedral Lattice FlowNet for Real-Scale 3D Scene Flow Estimation with Monocular Images. In *European Conference on Computer Vision (ECCV)*, 2022.
https://www.ecva.net/papers/eccv_2022/papers_ECCV/html/1569_ECCV_2022_paper.php
- ✓ **Runfa Li**, Truong Nguyen. SM3D: Simultaneous monocular mapping and 3d detection. In *IEEE International Conference on Image Processing (ICIP)*, pages 3652 – 3656, 2021. (Oral Presentation, 123/1722)
<https://ieeexplore.ieee.org/abstract/document/9506302>
<https://arxiv.org/abs/2111.12643>
- ✓ **Li, R.**; Feng, Y.; Pan, G.; Liu, L. Advances in Molecularly Imprinting Technology for Bioanalytical Applications. *SCI Sensors 2019*, 19, 177.
<https://doi.org/10.3390/s19010177>

CONFERENCE TALKS

- ✓ Oral presentation & Poster session in *2021 IEEE International Conference on Image Processing (ICIP)*
- ✓ UC San Diego Center for Wireless Communication, 2021 Annual “5G and Beyond Forum, innovating 5G – Envisioning 6G”. <http://6g.ucsd.edu/2021/speakers>
- ✓ UC San Diego Center for Wireless Communication, 2021 Research Review, <http://cwc.ucsd.edu/event/cwc-2021-virtual-research-review>

EXPERIENCE of WORK & EDUCATION

Work:

- | | |
|--|-------------------|
| Qualcomm | 06/2022 – 09/2022 |
| ✓ Position: Machine Learning Research Intern | |
| ✓ Business Group: Qualcomm Technologies, Inc. | |
| ✓ Department: Qualcomm R&D – XR/VR – Computer Vision Team | |
| ✓ Manager: Dr. Vasudev Bhaskaran, Senior Director, Engineering | |
| ✓ Location: San Diego, CA | |
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| Qualcomm | 06/2021 – 09/2021 |
| ✓ Position: Machine Learning Research Intern | |

- ✓ Business Group: Qualcomm Technologies, Inc.
- ✓ Department: Qualcomm R&D – XR/VR – Computer Vision Team
- ✓ Manager: Dr. Vasudev Bhaskaran, Senior Director, Engineering
- ✓ Location: San Diego, CA

Education:

UC San Diego 03/2021 – on going

- ✓ Degree: Doctoral
- ✓ Department: Electrical and Computer Engineering
- ✓ Research: 3D Computer Vision & Graphics

UC San Diego 09/2019 – 03/2021

- ✓ Degree: Master
- ✓ Department: Electrical and Computer Engineering
- ✓ Major: Signal and Image Processing

UCSD Video Processing Lab 07/2020 – on going

- ✓ Position: Graduate Student Researcher
- ✓ Advisor: Prof. Truong Nguyen

UCSD Mobile Systems Design Lab 01/2020 – 05/2021

- ✓ Position: Graduate Student Researcher
- ✓ Advisor: Prof. Sujit Dey, Prof. Sabur Baidya

Research-related Courses

COGS 225	Image Recognition	Prof. Zhuowen Tu	A+
		(Highest score over all 68 in the class)	
CSE 252C	Advanced Computer Vision	Prof. Manmohan Chandraker	A
CSE 252A	Computer Vision A	Prof. Benjamin Ochoa	A-
ECE 285	ML/CV on Autonomous Driving Systems	Prof. Mohan Trivedi	A

RESEARCH PROJECTS

Industry (Qualcomm)

SelfRecon: Self-supervised Explicit 3D Reconstruction (Qualcomm/UCSD collaborate)

07/2022 – on going

- ✓ **My work:**
State-of-the-art explicit 3D reconstruction models require large annotated data for training, while state-of-the-art implicit 3D reconstruction models (eg. Neural Radiance Field – Nerf) train in self-supervision without large annotated data. However, implicit models have very poor generalization ability – one model for one scene. We build SelfRecon, which is the first time the explicit 3D reconstruction can be trained in fully self-supervision with great generalization ability – Train on many scenes, use on many other scenes.
- ✓ **Achievement:**
Ongoing and target for ICCV 2023 submission.

Real-time 3D Hand Modeling & Tracking in C++

06/2021 – 10/2021

- ✓ **My work:**
Computer Vision & Graphics in 3D Hand Reconstruction, Modeling & Tracking
- ✓ **Achievement:**
 - **Development:** MANO is a widely used 3D hand model for both industry and research. However, the official MANO group only developed and released the code in python, where there is no open source C++ MANO implementation. I successfully implement MANO in C++, and replace the python implementation of the latest paper published by our group with my C++ implementation to extremely increase the inference speed for production demands.
 - **Research:** Based on the latest publication of our group, I designed a temporal-consistency model making use of the temporal information, and further boost the performance with other specifically designed 3D loss for temporal training.

UCSD (Graduate Level):**Monocular 3D Scene completion & Segmentation**

03/2022 – On going

- ✓ **Supervisor:** Prof. Truong Nguyen

MonoPLFlowNet: Permutohedral Lattice FlowNet for Real-Scale 3D Scene Flow with Monocular Images

01/2021 – 11/2021

- ✓ **Supervisor:** Prof. Truong Nguyen
- ✓ **My Work:**
We present a deep learning architecture on permutohedral lattice - MonoPLFlowNet. Different from all previous works, our MonoPLFlowNet is the first work where only two consecutive monocular images are used as input, while both depth and 3D scene flow are estimated in real scale. Our real-scale scene flow estimation outperforms all the state-of-the-art monocular-image based works recovered to real scale by ground truth, and is comparable to LiDAR approaches. As a by-product, our real-scale depth estimation also outperforms other the state-of-the-art works. Code will be available at <https://github.com/BlarkLee/MonoPLFlowNet>.
- ✓ **Achievement:**
Paper published to 2022 European Conference on Computer Vision (ECCV 2022) as the first author.

SM3D: Simultaneous Monocular Mapping and 3D Detection

06/2020 – 01/2021

- ✓ **Supervisor:** Prof. Truong Nguyen
- ✓ **My Work:**
we present an innovative and efficient multi-task deep learning framework

(SM3D) for Simultaneous Mapping and 3D Detection by bridging the gap with robust depth estimation and “Pseudo-Lidar” point cloud for the first time. The Mapping module takes consecutive monocular frames to generate depth and pose estimation. In 3D Detection module, the depth estimation is projected into 3D space to generate “Pseudo-Lidar” point cloud, where Lidar-based 3D detector can be leveraged on point cloud for vehicular 3D detection and localization. By end-to-end training of both modules, the proposed mapping and 3D detection method outperforms the state-of-the-art baseline by 10.0% and 13.2% in accuracy, respectively. While achieving better accuracy, our monocular multi-task SM3D is more than 2 times faster than pure stereo 3D detector, and 18.3% faster than using two modules separately.

✓ **Achievement:**

Paper published on 2021 IEEE International Conference on Image Processing (ICIP) as the first author, selected for **oral presentation** (123/1722).

<https://github.com/BlarkLee/SM3D>

Monocular Trajectory Prediction on Moving Source View

11/2020 - current

✓ **Supervisor:** Prof. Sujit Dey, Prof. Sabur Baidya

✓ **My Work:**

We try to build an innovative and efficient system that only takes monocular image snippets from a monocular camera on the moving ego-vehicle as the input, to predict the trajectory of both ego vehicle and surrounding vehicles. Object detection, localization, tracking and trajectory prediction are critical components in Autonomous Driving and Smart Transportation. Previous works tried to solve these tasks separately with cumbersome and expensive devices including LiDAR, Radar, GPS, Depth Camera, Stereo Camera, while no works proposed an efficient system dealing with all the tasks simultaneously and altogether with an affordable single device. In addition, all previous trajectory prediction works only assume a static source view and take the location information labeled from datasets as the input, and no works consider a moving source view and only take image sequences as the input, e.g., a camera installed on a moving vehicle. Our novel model and algorithm enable the system to be GPS-free and totally Vision-based, all we need is a monocular camera installed on the ego-vehicle.

✓ **Achievement:**

Substantial progress has made and still ongoing.

Trajectory Prediction for Collaborative Vehicular Perception Systems

07/2020-11/2020

✓ **Supervisor:** Prof. Sujit Dey, Prof. Sabur Baidya

✓ **My Work:**

This work consists of two parts. In the first part, our team build visual feature matching model for collaborative vehicular perception system, the visual matching algorithm augment collaborative vision to enhance safety in occluded

or blind traffic situation. In the second part, since we use edge computing to transmit visual info across vehicles, there is latency in data uploading and downloading between vehicles and the edge, I designed the trajectory prediction model to compensate the latency.

✓ **Achievement:**

Paper submitted to IEEE AI-Empowered Mobile Edge Computing in the Internet of Vehicles.

Gated Multi-Level Wavelet Convolutional Neural Networks in Semantic Segmentation

11/2020 – 12/2020

✓ **Supervisor:** Prof. Truong Nguyen

✓ **My Work:**

Current state-of-the-art semantic segmentation models typically extract the color, shape, and texture information from the spatial domain and are processed once and for all inside a deep Convolutional Neural Network (CNN). However, such a prototype is not ideal from two aspects. Firstly, solely considering and processing features in the spatial domain ignores the inner connection of features in the frequency domain; Secondly, a single stream CNN is not enough to process different types of information. Based on the concerns above, we proposed three new models: 1) The innovative Multi-Level Wavelet CNN (MWCNN) as applied to semantic segmentation, using the intuition that different types of information, especially texture features, are better extracted and learned in the wavelet domain. 2) A skip connection is then added to MWCNN to ensure low-level and high-level information are considered simultaneously. 3) Finally, to explicitly wire the shape features from different types of information, we build an innovative, new model named Gated-MWCNN (GMWCNN) which has an additional stream comprised of gated convolutional layers between the symmetric layers of encoder and decoder. Combining frequency domain analysis and gated convolutional mechanisms, it enables the model to use shallow CNN layers compared to extremely deep CNN prototypes used in semantic segmentation. Our GMWCNN achieves competitive and even better performance over strong baselines on Cityscapes Benchmarks. Code is available at: <https://github.com/BlarkLee/GMWCNN>.

✓ **Achievement:**

This is my final project for the course ECE251 C “Filter Banks and Wavelets” by Prof. Truong Nguyen in UCSD.

Undergraduate Level:

Research on Computer Vision, Image Processing and Machine Learning Related to Autonomous Vehicles

03/2018-01/2019

✓ **Supervisor:** Dr. Luyao Xu(UCLA Postdoc/PhD, Google)

✓ **Achievement:**

- Learned and coded most of the basic image processing and computer vision algorithms from scratch.

- Successfully developed two computer-vision based algorithms for lane-detection of autonomous driving, which run stably in complex road environment including highway and mountain road, and developed a multi-lane detection algorithm to achieve simultaneously four-lane detection in highway environment.
- Finished a paper as the first author and submitted to SCI.

Research on Big-data by integrating deep learning with container technology and database technology 08/2018- 11/2018

- ✓ **Supervisor:** Dr. Fan Zhang (MIT IBM Watson, MIT LIGO Lab)
- ✓ **Objective:** Achieve image prediction with CNN on cloud platform with Docker, deploy the prediction in Cassandra database by container communication.
- ✓ **Achievement:**
 - A trained-model of Convolutional Neural Network(CNN) is deployed into the container with Docker; Two types of web interfaces are designed using Flask for users to submit their images; The program then processes the image with the trained-model to predict a reliable result and expose the result back to the webpage with RESTful API. At the same time, the result (the prediction and the testing time) are deployed and stored in the database Apache Cassandra. The real time process of prediction and data storage are guaranteed by the communication between two containers on one local area network (LAN).
 - Finished report and released code to <https://github.com/BlarkLee/Big-data>.

Nano Bioprobes for biosensors based on Molecular Imprinting Technology

03/2017-04/2019

- ✓ **Supervisor:** Prof. Lei Liu (Jiangsu University)
- ✓ **My Work:**

Review the latest research in the field of MIP (Molecularly Imprinted Polymers) bioprobes for biosensors, design and experiment with different Nano polymeric modifiers for different properties and higher performance on biosensors for recognition, printing and capture of biomolecules and cells
- ✓ **Achievement:**
 - Published a review with our experiment on the state-of-the-art Nano MIP bioprobes for biosensors as the first author to **SCI Sensors**.

FELLOWSHIPS & HONERS

- ✓ First-class Fellowship awarded by Jiangsu University 2016 & 2017 & 2018
- ✓ Merit Student of Jiangsu University 2016 & 2017 & 2018
- ✓ Hall of Fame in Class of 2019 & Graduate with honors by Jiangsu University

ACHIEVEMENTS IN PROFESSIONAL MUSIC

- ✓ Professional musical training – Percussion Instrument 2000 - 2010

- ✓ Professional Level 9 (Highest level) in Central Conservatory of Music (CCOM, the Highest conservatory of music in China) 2006
- ✓ Admission by The Middle School affiliated to CCOM 2009
- ✓ First Prize in Beijing Instrumental Competition 2006&2007&2008

TECHNICAL SKILLS

C/C++, Python (Pytorch, Tensorflow, OpenCV), MATLAB, Linux programming, NoSQL (Apache Cassandra), Container Technology(Docker), Assembly Language

OUTREACH ACTIVITIES

Volunteer Service in the program organized by “China Foundation for Poverty Alleviation” to raise money for preschool and primary school kids in Guizhou Province, China 10/2015-12/2015