

## Hengli Wang

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### EDUCATION

**The Hong Kong University of Science and Technology, Hong Kong SAR, China.**

Ph.D. in *Electronic & Computer Engineering* 09/2018–11/2022

- Research Interests: Stereo matching, optical flow estimation, semantic segmentation, ground mobile robots, autonomous driving, computer vision, and deep learning.
- Thesis Title: Semantic Segmentation with the Assistance of Visual Features for Autonomous Driving.
- Supervisor: **Prof. Ming Liu.**

**Zhejiang University, Hangzhou, China.**

B.Eng. in *Mechotronics Engineering* 09/2014–06/2018

- Overall GPA: 3.95/4.00 (91.10/100), ranking **2nd** out of 83 students.

### WORKING & RESEARCH EXPERIENCE

**The Hong Kong University of Science and Technology, Hong Kong SAR, China.**

- Research in *RAM-LAB* 09/2018–11/2022
  - **Stereo Matching**  
This work developed a novel network architecture that can achieve a great trade-off between accuracy and efficiency for supervised stereo matching. We also proposed an effective training strategy for unsupervised stereo matching. The proposed approach can achieve competitive performance on the *KITTI Stereo Benchmarks*. (*Accepted by IEEE RA-L*). [\[Video\]](#)
  - **Optical Flow Estimation**  
We developed CoT-AMFlow, a novel unsupervised optical flow estimation approach. Our CoT-AMFlow can achieve competitive performance on the *KITTI Optical Flow Benchmarks* and the *MPI Sintel Benchmark*. (*Accepted by CoRL 2020*). [\[Video\]](#)
  - **Surface Normal Estimation**  
We developed an accurate and ultrafast surface normal estimator, which can generate surface normal estimations from dense depth images. Our approach can greatly minimize the trade-off between accuracy and efficiency for surface normal estimation. (*Accepted by IEEE RA-L*). [\[Video\]](#)
  - **Drivable Area Detection for Autonomous Driving**  
This work focused on improving the performance of drivable area detection with the assistance of surface normal information for autonomous driving. The proposed approaches can achieve competitive performance on the *KITTI Road Benchmark*. (*Accepted by ECCV 2020 and IROS 2021*). [\[Video\]](#)
  - **BEV Semantic Forecasting for Autonomous Driving**  
This work focused on BEV semantic forecasting for autonomous driving. The proposed approach takes past and current surrounding-view images as input, and generates the corresponding current and future semantic estimations in the BEV space. The experimental results demonstrated the effectiveness of the proposed approach. (*Accepted by ICRA 2021*). [\[Video\]](#)
  - **Drivable Area and Road Anomaly Detection for Ground Mobile Robots**  
This work constructed a drivable area and road anomaly detection benchmark for ground mobile robots. We also adopted different types of visual features and proposed a novel data-fusion module to improve the detection performance. (*Accepted by IEEE T-CYB, IEEE RA-L, and IROS 2020*). [\[Page\]](#)
  - **Road Pothole Detection**  
This work provided public datasets for road pothole detection. We also employed different types of visual features and incorporated different attention mechanisms into the frameworks to improve the detection performance. (*Accepted by IEEE T-IP and ECCV Workshops 2020*). [\[Page\]](#)
  - **Parking Violation Detection on a Drone**  
We proposed a novel parking violation detection system embedded in a drone. The experimental results demonstrated the effectiveness of the proposed system. (*Accepted by ECCV Workshops 2020*). [\[Video\]](#)

- *Engineering Projects in RAM-LAB*
  - **Trials of the Autonomous Logistic Vehicle in HKUST** 05/2020–07/2022  
This project aims at deploying an autonomous logistic vehicle (please check our IEEE RAM paper) in HKUST to deliver food and goods between restaurants and offices. I am in charge of conducting a series of tests on the campus to demonstrate that the autonomous vehicle (AV) is safe, reliable, and intelligent. We have got Hong Kong Transport Department’s appreciation that: “HKUST has been advancing the trials and becoming the **first** trialing organization in Hong Kong to carry out AVs without a driver/operator on board”. [\[Video\]](#)
  - **The Autonomous Platform in Elderly Care Centers** 09/2019–05/2021  
This project aims at developing an autonomous platform to support the movement of the elderly in elderly care centers. I am the principal investigator (PI) of this project. Specifically, I designed and constructed the autonomous platform, and deployed an autonomous navigation algorithm. [\[Video\]](#)
- *Teaching Assistant*
  - ELEC 1100: Introduction to Electro-Robot Design. Fall 2019  
Instructor: [Prof. Shaojie Shen](#), [Prof. Johnny Kin On Sin](#), and [Prof. Qiming Shao](#).
  - ELEC 3200: System Modeling Analysis and Control. Spring 2019  
Instructor: [Prof. Wei Chen](#).

## PUBLICATIONS

\* indicates equal contribution

### Journal Publications

- [1] P. Cai, **H. Wang**, Y. Sun, and M. Liu, “DQ-GAT: Towards Safe and Efficient Autonomous Driving with Deep Q-Learning and Graph Attention Networks”, *IEEE Transactions on Intelligent Transportation Systems (T-ITS)*, 2022.
- [2] Z. Feng, Y. Guo, Q. Liang, M. U. M. Bhutta, **H. Wang**, M. Liu, and Y. Sun, “MAFNet: Segmentation of Road Potholes with Multi-Modal Attention Fusion Network for Autonomous Vehicles”, *IEEE Transactions on Instrumentation and Measurement (T-IM)*, 2022.
- [3] R. Fan\*, **H. Wang\***, Y. Wang\*, M. Liu, and I. Pitas, “Graph Attention Layer Evolves Semantic Segmentation for Road Pothole Detection: A Benchmark and Algorithms”, *IEEE Transactions on Image Processing (T-IP)*, 2021.
- [4] **H. Wang\***, R. Fan\*, Y. Sun, and M. Liu, “Dynamic Fusion Module Evolves Drivable Area and Road Anomaly Detection: A Benchmark and Algorithms”, *IEEE Transactions on Cybernetics (T-CYB)*, 2021.
- [5] **H. Wang\***, R. Fan\*, P. Cai, and M. Liu, “PVStereo: Pyramid Voting Module for End-to-End Self-Supervised Stereo Matching”, *IEEE Robotics and Automation Letters (RA-L)*, 2021.
- [6] R. Fan\*, **H. Wang\***, B. Xue\*, H. Huang, Y. Wang, M. Liu, and I. Pitas, “Three-Filters-to-Normal: An Accurate and Ultrafast Surface Normal Estimator”, *IEEE Robotics and Automation Letters (RA-L)*, 2021.
- [7] R. Fan\*, **H. Wang\***, P. Cai, J. Wu, M. J. Bocus, L. Qiao, and M. Liu, “Learning Collision-Free Space Detection from Stereo Images: Homography Matrix Brings Better Data Augmentation”, *IEEE/ASME Transactions on Mechatronics (T-MECH)*, 2021.
- [8] P. Cai, **H. Wang**, H. Huang, Y. Liu, and M. Liu, “Vision-Based Autonomous Car Racing Using Deep Imitative Reinforcement Learning”, *IEEE Robotics and Automation Letters (RA-L)*, 2021.
- [9] T. Liu, Q. Liao, L. Gan, F. Ma, J. Cheng, X. Xie, Z. Wang, Y. Chen, Y. Zhu, S. Zhang, Z. Chen, Y. Liu, M. Xie, Y. Yu, Z. Guo, G. Li, P. Yuan, D. Han, Y. Chen, H. Ye, J. Jiao, P. Yun, Z. Xu, **H. Wang**, H. Huang, S. Wang, P. Cai, Y. Sun, Y. Liu, L. Wang, and M. Liu, “The Role of the Hercules Autonomous Vehicle During the COVID-19 Pandemic: An Autonomous Logistic Vehicle for Contactless Goods Transportation”, *IEEE Robotics and Automation Magazine (RAM)*, 2021.
- [10] P. Cai, Y. Sun, **H. Wang**, and M. Liu, “VTGNet: A Vision-Based Trajectory Generation Network for Autonomous Vehicles in Urban Environments”, *IEEE Transactions on Intelligent Vehicles (T-IV)*, 2020.

- [11] Y. Sun, W. Zuo, P. Yun, **H. Wang**, and M. Liu, “FuseSeg: Semantic Segmentation of Urban Scenes Based on RGB and Thermal Data Fusion”, *IEEE Transactions on Automation Science and Engineering (T-ASE)*, 2020.
- [12] **H. Wang**, Y. Sun, and M. Liu, “Self-Supervised Drivable Area and Road Anomaly Segmentation Using RGB-D Data for Robotic Wheelchairs”, *IEEE Robotics and Automation Letters (RA-L)*, 2019.

#### Conference Publications

- [13] **H. Wang**, R. Fan, P. Cai, M. Liu, and L. Wang, “UnDAF: A General Unsupervised Domain Adaptation Framework for Disparity or Optical Flow Estimation”, *International Conference on Robotics and Automation (ICRA)*, 2022.
- [14] **H. Wang\***, R. Fan\*, P. Cai, and M. Liu, “SNE-RoadSeg+: Rethinking Depth-Normal Translation and Deep Supervision for Freespace Detection”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2021.
- [15] P. Cai, **H. Wang**, Y. Sun, and M. Liu, “DiGNet: Learning Scalable Self-Driving Policies for Generic Traffic Scenarios with Graph Neural Networks”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2021.
- [16] **H. Wang**, P. Cai, Y. Sun, L. Wang, and M. Liu, “Learning Interpretable End-to-End Vision-Based Motion Planning for Autonomous Driving with Optical Flow Distillation”, *International Conference on Robotics and Automation (ICRA)*, 2021.
- [17] **H. Wang**, Y. Sun, R. Fan, and M. Liu, “S2P2: Self-Supervised Goal-Directed Path Planning Using RGB-D Data for Robotic Wheelchairs”, *International Conference on Robotics and Automation (ICRA)*, 2021.
- [18] **H. Wang**, R. Fan, and M. Liu, “Co-Teaching: An Ark to Unsupervised Stereo Matching”, *IEEE International Conference on Image Processing (ICIP)*, 2021.
- [19] **H. Wang**, R. Fan, and M. Liu, “SCV-Stereo: Learning Stereo Matching from a Sparse Cost Volume”, *IEEE International Conference on Image Processing (ICIP)*, 2021.
- [20] **H. Wang**, R. Fan, and M. Liu, “CoT-AMFlow: Adaptive Modulation Network with Co-Teaching Strategy for Unsupervised Optical Flow Estimation”, *Conference on Robot Learning (CoRL)*, 2020. (34% acceptance rate).
- [21] R. Fan\*, **H. Wang\***, P. Cai, and M. Liu, “SNE-RoadSeg: Incorporating Surface Normal Information into Semantic Segmentation for Accurate Freespace Detection”, *European Conference on Computer Vision (ECCV)*, 2020.
- [22] **H. Wang\***, R. Fan\*, Y. Sun, and M. Liu, “Applying Surface Normal Information in Drivable Area and Road Anomaly Detection for Ground Mobile Robots”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020.

#### Workshop Publications

- [23] **H. Wang**, P. Cai, R. Fan, Y. Sun, and M. Liu, “End-to-End Interactive Prediction and Planning with Optical Flow Distillation for Autonomous Driving”, *IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2021.
- [24] **H. Wang\***, Y. Liu\*, H. Huang\*, Y. Pan\*, W. Yu, J. Jiang, D. Lyu, M. J. Bocus, M. Liu, I. Pitas, and R. Fan, “ATG-PVD: Ticketing Parking Violations on a Drone”, *European Conference on Computer Vision (ECCV) Workshops*, 2020.
- [25] R. Fan\*, **H. Wang\***, M. J. Bocus, and M. Liu, “We Learn Better Road Pothole Detection: From Attention Aggregation to Adversarial Domain Adaptation”, *European Conference on Computer Vision (ECCV) Workshops*, 2020.

## ACADEMIC ACTIVITIES

### Technical Program Committees

- **3rd Autonomous Vehicle Vision (AVVision) Workshop** in conjunction with ECCV 2022.
- **2nd Autonomous Vehicle Vision (AVVision) Workshop** in conjunction with ICCV 2021.
- **1st Autonomous Vehicle Vision (AVVision) Workshop** in conjunction with WACV 2021.

- Special sessions in ICIP 2021, ICAS 2021, and IROS 2021.

#### **Conference Presentations**

- ICRA 2022, Philadelphia, USA.
- IROS 2021, Prague, Czech Republic.
- ICIP 2021, Anchorage, USA.
- CVPR 2021, Virtual.
- ICRA 2021, Xi'an, China.
- CoRL 2020, Cambridge MA, USA.
- IROS 2020, Las Vegas, USA.
- ECCV 2020, Glasgow, UK.

#### **Reviewer Services**

- IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI).
- IEEE Transactions on Image Processing (T-IP).
- IEEE Transactions on Robotics (T-RO).
- IEEE Transactions on Neural Networks and Learning Systems (T-NNLS).
- IEEE Transactions on Intelligent Transportation Systems (T-ITS).
- IEEE Transactions on Vehicular Technology (T-VT).
- IEEE Transactions on Instrumentation and Measurement (T-IM).
- IEEE Robotics and Automation Letters (RA-L).
- IEEE Signal Processing Letters (SP-L).
- Pattern Recognition.
- Journal of Systems Architecture.
- Engineering Applications of Artificial Intelligence.
- AAAI Conference on Artificial Intelligence (AAAI), 2023.
- European Conference on Computer Vision (ECCV), 2022.
- IEEE/CVF International Conference on Computer Vision (ICCV), 2021.
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2021-2023.
- IEEE International Conference on Image Processing (ICIP), 2021-2022.
- IEEE International Conference on Autonomous Systems (ICAS), 2021.
- The British Machine Vision Conference (BMVC), 2020-2022.
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2019-2023.
- IEEE International Conference on Robotics and Automation (ICRA), 2019-2023.

#### **AWARDS**

- Postgraduate Scholarship in the HKUST, 2018-2022.
- Outstanding Graduates in Zhejiang Province, 2018.
- Second-Class Scholarship in Zhejiang University (Top 10%), 2017.
- Tang Lixin Scholarship (**Lifetime**, around **0.16%** every year), 2016-present.
- First-Class Scholarship in Zhejiang University (Top 5%), 2016.
- Meritorious Winner in the Interdisciplinary Contest In Modeling (Top 13%), 2016.
- First Prize for the 7th National College Student Mathematics Competition, 2015.
- National Scholarship in Zhejiang University (Top 2%), 2015.

#### **PROFESSIONAL SKILLS**

- Programming: Python, MATLAB, C/C++.
- Frameworks: PyTorch, ROS.
- Language: Passing CET-4 and CET-6; TOEFL-IBT, 100/120.
- National Computer Rank Examination C Language Certificate of Level 2.
- C1 Motor Vehicle Driving License.