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.
- Multimedia Systems.
- Machine Vision and Applications.
- AAAI Conference on Artificial Intelligence (AAAI), 2023.
- European Conference on Computer Vision (ECCV), 2022.
- IEEE/CVF International Conference on Computer Vision (ICCV), 2021, 2023.
- IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2021–2023.
- IEEE International Conference on Image Processing (ICIP), 2021–2023.
- IEEE International Conference on Autonomous Systems (ICAS), 2021.
- The British Machine Vision Conference (BMVC), 2020–2023.
- 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.