BOYI LIU

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PERSONAL SUMMARY

I am a self-motivated student and I love to try new things. I was engaged in the research of cloud robotics, agricultural robotics and machine learning. **I am currently a Research Scientist at State Key Laboratory of the Internet of Things for Smart City, University of Macau.**

EDUCATION

University of Chinese Academy of Science, Pattern Recognition and Intelligent System, *Master Student*

Excellent student award of the Computing Institute

Hainan University, Network Engineering, *Bachelor of Engineering*

GPA 2/120 (Top 2%), Student of the Year Award (Top 0.02% of the University, best honor), National Encouragement scholarship, Honor of the most innovative and practical college students, Outstanding graduation thesis, Outstanding Graduate Honor.

PAPERS

Research on Robotics (During Master)：

- **Boyi Liu**, Lujia Wang*, Ming Liu, Chengzhong Xu. Peer-Assisted Robotic Learning: A Data-Driven Collaborative Learning Approach for Cloud Robotic Systems, IEEE International Conference on Robotics and Automation (ICRA-2021).
- **Boyi Liu**, Lujia Wang*, Ming Liu, Chengzhong Xu. Lifelong Federated Reinforcement Learning: A Learning Architecture for Navigation in Cloud Robotic Systems, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2019) and IEEE Robotics and Automation Letters (IEEE RA-L).
- **Boyi Liu**, Lujia Wang*, Ming Liu, Chengzhong Xu. Federated Imitation Learning: A Privacy Considered Imitation Learning Framework for Cloud Robotic Systems with Heterogeneous Sensor Data, IEEE International Conference on Robotics and Automation (ICRA-2020) and IEEE Robotics and Automation Letters (IEEE RA-L).
- Bingjie Yan,**Boyi Liu(Co-first author)**, Lujia Wang*, etc. FedCM: A Real-time Contribution Measurement Method for Participants in Federated Learning (IJCNN 2021).

Research on Machine Learning (During Undergraduate)：

- **Boyi Liu**, Jieren Cheng*, Kuanqi Cai, Pengchao Shi, Xxiangyan Tang. Singular Point Probability Improve LSTM Network Performance for Long-term Traffic Flow Prediction, National Conference of Theoretical Computer Science, 328-340. **(Outstanding Student Paper Award)**

Research on Image Processing in Agriculture and Traffic(During Undergraduate)：

- Zhuhua Hu, **Boyi Liu***, Yaochi Zhao, Mengxing Huang, Yong Bai, Fusheng Lin. Recognition of Pyralidae Insects with Unmanned Monitoring Robot Based on Histogram Reverse Mapping and Invariant Moment, IEEE International Conference on Advanced Manufacturing (ICAM), 407-410.
- Jieren Cheng, **Boyi Liu***, Xiangyan Tang, Zhuhua Hu, Jianping Yin. Traffic flow detection method based on vertical virtual road induction line, International Journal of Embedded Systems 10 (6), 518-525.
- Jieren Cheng, **Boyi Liu***, Xiangyan Tang. An automatic traffic-congestion detection method for bad weather based on traffic video, International Journal of High Performance Computing and Networking 3 (11), 251-259.

COMPETITION(MAINLY ABOUT ROBOTICS)

- "Challenge cup" national college students extracurricular academic works competition，**Provincial Grand Prize** once，**Provincial First Prize** once.
- "Creating Youth" National University Student Innovation and Entrepreneurship Competition，**Provincial Grand Prize**，**National Silver Award**
- National College Students Mathematical Modeling Competition，**National Second Prize**
- American College Student Math Modeling Competition，**Meritorious Honor**

- "Internet +" national college students innovation and entrepreneurship competition， **Provincial Gold Award** Twice.
- "Silk Road" Robot Creative Competition， **Grand Prize of National Finals**
- Microsoft Image cup International University Student Technology Competition**First Prize of South China Division (Top 2)**

HONOR

- During the undergraduate period, I was awarded the national inspirational scholarship for three consecutive years, "the most innovative and practical college student", and "the three best students"
- Excellent undergraduate thesis, outstanding undergraduate
- Student of the Year Award (Top 0.02% of Hainan University)
- Outstanding Paper Award of National Theoretical Computer Science Annual Meeting

EXTRACURRICULAR ACTIVITIES/VOLUNTEER WORK

- Reviewer of IEEE Transactions on SMC, IEEE Transactions on Vehicle Technology, IROS, ICRA, etc.
- Counselor of IEEE Hainan University Branch.
- Honorary president of Robotics and Artificial Intelligence Association of Hainan University.

ENGLISH LANGUAGE PROFICIENCY

- Duolingo: 125/160

125 **Overall**
The test taker's ability to use English in a variety of modes and contexts.

10 ———————————————————————————— 160

- Can understand a variety of demanding written and spoken language including some specialized language use situations.
- Can grasp implicit, figurative, pragmatic, and idiomatic language.
- Can use language flexibly and effectively for most social, academic, and professional purposes.

PROJECTS
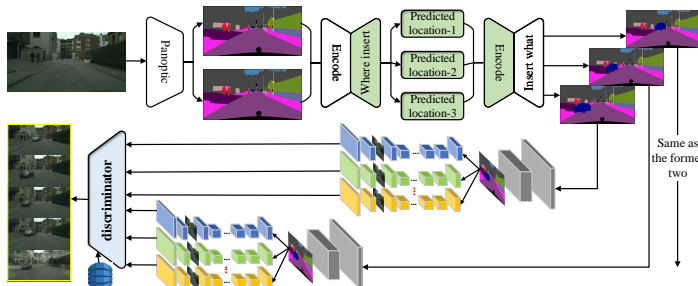
Peer-assisted robotic learning for cloud robotics, 2021. The work presents Peer-Assisted Robotic Learning (PARL) in robotics, which is inspired by the peer-assisted learning in cognitive psychology and pedagogy. PARL implements data collaboration with the framework of cloud robotic systems. Both data and models are shared by robots to the cloud after semantic computing and training locally. **Video Link: https://youtu.be/CUI4WK6bDj0**
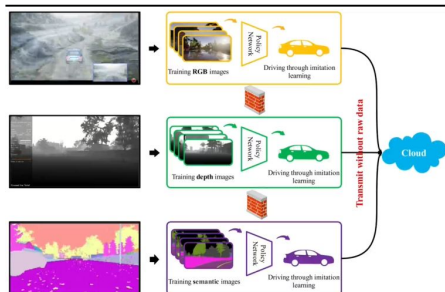
Federated imitation learning for cloud robotics, 2020 In this work a knowledge fusion algorithm is proposed for the cloud fusing knowledge from local robots. Then, a knowledge transfer scheme is presented to facilitate local robots acquiring knowledge from the cloud. With FIL, a robot is capable of utilizing knowledge from other robots to increase its imitation learning in accuracy and training efficiency. FIL considers information privacy and data heterogeneity when robots share knowledge. **Video Link: https://youtu.be/_lxZFD0bJcU**

Lifelong federated reinforcement learning system for robotics, 2018.6-2019.6. This work was motivated by the problem of how to make robots fuse and transfer their experience so that they can effectively use prior knowledge and quickly adapt to new environments. To address the problem, we present a learning architecture for navigation in cloud robotic systems: Lifelong Federated Reinforcement Learning (LFRL). **Video Link: https://youtu.be/SmDpOPw3m7I**

Autonomous Navigation Robot for pest identification and environmental monitoring, Team Leader, 2017 Diseases and insect pests are important factors that affect crop yield. At present, the identification of crop diseases and insect pests in China mainly depends on manual work, which has a large workload. And the staff experience, knowledge reserve requirements are high. Aiming at the above problems, this paper designs and implements an autonomous navigation robot for pest identification and environmental monitoring. Its main functions include pest identification, pest trapping, environmental monitoring, real-time positioning, map building, autonomous navigation, human-computer dialogue, network storage and other functions. **Video Link: https://youtu.be/ryYF6uCD1FY**

Pest control robot based on Beidou navigation and infrared thermal imaging technology, Team Leader, 2018. Agriculture is the first industry in the national economy. For a large population country like China, agriculture has a strategic position. Diseases and insect pests are the main factors that cause crop yield reduction. In order to reduce the losses caused by pests and reduce the dependence on human resources, the team developed a pest control robot based on Beidou navigation and thermal imaging vision technology. Its main functions include pest identification, autonomous cruise, environmental monitoring, precise spraying and ground air coordination. **Video Link：https://youtu.be/OkqVeXv_zyo**
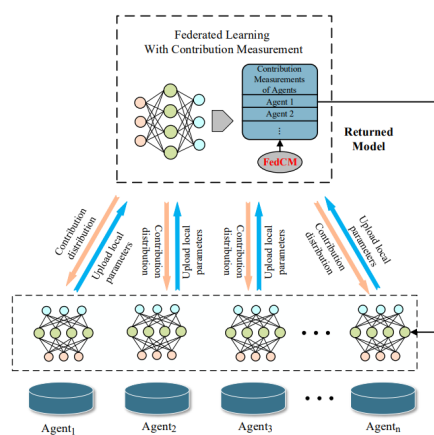
Real-time contribution measurement for Federated Learning, 2021 In this paper, we develop a real-time contribution measurement method FedCM that is simple but powerful. The method defines the impact of each agent, comprehensively considers the current round and the previous round to obtain the contribution rate of each agent with attention aggregation. Moreover, FedCM updates contribution every round, which enable it to perform in real-time. Real-time is not considered by the existing approaches, but it is critical for FL systems to allocate computing power, communication resources, etc. Compared to the state-of-the-art method, the experimental results show that FedCM is more sensitive to data quantity and data quality under the premise of real-time. Furthermore, we developed federated learning open-source software based on FedCM. The software has been applied to identify COVID-19 based on medical images. **Video Link：https://youtu.be/ScXhNN0dvB8**