

Yulong Zhang



Personal data

Hometown: Ningbo, Zhejiang

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<https://github.com/ulen2000>

Languages

CET6(503), IELTS(6.5),
GRE(314-3)

Computer Skills

Language: C/Python/Java,
TEX, Git..

Computer OS: Ubuntu, CentOS,
Debian, Android, Robot
Operating System (ROS)...

Cloud Platform: AWS, Google,
Alibaba, Tencent, HUAWEI,
Baidu...

Hardware: Raspberry Pi,
STM51, STM32, PLC, Various
types of sensors...

Softwares: MATLAB,
SolidWorks, Github, Cloud
Database, Docker, Overleaf,
VMware, Office, visio, PS...

Other IT skills: Network
Programming/
communication(Kafka, Mqtt),
Cloud & edge computing, IoT,
Deep learning(Pytorch,
Tensorflow, Caffe), Web
production, Image
processing, CAD modelling...

Education

2018.09 – present **Wuhan University of Technology · Mechanical design and automation major**

- **GPA:3.9/5.0**
- **Rank:18/209(top 8.6%)**
- **Part of the compulsory course results:**
Mechanics of Materials(100), College physics(97.9), SCM principles and interface technology(97.5), Numerical calculation method(96.4), C programming foundation(94.5), Probability and Mathematical Statistics(93.4), Mechanical Manufacturing Technology(92.5), Computer Basics and C Programming(92.5), Electrical and electronic technology(91).

Research experience

2018.9 – 2019.9 **♥The American MCM (Freshman)**

♥ I have participated in some mathematical modeling competitions and technological innovation competitions during 2018 - 2019, and achieved good results in the competitions. One example was the American MCM that I participated in as the team leader.

Table 1: License Plate Recognition

| Position | Affiliation | Advisor | Project outcome |
|-------------|----------------------------------|-----------------------------|--|
| Team leader | Cooperated with three classmates | A compulsory course teacher | As the first author, I published a paper in the international conference MEMA2019 (EI) |

Abstract: The project aims to use different digital image processing technology to recognise license plates under different environments and help to manage and control modern traffic in intelligent traffic systems. In the competition, we needed to quickly identify long-distance colour reflective license plate pictures, oblique and blurred license plate pictures, and moving vehicle license plates in surveillance videos. Therefore, we used image preprocessing, license plate positioning, character segmentation and character recognition, and for different situations, we established three models to realize the rapid recognition of license plates.

Reference: 1. Zhang Y. Intelligent license plate recognition system based on digital image processing[C]//IOP Conference Series: Materials Science and Engineering. IOP Publishing, 2020, 740(1): 012160.

2019.9 – 2020.9 **♥Automobile license plates tracking system (Sophomore)**

♥ In my sophomore year, I joined the IROS laboratory and became a student of Professor Sun. Under the guidance of Prof. Sun, I systematically studied computer-related knowledge. From the basic instructions of Linux, the syntax of python to the deep learning algorithm, the dynamic adaptive design of the network, the harvest was very rich.

♥ Prof. Sun has never taught us knowledge according to textbooks, but by assigning small tasks and small projects to encourage us to take the initiative to learn. For example, he once arranged an automobile license plates tracking system.

Abstract: The project required us to complete a system coordinated by the local side, the edge, and the cloud server. To complete this task, I needed to comprehensively and critically analyze the system's needs and constantly learn new knowledge. For example, for acquiring images, I had to think about what hardware devices to use to acquire images, a single device or multiple devices, and what should I do if the device is damaged; Or how should the image and video

Table 2: Automobile license plates tracking system

| Position | Affiliation | Advisor | Project outcome |
|-------------|--|---------------|--|
| Team member | Cooperated with two graduate students and one doctoral student | Professor Sun | A large number of computer-related skills and dialectical thinking |

be transmitted, whether it was transmitted to the edge first or directly to the cloud server and so on.

Reference: 1. Jupyter-notebook deployment instructions: <https://whuteducn-my.sharepoint.com...>

2020.9 – 2021.3 ♥ **Survey of Intelligent Rain Removal Algorithms for Cloud-IoT Systems (Junior)** 111

♥ After continuous study and discussion in my sophomore year, I begin to pay attention to some easy-to-overlook things in life that we are accustomed to in life. Once I was discussing an image processing problem of Smart City with Professor Sun, we found that urban weather has a major impact on the development of smart cities, and the images obtained under different weather contain different impurities, so it needs to be tackled based on different weather conditions, but surprisingly few articles mentioned this. Therefore, under the guidance of Prof. Sun, I read a lot of relevant literature and surveyed the related research status.

Table 3: Survey of Intelligent Rain Removal Algorithms for Cloud-IoT Systems

| Position | Affiliation | Advisor | Project outcome |
|-------------|--------------------------------------|---------------|--|
| Team leader | Cooperated with one doctoral student | Professor Sun | Published an article in the journal "Computer Science" (CCF B) as the first author |

Abstract: According to the "White Paper on China's Intelligent Internet of Things (AIoT) 2020", with the prompt development of China's 5G network, the rapid popularization of large-capacity with low-price IoT sensor devices and the explosive growth of data, image processing is widely used in various fields of Internet of Things, such as smart city, smart transportation, smart healthcare, and other industry, etc. In these research areas, researchers usually ignore the actual problems in the data collection process, for instance, data degradation caused by time changes: seasonal shifting, diurnal variation, weather changes, and noise problems caused by spatial changes: object superposition, blur, and partial occlusion. Among those problems, the weather problems represented by rainy days are the most challenging and common. Therefore, this paper systematically investigates the actual problems in the data collection process above, classifies and summarizes the image rain-removal algorithms under complex weather conditions. At the same time, regarding the compute-intensive execution of such algorithms, we utilizes the Amazon EC2 cloud instance G4 and P3 series to quantitatively evaluate the processing time and effect of various reviewed rain removal algorithms. Finally, we illustrates the characteristics of various rain removal algorithms and the latest trends in Cloud-IoT applications.

Reference: 1. ZHANG Yu-Long, Wang Qiang, CHEN Ming-Kang and SUN Jing-Tao, "Survey of Intelligent Rain Removal Algorithms for Cloud-IoT Systems" [J]. Computer Science, 2021.9
2021.3 – present ♥ **Multi-Weather Classification using Evolutionary Algorithm on EfficientNet (Junior)**

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♥ In reading the literature, I found that current researches on weather classification could not comprehensively deal with composite weather classification, and the accuracy and processing time were still not satisfactory, which can be a challenge for the popularization of IoT applications. Therefore, after discussing with Prof. Sun, I decided to survey the relevant issues and try to propose my methods.

Abstract: Complex weather factors seriously affect the quality and accuracy of image processing, and indirectly pose severe challenges to the expansion of IoT applications in smart

Table 4: Survey of Intelligent Rain Removal Algorithms for Cloud-IoT Systems

| Position | Affiliation | Advisor | Project outcome |
|-------------|--------------------------------------|---------------|---|
| Team leader | Cooperated with one doctoral student | Professor Sun | Published a paper in the top international conference PerIoT2021 (Workshop of PerCom Top73) as the first author, and was invited to report in Germany |

cities and the actual intelligent classification of research. However, the current research on weather classification cannot comprehensively deal with composite weather classification, and the accuracy and processing time are still not satisfactory. This is still a challenge for the popularization of IoT applications. This paper proposes a multi-weather classification method that can intelligently classify the weather elements in the image data collected by IoT applications. The idea behind us is to propose the evolutionary algorithm into EfficientNet to solve the various weather classification problem. Our experimental results show that we can achieve remarkable classification results with a high degree of confidence in five complex weather conditions, even in pictures with obvious weather characteristics, and the recognition accuracy increases to more than 95%.

Reference: 1. Yulong Zhang, Jingtao Sun, Mingkang Chen, Qiang Wang, Yuan Yuan, Rongzhe Ma, "Multi-Weather Classification using Evolutionary Algorithm on EfficientNet" in PerIoT 2021: 5th International Workshop on Mobile and Pervasive Internet of Things, pp.723-728, accepted.

♥ **Recently**, we integrated the method through docker, making it easier to deploy in heterogeneous IoT devices and apply to scenarios of the smart city. We further optimized the superimposed complex weather, as well as its accuracy and execution time. The latest article has been submitted to "The Computer Journal" (Impact Factor 1.494, SCI Q3) but still in the preliminary review.

Publication

Journal

- Survey of Intelligent Rain Removal Algorithms for Cloud-IoT Systems
- IoT Based Multi-Weather Classification using Evolutionary Algorithm for Smart City Applications (Advanced Engineering Informatics, Impact Factor 5.603, SCI Q2) <Still in preliminary review>
- Research on Digital Twin System of Port Equipment Management (Ocean & Coastal Management, Impact Factor 3.284, SCI Q2, the second author) <Still in preliminary review>

Conference paper

- Intelligent license plate recognition system based on digital image processing
- Multi-Weather Classification using Evolutionary Algorithm on EfficientNet
- A Dynamic Video Switching Mechanism for Distributed Crane Control System (the second author)

Patent

- Acceptance of an invention patent: a dust-proof six-degree-of-freedom robotic arm
- Acceptance of a utility model patent: a manipulator with adjustable gripping volume

Student work

2018.09 – present **Monitor**

2020.08 – present **Minister of Innovation and Entrepreneurship Department**

Scholarship

| | |
|-------------|--|
| 2018 – 2019 | Yang Ge First-Class Scholarship |
| 2019 – 2021 | School scholarships |
| 2018 – 2021 | Merit Student |

Other experiences

- Served as **TA** (Teaching Assistant) in the school's **graduate** internationalization course 'Advanced Cloud of Things'.
- Gave presentation on **PerIoT 2021**: 5th International Workshop on Mobile and Pervasive Internet of Things
- Served as the Publication Chair in IEEE **IBPI2021**¹.
- Set up an international **conference website**².
- Set up our **laboratory website**³.

Motivation

I am very interested in doing scientific research on artificial intelligence and machine learning with Professor Yan. As stated in Professor Yan's paper⁴⁵⁶, modern data-driven fault detection and diagnosis (FDD) techniques show impressive high diagnostic accuracy in recognizing various air handling units (AHUs) faults and in developing building management systems (BMS) for high-performance buildings. However, in real-world AHU/FDD scenarios, the number of incorrect training samples is not enough to support supervised learning methods because the errors are usually fixed in a short time. So I wonder if I can use evolutionary algorithms to solve the lack of training samples, gene my algorithm proposed in the weather classification paper, Or use more advanced neural networks such as EfficientNet or cutting-edge GAN algorithms to achieve fault detection and diagnosis. I am willing to conduct investigations and research in this area or use big data and artificial intelligence technology to explore new methodologies and applications. I hope to devote myself to these key technologies in related fields and help solve the dilemma of neck-stuck in this regard.

¹<https://ulen2000.github.io/ibpi2021//>

²<https://ulen2000.github.io/ibpi2021//>

³<http://www.ccs310.cn/>

⁴Yan K, Ji Z, Lu H, et al. Fast and accurate classification of time series data using extended ELM: Application in fault diagnosis of air handling units[J]. IEEE Transactions on Systems, Man, and Cybernetics: Systems, 2017, 49(7): 1349-1356.

⁵Yan K, Du Y, Ren Z. MPPT perturbation optimization of photovoltaic power systems based on solar irradiance data classification[J]. IEEE transactions on sustainable energy, 2018, 10(2): 514-521.

⁶Yan K, Zhong C, Ji Z, et al. Semi-supervised learning for early detection and diagnosis of various air handling unit faults[J]. Energy and Buildings, 2018, 181: 75-83.