

# Jiawen Wei

✉ jiawenwei@csu.edu.cn | ☎ +86 138-5834-3886 | 📍 Changsha, Hunan, P.R. China(PRC), 410083

## Education

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### Master of Science in Engineering

09/2018 - 06/2021

Institute of Control Engineering

School of Automation, **Central South University(CSU)**, PRC.

- Specialize in Control Science & Engineering, GPA: 3.8/4.0.
- Awards: Academic Scholarships

### Bachelor of Engineering

09/2014 - 06/2018

School of Information Science and Engineering, **CSU**, PRC.

- Specialize in Automation, GPA: 3.7/4.0.
- Awards: First Prize in National University Students Intelligent Car Race(Top 1% amongst all teams), Academic Scholarship, Outstanding Students
- Received the waiver for the National Graduate Entrance Exam to enter CSU.

## Professional Experience

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### Research Assistant

06/2021 - Present

School of Computer Science and Engineering, CSU, PRC. Supervised by Assoc. Prof. Ning Gui.

- **Active flow control(AFC) and optimal sensor placement of fluid**

This research aims to reduce the drag of 2D Kármán vortex street scenario and explore the critical region of sensor layout. Main contributions:

- Designed the geometry mesh of the simulation by Gmsh, considering the accuracy and computational resources.
- Achieved effective AFC of fluid using proximal policy optimization(PPO), and explored the effective sensor placement(both numbers and locations) using an embedded attention mechanism simultaneously in a global control process.
- Designed a distributed Deep Reinforcement Learning(DRL) structure to accelerate the training process and improve the data utilization.
- One conference paper is under the Second Round(co-first author) and another journal paper is preparing for the robustness over a range of Reynolds numbers.(On process)

- **Physics-based structured learning of incompressible fluid dynamics(On process)**

This research aims to harness data to discover the underlying governing partial differential equations(Navier-Stokes equations) that describe the behavior of complex fluid dynamics.

- Design the physics embedded deep neural networks(DNN) which integrates the structure of fluid dynamics to approximate the parameters.
- Research on the system identification based on physical priors and large amounts of data.

### Research on automatic generation of object knowledge based on DRL

09/2019 - Present

Supervised by Assoc. Prof. Zhifeng Qiu and Assoc. Prof. Ning Gui.

This project is awarded by National Natural Science Foundation of China(NSFC). It aims to extract the underlying information of the control object based on the interaction framework of DRL. Main contributions:

- One of main authors of this grant proposal and deeply involved in three aspects of research.
- **Automatic evaluation of feature contribution**
  - Proposed a new direction and quantitative criteria for feature selection over a long-time global control process; designed a general dual-world attentive DRL architecture to identify the more effective feature representation and make it more interpretable towards objects.
  - Applied the proposed method to several mechanical control systems, both discrete and continuous action space.
  - One journal paper: **J. Wei**, Z. Qiu, F. Wang et al. D-AFS: A Dual-world based Attentive Feature Selection Framework for Control. IEEE Transactions on Neural Networks and Learning Systems. (Under review: Second-Round)
  - Patent: Z. Qiu, **J. Wei**, W. Lin, et al. A method for evaluating contribution of DRL environment based on attention mechanism(Application No. 202110038931.0). Patent pending.

- **Identification and extraction of the sub-system**

- Cooperated with another two master students to design the dynamic time warping clustering method for subsystem division considering local shape features.
- One paper(third author) was accepted by the 32nd Chinese Process Control Conference(2021); one patent: Z. Qiu, W. Lin, **J. Wei**, et al. System identification method based on neural ordinary differential equation under discontinuous excitation(Application No. 202110038650.5). Patent pending.

- **Refinement of structural parameters of mechanical systems**

- Designed Lagrangian and Hamiltonian dynamics-guided DNN for structured learning of mechanical systems based on the DRL interaction process data.
- Identified structural parameters related to the motion of the manipulator, including time-varying parameters.

**Modeling and control optimization of distillation tower in the chemical industry**

*07/2018 - 10/2019*

Supervised by Assoc. Prof. Ning Gui and Assoc. Prof. Zhifeng Qiu.

This project is awarded by the Ministry of Industry and Information Technology of PRC. It aims to establish the modeling, diagnosis, and optimal control criterion for distillation tower equipment in the chemical industry based on industrial big data; and design a verification platform. Main contributions:

- Completed industrial data processing and realized multi-constraint optimization control of distillation process; wrote the criterion.
- Cooperated with engineers from Hollysys Automation Technology Co., Ltd. and Shenyang Institute of Automation Chinese Academy of Sciences to participate in the design of the verification platform, including establishing the database, accessing data, and visualization, etc.
- Participated in the deployment of the controller and the platform in Zhuhai Long Success Chemicals Industry Co., Ltd.

**Wind power prediction**

*09/2017 - 06/2018*

- Researched on the data pre-processing, feature selection and extraction, correlation analysis, etc.
- Achieved an effective wind power prediction method based on machine learning technology.

**Intelligent car system guided by camera**

*12/2015 - 08/2017*

- Collaborated with two teammates to design the mechanical structure, printed circuit board and auto-navigation algorithm of the intelligent car.
- Researched on the real-time positioning and closed-loop control algorithm based on the two-wheel balance intelligent car system.
- Awarded the first prize in National University Students Intelligent Car Race; National College Student Innovation and Entrepreneurship Training Program Project(Person in charge, National Funding, 2017).

## Teaching Experience

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**Teaching Assistant for Course “Design of Programmable Logic Controller(PLC) Application Technology”**

School of Automation, CSU, PRC. Supervisor: Assoc. Prof. Zhifeng Qiu.

- Taught experimental operation courses for PLC experiments based on the Siemens S7-Series for > 100 students.
- Answered students’ questions about theory and experiment; allocated weekly experimental hours, exams and graded the performance of students.

## Skills

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- Programming Languages: Python, C/C++, MATLAB, LaTeX.
- Frameworks and tools: Pytorch, Tensorflow, Scikit-learn, Docker, Anaconda, git, etc.
- Operating systems: Linux(Ubuntu), Mac OS X, Windows XP.

## Research Interests

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Experiences in artificial intelligence, machine learning, control systems, dynamics analysis, and several other disciplines provide me with opportunities for interdisciplinary research. My interest is to **combine physical priors and data-based learning methods** to solve problems and apply them to different fields, including but not limited to the **detection, cognition, modeling and optimization**.