Cao, Yue

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Google Scholar

Personal Website

Education

University of Kentucky, Lexington, KY, USA

Ph.D. Candidate in Electrical Engineering

Jan 2023 – May 2026 (expected)

Tianjin University, Tianjin, China

Master of Engineering in Materials Processing Engineering

Sep 2018 – Jun 2021

Tianjin University, Tianjin, China

Bachelor of Engineering in Material Forming and Control Engineering

Sep 2014 – Jun 2018

Research Interests

My research focuses on **intelligent manufacturing**, integrating **robotics** and **deep learning** to automate advanced welding and additive manufacturing processes. I build intelligent **human–robot collaboration** systems and transfer **human knowledge** to robots, enabling automation of complex manufacturing tasks that cannot be achieved by rigid preprogramming.

Research Publications (First Author)

Total of **19 published peer-reviewed papers** (7 first-author); Google Scholar citations: 292, h-index: 10. Google Scholar

1. Cao, Y., Ye, Q., & Zhang, Y. (2025). **Synthesizing Weld Pool Dynamics via VAE-GAN to Enhance Human Control Performance**. *Journal of Manufacturing Processes.*
2. Cao, Y., Chen, H., & Zhang, Y. (2025). **Monitoring of DE-GMAW process in human–robot collaboration**. *Welding in the World*.
3. Cao, Y., & Zhang, Y. (2025). **Control of DE-GMAW through human–robot collaboration**. *Welding in the World*.
4. Cao, Y., Guo, S., & Zhang, Y. (2025). **Robotizing GTAW through learning human response**. *Welding in the World*.
5. Cao, Y., Zhou, Q., Yuan, W., Ye, Q., Popa, D., & Zhang, Y. (2024). **Human–robot Collaborative Assembly and Welding: A review and analysis of the state of the art**. *Journal of Manufacturing Processes*, 131, 1388–1403. Elsevier.
6. Cao, Y., Wang, Z., Hu, S., & Wang, T. (2023). **Adaptive predictive control of backside weld width in pulsed gas metal arc welding using electrical characteristic signals as feedback**. *IEEE Transactions on Control Systems Technology*, 31(6), 2879–2886. IEEE.
7. Cao, Y., Wang, Z., Hu, S., & Wang, W. (2021). **Modeling of weld penetration control system in GMAW-P using NARMAX methods**. *Journal of Manufacturing Processes*, 65, 512–524. Elsevier.
8. Cao, Y., Ye, Q. & Zhang, Y. (2025). **Application of Generative Adversarial Networks (GANs) in Intelligent Welding Manufacturing**. *Welding in the World*. **[Under Review]**
9. Cao, Y., Ma, N., Ye, Q. & Zhang, Y. (2025). **Human Adaptive Control of Arc Welding Process through Generative AI Enhanced Human-Robot Collaboration.** *IEEE Robotics and Automation Letter.* **[Under Review]**
10. Cao, Y., Lin, H. & Zhang, Y. **Robust Monitoring of Arc Welding Processes: A Generalizable Framework with DVAE and Particle Filter**. *Journal of Manufacturing Processes.* **[Under Review]**

Academic Service

Manuscript Reviewer for Journal of Manufacturing Processes, Measurement, Chinese Journal of Mechanical Engineering, Welding in the World.

Reviewed over **50** papers in intelligent manufacturing, robotics, and AI-based sensing and control.

Research Experience

Graduate Research Assistant, Welding Research Laboratory, **University of Kentucky**, **Jan 2023 – Present**
Supervised by Prof. Yuming Zhang, and collaborated with Prof. Qiang Ye

- Develop deep generative models (e.g., VAEs, GANs) for welding state estimation and dynamic modeling.
- Design human-in-the-loop control systems integrating robotics, deep learning, and virtual reality for adaptive and precise welding teleoperation.
- Model human operational intelligence using supervised and imitation learning to enhance automation capability.
- Devise novel automated additive manufacturing processes (double-electrode Gas Metal Arc Welding, DE-GMAW) through intelligent human–robot collaboration.

Graduate Research Assistant, Tianjin Key Laboratory of Modern Joining Technology, **Tianjin University**, **Sep 2018 – Jun 2021**
Supervised by Dr. Zhijiang Wang

- Developed sophisticated structured-light sensing methods for precise weld-pool surface characterization.
- Developed adaptive-control algorithms for weld-penetration control using low-cost electrical-signal sensing, facilitating field implementation.

Awards

- Awarded the **2024 American Welding Society A. F. Davis Silver Medal** for contributions to welding process stability monitoring and control.
- Awarded the **2025 International Institute of Welding Henry Granjon Award** for innovative research on human–robot collaboration and intelligent welding of complex processes. Read the full news article

Conference Presentations

1. Yue Cao, Giulio Mattera, and Yuming Zhang. Addressing Label Inaccuracy in WAAM Anomaly Detection via Iterative Label Refinement and Unsupervised Feature Learning (AWS Professional Program at FABTECH 2025). 2025.9.08-11, Chicago, USA (Oral presentation)
2. Yue Cao, Yuming Zhang. Unsupervised Weld Penetration Prediction for Visual Monitoring Via Guided Variational Autoencoder (AWS Professional Program at FABTECH 2025). 2025.9.08-11, Chicago, USA (Oral presentation)
3. Yue Cao, Yuming Zhang. Learning Human Knowledge for Robotizing Double-Electrode Gas Metal Arc Welding via Generative Modeling and Imitation Learning (AWS Professional Program at FABTECH 2025). 2025.9.08-11, Chicago, USA (Oral presentation)
4. Yue Cao, Edison Mucllari, Yuming Zhang and Qiang Ye. Weld Penetration Prediction using GAN with Inaccurate Labels (AWS Professional Program at FABTECH 2024). 2024.10.15-17, Orlando, USA (Oral presentation)
5. Tianpu Li, Yue Cao and Yuming Zhang. Critical Weld Pool Information Detection in GMAW using LSTM U-net. (AWS Professional Program at FABTECH 2024). 2024.10.15-17, Orlando, USA (Oral presentation)
6. Yue Cao, Yuming Zhang. Human Robot Collaboration for DE-GMAW (AWS Professional Program at FABTECH 2024). 2024.10.15-17, Orlando, USA (Oral presentation)
7. Edison Mucllari, Yue Cao, Rui Yu, Qiang Ye, Yuming Zhang. Do We Need a New Foundation to Use Deep Learning to Monitor Weld Penetration? (AWS Professional Program at FABTECH 2023). 2023.9.11-14, Chicago, USA (Oral presentation)
8. Rui Yu, Yue Cao, Qiang Ye, Yuming Zhang. Monitoring Weld Penetration using a Deep Learning Model Pre-trained from Filtered Current. (AWS Professional Program at FABTECH 2023). 2023.9.11-14, Chicago, USA (Oral presentation)
9. Yue Cao, Rui Yu, Edison Mucllari, Qiang Ye, Yuming Zhang. Robotizing Double-electrode GMAW by Learning from Human Welders. (AWS Professional Program at FABTECH 2023). 2023.9.11-14, Chicago, USA (Oral presentation)

Industrial Experience

Calmcar Co., Ltd.	**Autonomous Driving Engineer**	Jul 2022 – Dec 2022
Tianjin, China	Developed path planning and vehicle control algorithms for autonomous driving of electrical cars.	
Weichai Power Co., Ltd.	**Motor Control Engineer**	Aug 2021 – Jul 2022
Weifang, Shandong, China	Developed motor control algorithms and embedded software for powertrain systems.	

Teaching & Mentoring

Graduate Teaching Assistant, University of Kentucky

EE 415G *Electromechanics* (Prof. Yuan Liao), Spring 2025

EE 599 *Applied Model Predictive Control* (Prof. Yuming Zhang), Spring 2025

Student Mentoring

- Tianpu Li (B.S. EE '24): Supervised research on deep learning for welding;
  Two journal papers published with my monitoring:
  Li, T., Cao, Y., Ye, Q., & Zhang, Y. (2025). Generative adversarial networks (GAN) model for dynamically adjusted weld pool image toward human-based model predictive control (MPC). *Journal of Manufacturing Processes*.
  Li, T., Cao, Y., & Zhang, Y. (2024). Analysis of weld pool region constituents in GMAW for dynamic reconstruction through characteristic enhancement and LSTM U-Net networks. *Journal of Manufacturing Processes*.
- Sam Kotter (High School, Fall 2025): Guided project on deep learning in manufacturing applications.

Skills

Core Strength: Building intelligent manufacturing systems capable of real-time decision-making through the integration of algorithms, robotic execution, and physical processes.

- **Manufacturing Processes**: Arc welding expertise, including Gas Tungsten Arc Welding (GTAW) and Gas Metal Arc Welding (GMAW)
- **AI & Deep Learning**: Supervised learning, generative modeling, reinforcement and imitation learning
- **Control Theory**: PID, Model Predictive Control (MPC), adaptive control
- **Robotics & Automation**: Collaborative robot control, human motion capture, human–robot interaction
- **Virtual/Augmented Reality**: VR/AR environment development using Unity for immersive human–machine interaction
- **Programming & Software**: Python, MATLAB/Simulink, C/C++, C#, Unity