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Hao Wang

Ph.D. student (Expected to graduate in July 2026)
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Educational background

Ph.D. student, Product and Production Development, Chalmers University of Technology, Sweden	2021.08–2026.07
M.Sc., Informatics, University of Edinburgh, UK	2018.09–2019.11
B.Eng., Telecommunication Engineering, Beijing Univ. of Posts and Telecommunications, China	2014.09–2018.06

Research experience

Ph.D. student, Div. of Production Systems, Dept. of Mechanical Engineering, Chalmers	2026.01–2026.07
Ph.D. student, Div. of Production Systems, Dept. of Industrial and Materials Sci., Chalmers	2021.08–2025.12
Research intern, National Laboratory of Pattern Recognition, CASIA	2019.10–2021.06
Undergraduate research assistant, Next Generation Internet Research Center, BUPT	2017.08–2017.10

Project experience

Main project

1. **Doctoral thesis: Computer vision for non-rigid object assembly automation**
   Chalmers University of Technology, Sweden, 2021–2026
   i. Project background
   Flexible components such as automotive wiring harnesses and high-voltage cables are key components in the final assembly of electric vehicles. However, due to their variable shape, complex structure, frequent obstruction, and difficult positioning, they have long relied on manual assembly. To improve assembly efficiency, quality, and ergonomics, it is urgent to research robotic vision perception and human-robot collaborative assembly methods suitable for flexible and complex components.
   ii. Major work
   a. Conduct research on visual perception in robotic wire harness assembly, systematically review the current application status of computer vision in robotic wire harness assembly, and analyze key technologies such as target detection, pose estimation, 3D perception, and human-robot collaboration;
   b. Research a deep learning-based method for detecting automotive wiring harness connectors, enabling the identification and localization of connector targets in complex industrial scenarios;
   c. To address the high cost of industrial vision data acquisition and annotation, a robot-assisted systematic dataset preparation method is proposed to accelerate the development of target detection and pose estimation models;
   d. Experimental verification was conducted in the context of automotive wiring harness assembly, electric vehicle manufacturing, and human-machine collaboration to form a systematic research framework for the automation of non-rigid object assembly.
   iii. Main achievements
   a. Completed doctoral thesis *Computer vision for non-rigid object assembly automation: With applications in automotive wire harness assembly* and Licentiate thesis *Toward enabling robotic visual perception for assembly tasks: An application in wire harness assembly onto electric vehicles*;
   b. As the first author, published a review paper on computer vision for robotic wiring harness assembly in Advanced Engineering Informatics, a paper on the construction of industrial vision datasets in Engineering Applications of Artificial Intelligence, and a paper on automotive wiring harness connector inspection at IEEE CASE 2023;
   c. Research findings have supported Swedish smart manufacturing projects such as EWASS and have been integrated with industrial scenarios such as Volvo Cars, AB Volvo, and Scania, enhancing their engineering application value.
2. **EWASS - Empowering Human Workers for Assembly of Wire Harnesses**
   SIP Produktion2030, VINNOVA, Sweden, 2022–2025
   i. Project background
   The EWASS project addresses the challenges of assembling automotive wiring harnesses and high-voltage cables. In collaboration with industry partners such as Volvo Cars, AB Volvo, Scania, and Wiretronic, it aims to improve the efficiency, quality, safety, and ergonomics of wiring harness assembly through collaborative robots, human-robot collaboration, and simulation technology.

ii. Major work
    a. Responsible for research on artificial intelligence and computer vision in intelligent robot assembly and human-robot collaborative assembly, focusing on flexible wire harness recognition, localization, grasping assistance, connector detection, pose estimation, and visual data acquisition;
    b. Responsible for research on collaborative robot and worker working modes, supporting physical and virtual demonstrations in projects, and conducting experimental verification in industrial scenarios using Volvo, Scania, and other companies.
iii. Main achievements
    a. This project supports the core research on visual perception in automotive wiring harness assembly robots in my doctoral thesis, forming a research foundation for the automation of non-rigid object assembly;
    b. Research findings, published as the first author in Advanced Engineering Informatics, Engineering Applications of Artificial Intelligence, and IEEE CASE 2023, promote the application of artificial intelligence, computer vision, and collaborative robot technologies in wire harness assembly scenarios.

3. **Code Agents - AI-powered end-to-end solutions for flexible manufacturing**
   VINNOVA, Sweden, 2024–2025
   i. Project background
   The manufacturing industry is evolving towards greater flexibility, automation, and rapid reconfiguration; however, equipment such as robots and PLCs still relies on manual programming and debugging, making it difficult to adapt to the demands of multi-variety, small-batch production. The Code Agents project aims to combine generative artificial intelligence, AI agents, and industrial automation systems to develop code generation and verification solutions for flexible manufacturing.
   ii. Major work
    a. Led the team to build an AI-driven robot code generation, verification, deployment, and version management system for flexible manufacturing;
    b. Investigated methods for automatic robot code generation with Accenture;
    c. Explored mechanisms for automated code inspection, simulation verification, and security verification with PTC and Rockwell;
    d. Built an end-to-end process from task description, code generation, and verification to robot deployment, and investigated the transparency, interpretability, and reliability of AI-generated code in industrial settings with Volvo Cars.
   iii. Main achievements
    a. The project promotes the application of generative artificial intelligence and AI agent technology in robot programming and industrial automation;
    b. The related paper *Developing code agents for robot programming: Technical and managerial perspectives*, published at APMS 2025, provides a technical path for the transformation of manufacturing systems from traditional static programming to adaptive, intelligent, and verifiable automated programming.

4. **3D facial reconstruction and deepfake detection**
   National Laboratory of Pattern Recognition, CASIA, China, 2019–2021
   i. Project background
   This project addresses the challenges of 3D face reconstruction and deepfake detection in face recognition and digital media security. It combines deep learning and 3D vision methods to explore high-fidelity face shape restoration and face forgery detection techniques based on 3D structural decomposition.
   ii. Major work
   Participated in high-precision 3D face reconstruction, face forgery detection, 3D visual feature modeling, deep learning model training and experimental verification, etc. My research focuses on fine-grained face geometric modeling methods that overcome the limitations of traditional 3DMM representation space and utilizes 3D face structure decomposition and geometric consistency information to identify abnormal features in forged images or videos.
   iii. Main achievements
    a. Published as a co-first author paper *Face Forgery Detection by 3D Decomposition* at CVPR 2021 (oral);
    b. 3D face reconstruction research published at ECCV 2020 and further published in IEEE TPAMI.

Other projects

1. Battery production, products and systems (MAXBATT), VGR, Sweden, 2025–2028
2. PLENary multi-User developMent arena for future industrial workspaces (PLENUM), VINNOVA, Sweden, 2022–2025
3. Boosting the Exploitation of Standardisation Inputs from European Projects (STAND4EU), Horizon Europe, EU, 2022–2024
4. DIGITAL work InStructions for cognitive work (DIGITALIS), SIP Produktion2030, VINNOVA, Sweden, 2022–2024
5. A Pan-European Network of Robotics DIHs for Agile Production (DIH^2), Horizon 2020, EU, 2019–2023

Publication

Google Scholar (h-index 9，May 2026): https://scholar.google.com/citations?user=hKFj_QwAAAAJ
Scopus (h-index 7，May 2026): https://www.scopus.com/authid/detail.uri?authorId=56181425300

Journal

1. **Wang, H.**,Urbanos Uriel, G., El-Nahass, K., Ekered, S., Johansson, B. (2026). Accelerating industrial vision: Systematic robot-assisted dataset preparation for object detection and pose estimation. *Engineering Applications of Artificial Intelligence*, 176, 114741. doi: 10.1016/j.engappai.2026.114741
2. **Wang, H.**, Salunkhe, O., Quadrini, W., Lämkull, D., Ore, F., Despeisse, M., Fumagalli, L., Stahre, J., & Johansson, B. (2024). A systematic literature review of computer vision applications in robotized wire harness assembly. *Advanced Engineering Informatics*, *62*, 102596. doi: 10.1016/j.aei.2024.102596
3. Johansson, B., Despeisse, M., Bokrantz, J., Braun, G., Cao, H., Chari, A., Fang, Q., Chávez, C.A.G., Skoogh, A., Söderlund, H., **Wang, H.**, Wärmefjord, K., Nyborg, L., Sun, J., Örtengren, R., Schumacher, K. A., Espinal, L., Morris, K. C., Nunley, J., Kishita, Y., Umeda, Y., Acerbi, F., Pinzone, M., Persson, H., Charpentier, S., Edström, K., Brandell, D., Gopalakrishnan, M., Rahnama, H., Abrahamsson, L., Rönnbäck, A. Ö., & Stahre, J. (2024). Challenges and opportunities to advance manufacturing research for sustainable battery life cycles. *Frontiers in Manufacturing Technology*, *4*, 1360076. doi: 10.3389/fmtec.2024.1360076
4. Zhu, X., Yu, C., Huang, D., Lei, Z., **Wang, H.**, & Li, S. Z. (2023). Beyond 3dmm: Learning to capture high-fidelity 3d face shape. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *45*(2), 1442-1457. doi: 10.1109/TPAMI.2022.3164131

Conference

1. Salunkhe, O., Chávez, C.A.G., **Wang, H.**, Syberfeldt, A., Romero, D., & Stahre, J. (2025). Developing code agents for robot programming: Technical and managerial perspectives. *Advances in Production Management Systems. Cyber-Physical-Human Production Systems: Human-AI Collaboration and Beyond*, 134–147. doi: 10.1007/978-3-032-03515-8_10
2. **Wang, H.**, Salunkhe, O., Quadrini, W., Lämkull, D., Ore, F., Johansson, B., & Stahre, J. (2023). Overview of computer vision techniques in robotized wire harness assembly: Current state and future opportunities. *Procedia CIRP*, *120*, 1071-1076. doi: 10.1016/j.procir.2023.09.127
3. Salunkhe, O., Quadrini, W., **Wang, H.**, Stahre, J., Romero, D., Fumagalli, L., & Lämkull, D. (2023). Review of current status and future directions for collaborative and semi-automated automotive wire harnesses assembly. *Procedia CIRP*, *120*, 696-701. doi: 10.1016/j.procir.2023.09.061
4. Despeisse, M., Johansson, B., Bokrantz, J., Braun, G., Chari, A., Chen, X., Fang, Q., Chávez, C.A.G., Skoogh, A., Stahre, J., Theradapuzha Mathew, N., Turanoglu Bekar, E., **Wang, H.**, & Örtengren, R. (2023). Battery production systems: State of the art and future developments. *Advances in Production Management Systems. Production Management Systems for Responsible Manufacturing, Service, and Logistics Futures*, 521-535. doi: 10.1007/978-3-031-43688-8_36
5. **Wang, H.**, & Johansson, B. (2023). Deep learning-based connector detection for robotized assembly of automotive wire harnesses. *2023 IEEE 19th International Conference on Automation Science and Engineering (CASE)*, 1-8. doi: 10.1109/CASE56687.2023.10260619
6. Zhu, X., **Wang, H.**, Fei, H., Lei, Z., & Li, S. Z. (2021). Face forgery detection by 3d decomposition. *2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR),* 2928-2938. doi: 10.1109/CVPR46437.2021.00295
7. Zhu, X., Yang, F., Huang, D., Yu, C., **Wang, H.**, Guo, J., Lei, Z., & Li, S. Z. (2020). Beyond 3dmm space: Towards fine-grained 3d face reconstruction. *Computer Vision - ECCV 2020*, 343-358. doi: 10.1007/978-3-030-58598-3_21

Report

1. 2024 World manufacturing report - New perspectives for the future of manufacturing: Outlook 2030. Available: https://worldmanufacturing.org/report/report-2024-new-perspectives-for-the-future-of-manufacturing-outlook-2030/
2. 2023 World manufacturing report - New business models for the manufacturing of the future. Available: https://worldmanufacturing.org/report/report-2023-new-business-models-for-the-manufacturing-of-the-future/

Thesis

1. **Wang, H.** (2026). *Computer vision for non-rigid object assembly automation: With applications in automotive wire harness assembly* [PhD thesis]. doi: 10.63959/chalmers.dt/5880
2. **Wang, H.** (2024). *Toward enabling robotic visual perception for assembly tasks: An application in wire harness assembly onto electric vehicles* [Licentiate thesis]. Available: https://research.chalmers.se/en/publication/540720

Academic service

Journal reviewer

CMC-Computers, Materials & Continua
International Journal of Industrial Engineering and Management
Neural Processing Letters
Pattern Recognition

Scientific Reports
Signal, Image and Video Processing

Conference reviewer

IEEE International Conference on Multimedia and Expo (ICME)
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Teaching experience

Chalmers University of Technology

Automation:
Automation Technique (LMT108)，Robotics and Manufacturing Automation (MPR213)
Production systems:
Production Systems (PPU161)，Simulation and Optimisation of Sustainable Production Systems (IMS085)，Simulation and Visualization of Production Systems (IMS020)，Virtual Production (PPU055)
Others:
Research Methodology in Production Projects (PPU215)

Award

Chinese Government Award for Outstanding Self-Financed Students Abroad

The 2024 Chinese Government Award for Outstanding Self-Financed Students Abroad (Category A)

Certificate

IELTS 7.5, TOEFL 105, GRE 325