Wei DAI

wei.dai@my.cityu.edu.hk anthonyweidai Hong Kong

Education

City University of Hong Kong, Hong Kong, China *Sep. 2021 - Aug. 2025*
Ph.D. in Robotics and Automation
Supervisor: Prof. Jun Liu & Prof. Steven Wang

South China University of Technology, Guangzhou, China *Sep. 2017 - Jun. 2021*
B.Eng. in Mechanical Engineering
Supervisor: Prof. Zhenping Wan

Selected Awards

- **Research Tuition Grant**, CityU *2021-2025*
- **Postgraduate Studentship**, CityU *2021-2025*
- **Research Activities Fund**, CityU *2024-2025*
- **Outstanding Academic Performance Award**, CityU *2024*
- **Institutional Research Tuition Scholarship**, CityU *2024*
- **ISBI Student Travel Grant** (3 recipitents in Hong Kong), ISBI *2024*
- **Conference Grant**, CityU *2024*
- **Outstanding Undergradutate Thesis Award** (Top 1%), SCUT *2021*
- **The First Prize Scholarship** (Top 2%), SCUT *2019-2020*
- **National Stellar Volunteer Award** (121 volunteer hours), CVSF *2020*
- **Honorable Mention**, National University Student Mechanics Competition *2019*
- **Honorable Mention**, Mathematical Contest in Modeling (MCM) *2019*
- **Zhangtao-Lifen Dengyun Scholarship** (Top 1%), SCUT *2018*

Research Experience

Analyse Small-scale Medical Objects:

I developed SvANet, a scale-variant attention-based architecture for segmenting small medical objects. SvANet employs a scale-variant attention (SvAttn) method and a cross-scale guidance module to track feature changes and reuse attention maps from progressively compressed stages, leveraging high-resolution features from early learning stages to reduce compression artefacts. Additionally, SvANet integrates Monte Carlo attention and convolution with vision transformer to capture multi-scale information within a single feature map by generating attention maps at various scales.

Construct Light-weight Neural Networks:

I developed a hierarchical attention-based network (HierAttn), a lightweight architecture designed to efficiently differentiate multi-class skin lesions with minimal computational cost and memory use.

HierAttn combines branch attention and convolution-transformer hybrid module to capture hierarchical features and multi-scale representations.

Diagnose Sperm Health for IVF Robotics:

I developed a sperm feature-correlated network (SFCNet) to assist IVF robotics by differentiating and characterising multiple sperms. SFCNet combines SaliencyMix, lightweight architecture design, and cross-scale guidance with SvAttn for enhanced segmentation and morphology analysis, while tracking sperm motility with lateral attention and a multi-scale tracking system. It achieves superior performance at over 70 FPS on a single RTX 3090.

Publications (Google Scholar)

Journal Papers

1. **W. Dai**, R. Liu, T. Wu, M. Wang, J. Yin and J. Liu, "Deeply Supervised Skin Lesions Diagnosis with Stage and Branch Attention," in *IEEE Journal of Biomedical and Health Informatics*, vol. 28, no. 2, pp. 719-729, Feb. 2024. (**JBHI, IF: 7.7**)
2. **W. Dai**, T. Wu, R. Liu, M. Wang, J. Yin, and J. Liu, "Any Region Can Be Perceived Equally and Effectively on Rotation Pretext Task Using Full Rotation and Weighted-region Mixture," in ***Neural Networks***, 2024. (**NN, IF: 7.8**)
3. **W. Dai**, Z. Wu, R. Liu, T. Wu, M. Wang, J. Zhou, Z. Zhang, and J. Liu, "Automated Non-invasive Analysis of Motile Sperms Using Sperm Feature-correlated Network," in *IEEE Transactions on Automation Science and Engineering*, pp. 1-11, 2024. (**TASE, IF: 5.9**)
4. R. Liu, **W. Dai**, C. Wu, T. Wu, M. Wang, J. Zhou, X. Zhang, W. Li, and J. Liu, "Deep Learning-based Microscopic Cell Detection Using Inverse Distance Transform and Auxiliary Counting," in *IEEE Journal of Biomedical and Health Informatics*, pp. 1-13, 2024. (**JBHI, IF: 7.7**)
5. R. Liu, **W. Dai**, T. Wu, M. Wang, S. Wan, and J. Liu, "AIMIC: Deep Learning for Microscopic Image Classification," Computer Methods and Programs in Biomedicine, vol. 226, p. 107162, 2022. (**CMPB, IF: 6.1**)
6. T. Wu, K. Shang, **W. Dai**, M. Wang, R. Liu, J. Zhou, and J. Liu, "High-resolution Cross-scale Transformer: A Deep Learning Model for Bolt Loosening Detection Based on Monocular Vision Measurement", in *Engineering Applications of Artificial Intelligence*, vol. 133, pp. 108574, Feb. 2024. (**EAAI, IF: 8.0**)
7. R. Liu, Y. Zhu, C. Wu, H. Guo, **W. Dai**, T. Wu, M. Wang, W. J. Li, and J. Liu, "Interactive Dual Network with Adaptive Density Map for Automatic Cell Counting," *IEEE Transactions on Automation Science and Engineering*, 2023. (**TASE, IF: 5.6**)
8. K. Shang, T. Wu, X. Jin, Z. Zhang, C. Li, R. Liu, M. Wang, **W. Dai**, and J. Liu, "Coaxiality Prediction for Aeroengines Precision Assembly Based on Geometric Distribution Error Model and Point Cloud Deep Learning," *Journal of Manufacturing Systems*, vol. 71, pp. 681–694, 2023. (**JMS, IF: 12.1**)
9. M. Wang, J. Zhang, R. Liu, T. Wu, **W. Dai**, R. Liu, J. Zhang, and J. Liu, "Liquid Metal-based Flexible Sensor for Perception of Force Magnitude, Location, and Contacting Orientation," *IEEE Transactions on Instrumentation and Measurement*, 2023. (**TIM, IF: 5.6**)

Conference Papers

1. **W. Dai**, Z. Wu, J. Wang, R. Liu, M. Wang, T. Wu, J. Zhou, Z. Zhang, and J. Liu, "Automated Non-invasive Analysis of Motile Sperms Using Cross-scale Guidance Network," in *IEEE International Conference on Robotics and Automation*. pp. 17708-17714, IEEE, 2024. (**ICRA 2024**)
2. **W. Dai**, Z. Wu, R. Liu, J. Zhou, M. Wang, T. Wu, and J. Liu, "SoSegFormer: A Cross-scale Feature Correlated Network for Small Medical Object Segmentation," in *IEEE International Symposium on Biomedical Imaging*. pp. 1-4, IEEE, 2024. (**ISBI 2024**)
3. J. Zhou, R. Liu, M. Wang, T. Wu, **W. Dai**, X. Zhang, and J. Liu, "Sonicplex: Simultaneous Arrangement of Massive Particles Through a Simple Acoustic Micromanipulation Platform," in *International Conference on Manipulation, Automation and Robotics at Small Scales*. IEEE, 2023, pp. 1–6. (**MARSS 2023**)
4. M. Wang, Z. Li, **W. Dai**, R. Liu, S. Yuan, and J. Liu, "On-chip Transportation and Mixing of Microsample Using Electrohydrodynamic Flow," in *International Conference on Manipulation, Automation and Robotics at Small Scales*. IEEE, 2022, pp. 1–6. (**MARSS 2022**)

Preprints

1. **W. Dai**, R. Liu, Z. Wu, T. Wu, M. Wang, J. Zhou, Y. Yuan, and J. Liu, "Exploiting Scale-Variant Attention for Segmenting Small Medical Objects ," in *arXiv*. 2024. *IEEE Transactions on Neural Networks and Learning Systems*. First revision.

Professional Activities

Journal Reviewers

- IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)
- IEEE Journal of Biomedical and Health Informatics (IEEE JBHI)
- IEEE Transactions on Biomedical Engineering (IEEE TBME)
- Computer Methods and Programs in Biomedicine (CMPB)
- IEEE Transactions on Robotics (IEEE TRO)
- IEEE Transactions on Automation Science and Engineering (IEEE TASE)
- IEEE Robotics and Automation Letters (IEEE RAL)
- Engineering Applications of Artificial Intelligence (EAAI)
- Lab on a Chip
- Advanced Intelligent Systems
- International Journal of Computing and Digital Systems

Conference Reviewers

- IEEE International Symposium on Biomedical Imaging
- IEEE International Conference on Robotics and Automation
- IEEE International Conference on Intelligent Robots and Systems
- IEEE International Conference on Advanced Robotics and Its Social Impacts
- IEEE International Conference on Nano/Micro Engineered and Molecular Systems

- IEEE International Conference on Manipulation, Automation and Robotics at Small Scales

Conference Presentations

- ISBI 2024, Athens, Greece *May 2024*
- ICRA 2024, Yokohama, Japan *May 2024*

Teaching Assistant

- MNE4032 Robotics and Machine Vision *Spring 2024*
- MNE8116 Computer Controlled Systems *Spring 2023*
- MNE6005/MNE8113 Micro Systems Technology *Fall 2022-2024*

Experience

University of St Andrews, St Andrews, United Kingdom *Jul. 2019 - Aug. 2019*
University of Dundee, Dundee, United Kingdom
Visiting student in School of Science and Engineering

- Applying a deep learning architecture U-Net to extract traffic lanes.
- Detecting ArUco markers and distinguishing the colour of the traffic light.

Extracurricular Activities

- 25th & 26th Standard Chartered Hong Kong Marathon (10 km), Hong Kong *2023 - 2024*
- 7th & 8th Nike Relay Race, Guangzhou *2018 - 2019*