Tongzhi Niu

+86 13164616835 ntongzhi@gmail.com
Wuhan, China
https://ntongzhi.github.io/

EDUCATION

Huazhong University of Science and Technology (HUST) - Mechanical Engineering Doctor — Sep 2018 - Sep 2024
· Innovation Institute Scholarship (Top 1% of School); Excellent Student Cadre (Top 10% of School)
National University of Sigapore (NUS) - Mechanical Engineering Joint Doctor — Jan 2023 - Jan 2024
Wuhan University of Technology (WHUT) - Mechanical Engineering Bachelor — Sep 2014 - Jun 2018
· National Encouragement Scholarship (Top 2% of School); Outstanding Graduates (Top 5% of School)

RESEARCH EXPERIENCE

Verification of Cyber-Physical System of Intelligent Production Line (Sub-project of National Key R&D Program Project) - Research Assistant — Sep 2018 - Aug 2022

- Utilized only positive samples during the cold start phase to build a distribution model based on an automatic memory mechanism, achieving a 96.9% recall rate and 30 frames/s on edge devices, fulfilling real-time detection demands. Published in IEEE T-mech.
- Employed a large number of positive samples and a few negative samples in the mid-stage of the production line to develop a Transformer-based positive sample pre-training model, achieving high-precision detection through distillation.
- Constructed a light reflection change model in the later stage of the production line to address image quality changes and feature drift due to tool and fixture wear, achieving feature alignment through illumination field resolution for metal surface detection domain generalization. Submitted to IEEE T-II.

Research on industrial image defect detection method with data imbalance (The Fundamental Research Funds for the Central Universities Project) - Research Leader — Jan 2020 - Dec 2021

- Developed a few-shot defect detection method using Graph Neural Networks (GNNs), enabling defect detection with minimal, even single, training samples. Results published in MSSP.
- Constructed a weakly supervised surface defect detection method based on cognitive uncertainty, utilizing Bayesian Neural Networks for defect detection under poor label quality and weak label scenarios. Findings submitted to Applied Soft Computing.
- Implemented an unsupervised surface defect detection method using positive samples only, through an adversarial encoder network with automatic memory, achieving unknown sample defect detection. Achievements published in IEEE Sensors Journal.

Optical Communication Device Detection (Enterprise cooperation R&D) - Research Assistant — Sep 2019 - Jan 2021

- Developed a positive sample comparison method to mitigate data drift in optical communication chips, focusing on learning template-sample comparison ability for enhanced cross-batch generalization. This method surpassed advanced techniques across three data types, with findings published in Computers in Industry.
- Constructed a dense-feature-based extraction and matching approach to tackle geometric variations in template-sample comparisons of optical communication chips. Achieved background generalization through matching subtraction and feature fusion, with results published in Knowledge-Based Systems.

HONOR & AWARDS

[1] The third prize of China University Student Social Practice and Science Contest on Energy Saving & Emission Reduction (Top 1000 of China, Leader) — Jun 2017
[2] The first prize of China Product Innovation Competition, supported by Autodesk (Top 100 of China) — Dec 2018
[3] The third prize of Hubei Province International College Students' "Internet+" Innovation and Entrepreneurship Competition (Top 100 of Hubei Province, Leader) — Sep 2020

PUBLICATIONS (Selected)

[1] **Tongzhi Niu**, Zhiyu Xie, Jie Zhang, Lixin Tang, Bin Li, and Hao Wang. “A generalized well neural network for surface defect segmentation in Optical Communication Devices via Template-Testing comparison.” Computers in Industry 151 (2023): 103978.

[2] **Tongzhi Niu**, Bin Li, Weifeng Li, Yuanhong Qiu, and Shuanlong Niu. “Positive-sample-based surface defect detection using memory-augmented adversarial autoencoders.” IEEE/ASME Transactions on Mechatronics 27, no. 1 (2021): 46-57.

[3] **Tongzhi Niu**, Biao Chen, Qianhang Lyu, Bei Li, Wei Luo, Zhenrong Wang, and Bin Li. “Scoring Bayesian Neural Networks for learning from inconsistent labels in surface defect segmentation.” Measurement 225 (2024): 113998.

[4] **Tongzhi Niu**, Biao Chen, Zhenrong Wang, Ruoqi Zhang, and Bin Li. “Background-Adaptive Surface Defect Detection Neural Networks via Positive Samples.” In IECON 2023-49th Annual Conference of the IEEE Industrial Electronics Society, pp. 01-09. IEEE, 2023.

[5] Biao Chen, **Tongzhi Niu** ***(Corresponding author)***, Ruoqi Zhang, Hang Zhang, Yuchen Lin, Bin Li. “Feature matching driven background generalization neural networks for surface defect segmentation.” Knowledge-Based Systems 287 (2024):111451.

[6] Chen Biao, **Tongzhi Niu** ***(Co-first author)***, Wenyong Yu, Ruoqi Zhang, Zhenrong Wang, and Bin Li. “A-Net: An A-shape Lightweight Neural Network for Real-time Surface Defect Segmentation.” IEEE Transactions on Instrumentation and Measurement (2023).

[7] Luo Wei, **Tongzhi Niu** ***(Co-first author)***, Haiming Yao, Lixin Tang, Wenyong Yu, and Bin Li. “Unsupervised Defect Segmentation Via Forgetting-Inputting-Based Feature Fusion and Multiple Hierarchical Feature Difference.” IEEE Sensors Journal (2023).

[8] Dai Jiahua, Peiqing Liu, Qiulin Qu, Ling Li, and **Tongzhi Niu**. “Aerodynamic optimization of high-lift devices using a 2D-to-3D optimization method based on deep reinforcement learning and transfer learning.” Aerospace Science and Technology 121 (2022): 107348.

[9] Dai, Jiahua, Peiqing Liu, Ling Li, Qiulin Qu, and **Tongzhi Niu**. "Multi-Disciplinary and Multi-Objective Optimization Method Based on Machine Learning." AIAA Journal (2023): 1-17.

[10] Li, Weifeng, Bin Li, Shuanlong Niu, Zhenrong Wang, Baohui Liu, and **Tongzhi Niu**. "Selecting informative data for defect segmentation from imbalanced datasets via active learning." Advanced Engineering Informatics 56 (2023): 101933.

[11] Li, Weifeng, Bin Li, Shuanlong Niu, Zhenrong Wang, Miao Wang, and **Tongzhi Niu**. "LSA-Net: Location and shape attention network for automatic surface defect segmentation." Journal of Manufacturing Processes 99 (2023): 65-77.