Biao Chen

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Education

Huazhong University of Science and Technology Sep 2020 - Jul 2024
Bachelor of Sci. in Machine Design, Manufacturing and Automation (experimental class)
GPA(overall): 3.97/4.0, **Ranking**: 7/30
Core Courses: Dynamics of Mechanical Systems (94/100), Linear Algebra (91/100), Calculus (92/100), Theoretical Mechanics (96/100), Complex Function and Integral Transform (94/100), Numerical Methods (92/100)

Research Experiences

Batch Adaptive Defect Segmentation Networks Based on Positive Samples Apr 2023 - Present
Research Assistant, National Engineering Research Center of Digital Manufacturing Equipment
Advisor: Professor Bin Li (Vice Director of State Engineering Research Center of Digital Manufacturing Equipment)

- Proposed a batch adaptive network based on positive samples, which realizes the adaptive detection of different batches of products by learning the difference between positive samples and test samples.
- Designed a feature alignment mechanism based on spatial transformer module to eliminate background displacement, rotation, texture change and other noises, so that the network can accurately extract defect features.
- Proposed a positive sample representative selection algorithm based on the pre-training model feature embedding method to adapt to the sample feature changes caused by tool and die wear.

Lightweight Real-Time Segmentation Network for Surface Defect Detection Oct 2022 - Mar 2023
Research Assistant, National Numerical Control System Engineering Technology Research Center
Advisor: Professor Wenyong Yu (Professor of State Engineering Research Center of Digital Manufacturing Equipment)

- Proposed a lightweight real-time network including feature extraction stage and feature fusion stage for surface defect detection, which only has 0.39M parameters and 0.44G FLOPs when input resolution is 224×224.
- Designed lightweight convolution blocks with residual connection for feature extraction and feature fusion stages.
- Fused low level details and high level semantic information efficiently during the feature fusion phase to guide network focusing on features at different levels at the same time.

Effect of Grinding Parameters on Surface Quality of Carbon Fiber Reinforced Plastics Mar 2022 - Mar 2023
Research Assistant, State Key Lab of Intelligent Manufacturing Equipment and Technology
Advisor: Professor Huan Zhao (Professor of State Key Lab of Intelligent Manufacturing Equipment and Technology)

- Built the CFRP griding parameters effect experimental platform on the robot processing equipment.
- Carried out single factor experiment and orthogonal experiment with different process parameters.
- Measured the grinding temperature and grinding force and the surface roughness of CFRP specimens after grinding.
- Analyzed the influences of different parameters on the surface quality of CFRP based on the experimental results.

Lightweight Networks for Surface Defect Segmentation Based on Neural Architecture Search Jun 2021 - Oct 2022
Research Assistant, National Engineering Research Center of Digital Manufacturing Equipment
Advisor: Professor Bin Li (Vice Director of State Engineering Research Center of Digital Manufacturing Equipment)

- Proposed search space suitable for industrial applications by combining design experience and experimental results.
- Designed a new loss function simultaneously focusing on the network weight parameters and structural light quantification parameters to balance the model accuracy and computational efficiency.
- Obtained the lightweight network which performs high competitiveness against other classical networks on three industrial datasets through Neural Architecture Search programmed by Python.
- Searched for lightweight network which achieved competitive performance with U-Net with only 30% parameters.

Robot-Based High-Quality Grinding of Large Thermoplastic Composite Members Oct 2021 - May 2022

Research Assistant, State Key Lab of Intelligent Manufacturing Equipment and Technology

Advisor: Professor Huan Zhao (Professor of State Key Lab of Intelligent Manufacturing Equipment and Technology)

- Investigated the related literature on composite grinding temperature measurement and roughness modeling to better understand existing research and their research methods.
- Participated in the design and construction of robot grinding carbon fiber reinforced plastics (CFRP) platform and conduct orthogonal grinding experiment and test the surface quality of the work after griding.
- Applied the back propagation algorithm to predict the surface roughness of the composite after processing.

Publications

[1] Tongzhi Niu, **Biao Chen** (Co-first author), Zhenrong Wang, Ruoqi Zhang, Bin Li*, "Background-Adaptive Surface Defect Detection Neural Networks via Positive Samples", submitted to the 49th Annual Conference of the IEEE Industrial Electronics Society (IECON 2023)

[2] **Biao Chen**, Tongzhi Niu (Co-first author), Wenyong Yu*, Ruoqi Zhang, Zhenrong Wang, Bin Li, "A-Net: A Lightweight Real-time Segmentation Network for Surface Defect Detection", submitted to IEEE Transactions on Instrumentation & Measurement [J]. (SCI, Q1, IF= 5.332)

[3] **Biao Chen**, Tongzhi Niu*, Yuchen Lin, Hang Zhang, Baohui Liu and Miao Wang, "Lightweight Convolutional Neural Networks for Surface Defect Segmentation Based on Neural Architecture Search", R&R, International Journal of Machine Learning and Cybernetics[J]. (SCI, Q2, IF=4.377)

Awards

- Excellent Conclusion of National College Student Innovation and Entrepreneurship Project 2023
- Honorable Mention of Mathematical Contest in Modeling Certificate of Achievement (30%) 2022
- Science and Technology Innovation Scholarship in Huazhong University of Science and Technology (2/30) 2021
- First Prize of Advanced Mapping Technology and Product Modeling Innovation Competition (10%) 2021
- First Prize of Asian Engineering Mechanics Competition (30%) 2021
- First Prize of National College Mathematics Challenge (20%) 2020

Leadership & Activities

League Branch Secretary of the Class Sep 2020 - Oct 2021

- Designed and organized various activities and for classmates and won the award of "Vitality League Branch".
- Organized every monthly study meeting and studied together with classmates.
- Strengthened the contact and communication between school leaders and teachers and students.

Member of the Lang Ya Team Nov 2020 - Jul 2021

- Designed robots for RoboMaster competition with other teammates participated in team management actively.
- Participated in the team meeting and communicated with teammates on robot design every week.

Skills

Programming: Python, Pytorch, Matlab
Software: Solidworks, Inventor, AutoCAD, LaTeX, Visio