Haodong Huang

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EDUCATION

Harbin Institute of Technology, Shenzhen — Guangdong, China
Master of Mechanical Engineering — *Aug 2021 – Mar 2024*

- **GPA:** 3.16/4.0
- **Supervisor:** Dr. Shilong Sun
- **Core Modules:** Matrix Analysis, Sensor and Engineering Signal Processing, Mechatronic System Modeling, Computer Control System, etc.

Northeastern University, Shenyang — Liaoning, China
Bachelor of Mechanical Engineering — *Aug 2017 – Jun 2021*

- **GPA:** 3.82/5.0
- **Core Modules:** Advanced Mathematics, Linear Algebra, Thermodynamics, Theoretical Mechanics, Mechanical Principles, Mechanical Design, Mechanical Manufacturing, etc.

ACADEMIC PROJECTS

Research on Intelligent Fault Diagnosis Framework and State Monitoring of Mechanical Systems Based on Distributed Learning of the Population Distribution.

- **Leader:** Shilong Sun
- **Sponsor:** Guangdong Provincial Natural Science Foundation

Research on High-dynamic Response Humanoid Robot Bipedal Gait Planning and Motion Stability Control.

- **Leader:** Shilong Sun
- **Sponsor:** State Key Laboratory of Robotics Technology and Systems, Harbin Institute of Technology

RESEARCH EXPERIENCE

Research on Intelligent Fault Diagnosis Based on Swarm Learning

- **Background:** The development of Industry 4.0 requires a large amount of data. However, in practical applications, collecting a significant amount of high-quality data is a time-consuming and challenging task. It is necessary to protect data privacy while expanding the volume of data information.
- **Methods:** Designed a specialized test bench for bearing and harmonic reducer faults, and explored a fault diagnosis approach based on swarm learning. By analyzing data from bearings and robotic harmonic reducers, features were extracted using CNN, and data consistency was optimized with DAN, successfully achieving collaborative diagnosis across multiple domains.

Research on Intelligent Faults of Different Models Based on Swarm Learning

- **Background:** During the aforementioned research on swarm learning, different training nodes (devices) employed the same training model. However, due to the lack of interpretability of the model, its effectiveness in practical industrial applications was limited.
- **Methods:** In the context of a swarm learning framework, distinct models are strategically deployed at individual nodes. By integrating CNN and innovatively replacing its initial layer with wavelets and specialized filters, the system not only ensures robust data privacy protection but also significantly enhances the interpretability of the processed data.

Research on Intelligent Fault Diagnosis Based on Extreme Label Imbalance

- **Background:** In the research based on swarm learning, there is a need to address the issue of extreme scarcity of certain label data, ensuring effective diagnosis even in the absence of label data.
- **Methods:** Thoroughly analyzed the variances in bearing data across different operating conditions. A novel approach using envelope order was introduced to bridge the gap between disparate data domains. Leveraging Generative Adversarial Networks (GANs), we produced refined envelope data, paving the way for effective cross-domain fault diagnosis.

Research on Intelligent Dumbbell Systems

- **Background:** In the face of the COVID-19 lockdown, maintaining physical exercise becomes crucial. Therefore, we need a guideline and evaluation metric to ensure we can effectively work out at home.
- **Methods:** Sensors were mounted on dumbbells to analyze motion classification and standardization across different populations. After noise reduction with Kalman filtering, the data was segmented and subsequently classified and assessed using neural networks. Additionally, algorithms like KNN were employed for comparative analysis.

Research on Bipedal Robot Gait Planning

- **Background:** Bipedal robots, due to their humanoid characteristics, can operate in human living scenarios and utilize tools designed for humans. Therefore, research on humanoid gait walking is necessary.
- **Methods:** Utilized the raisim and isaac sim platforms to simulate the gait of humanoid robots, training them through reinforcement learning. A reward system was set for the robot's forward movement, and the PPO algorithm was employed to train the robot's walking capability in a virtual environment.

PUBLICATIONS

- S. Sun, H. Huang, T. Peng, C. Shen*, and D. Wang. A Data Privacy Protection Diagnosis Framework for Multiple Machines Vibration Signals Based on a Swarm Learning Algorithm. IEEE Transactions on Instrumentation and Measurement, vol.72, pp. 1-9, 2023. IF: 5.6. JCR Q1. Student first author.
- S. Sun*, H. Huang, T. Peng, and D. Wang. An Improved Data Privacy Diagnostic Framework for Multiple Machinery Components Data Based on Swarm Learning Algorithm. IEEE Transactions on Instrumentation and Measurement, vol.72, pp. 1-9, 2023. IF: 5.6. JCR Q1. Student first author.
- S. Sun, T. Peng, H. Huang, Yufan Wang, Xiao Zhang*, Yu Zhou. IoT Motion Tracking System for Workout Performance Evaluation: A Case Study on Dumbbell. IEEE Transactions on Consumer Electronics, pp. 1-1, 2023. IF: 4.3. JCR Q2.
- S. Sun*, T. Peng, H. Huang. Machinery Prognostics and High-Dimensional Data Feature Extraction Based on A Transformer Self-Attention Transfer Network. Sensors, vol.23, issue 22, pages 9190, IF: 3.9. JCR Q2.
- S. Sun, H. Huang, T. Peng. A Swarm Learning Method for Data Privacy Protection and Rapid Diagnosis of Rotating Machinery Faults. 2022 National Academic Conference on Equipment Monitoring, Diagnosis, and Maintenance.
- J. Ding, S. Sun, C. Shen, T. Peng, and H. Huang. An Orthogonal Sparse Weight Matrix Algorithm for Bearing Early Fault Detection and Recognition. 2022 International Conference on Sensing, Measurement and Data Analytics in the era of Artificial Intelligence (ICSMD).

CHINESE PATENT

- S. Sun, H. Huang, W. Xu. Interactive fault diagnosis method, equipment, and medium based on the SL framework for multiple models. Application number: 2023108444762
- S. Sun, H. Huang, W. Xu. Method, equipment, and medium for generating bearing envelope order spectra based on adversarial networks. Application number: 2023108446518

HONORS AND AWARDS

Harbin Institute of Technology (Shenzhen) Second-Class Academic Scholarship	2021 − 2022
Harbin Institute of Technology (Shenzhen) First-Class Entrance Scholarship	2020 − 2021
Outstanding Graduate of Northeastern University	2020 − 2021
Northeastern University SMC Scholarship	2019 − 2020
Outstanding Student of Northeastern University	2018 − 2019
Northeastern University Da Jun Scholarship	2018 − 2019
Northeastern University First-Class Scholarship	2018 − 2019
Outstanding Student of Northeastern University	2017 − 2018
Northeastern University Second-Class Scholarship	2017 − 2018
Northeastern University Jianlong Scholarship	2017 − 2018

SKILLS

Programming language :	Python(TensorFlow, PyTorch), C++, Matlab etc.
Language Ability :	Chinese(native), English(Fluent)
Software :	SolidWorks, AUTO-CAD, Origin, Office Software, Raisim, Isaacsim etc.

HOBBIES

- Swimming, Badminton, Cycling, Walking, Music, Movies etc.