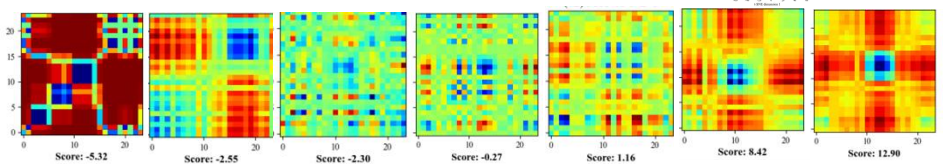
Research Summary

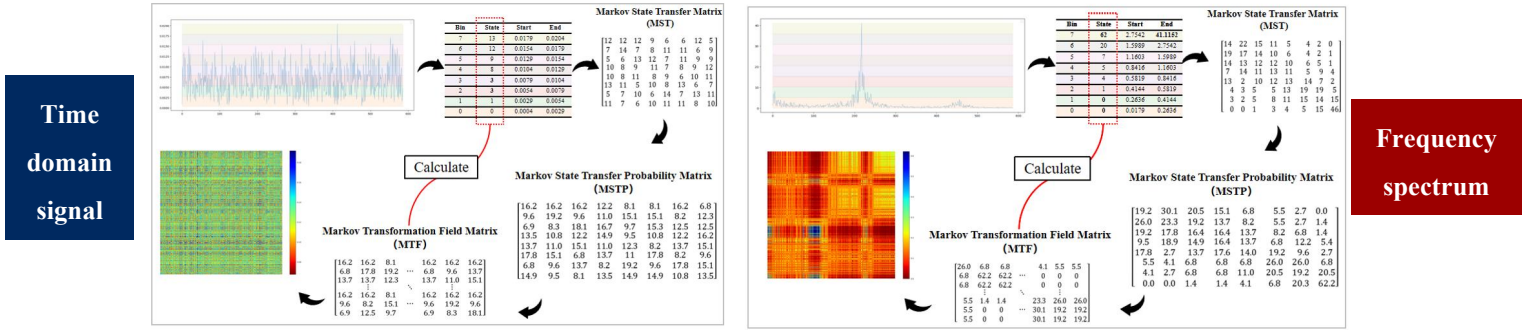
①Published & Under-review Research

Key publication

- **"Robust-GSR driven lightweight CNN framework for intelligent fault diagnosis under variable-speed conditions", Nonlinear Dynamics (under 2nd review, JCR Q1, Top 5% in Mathematical).**
- **"Robust GSR array-assisted fast intelligent diagnosis for multi harmonic fault characteristics under variable-speed conditions", Mechanical Systems and Signal Processing (JCR Q1, Top 1% in Engineering).**
- **A Robust GSR-Based Peak Feature Learning Approach for Fault Diagnosis under Data Scarcity and Class Imbalance. (under review)**

- Introduced **first- and second-order stochastic asymptotic stability conditions** to construct the Robust-GSR system, enabling single-step optimal output without repeated averaging.
- Converted steady-state time-domain signals into frequency-domain responses and generated **Markov Transition Field (MTF)** representations to enhance weak fault features.
- Proposed an **angular-domain transformation** to convert nonstationary time-domain signals into stationary angle-domain signals, effectively addressing variable-speed diagnosis.
- Demonstrated that MTF-based imaging achieved superior noise robustness **compared with other 1D-to-2D signal transformations.**
- Designed a **two-layer lightweight CNN**, outperforming other compact architectures in both accuracy and training efficiency.
- Achieved over 98% accuracy across **compound faults** and **multiple severity levels** on two public datasets.
- By analyzing the MTF **cross-structure**, a **penalized scoring index** is proposed.





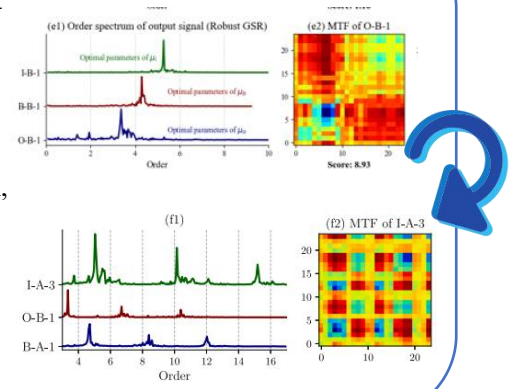
Research Summary

② Published & Under-review Research

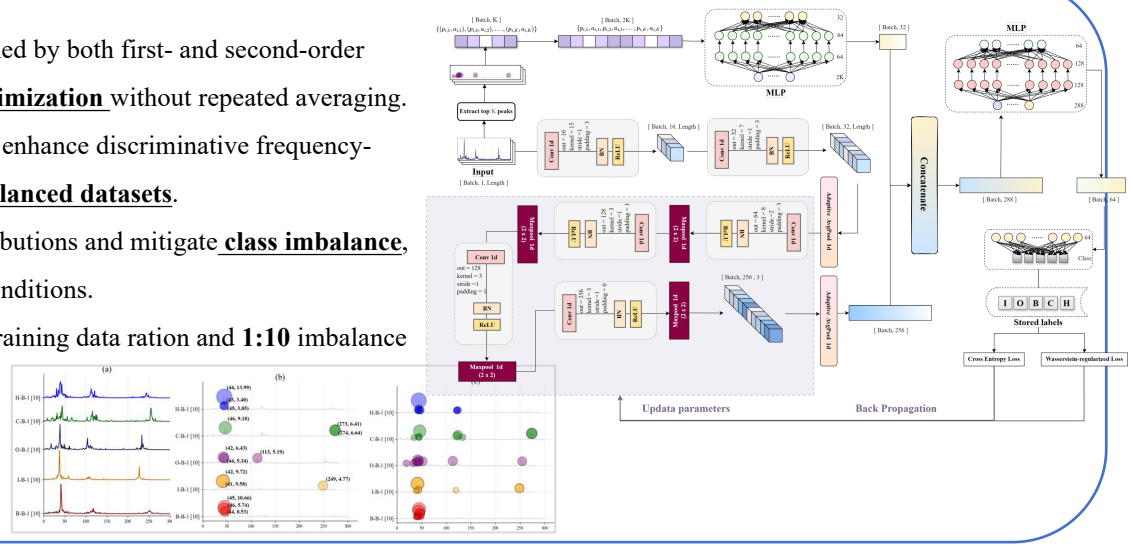
Key publication

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- Built upon the single-resonance Robust-GSR framework, extending stochastic resonance theory to **multi-harmonic fault** enhancement under variable-speed conditions.
- Introduced a resonance-array mechanism capable of simultaneously amplifying **multiple fault frequencies** (e.g., 100, 200, 300 Hz) for compound fault diagnosis.
- Validated robustness through **cross-condition experiments** and diverse **noise** types (impulsive, Gaussian, pink), maintaining >98% accuracy.
- Achieved faster convergence and superior feature separability compared to lightweight CNNs, enabling efficient and noise-resilient intelligent diagnosis.



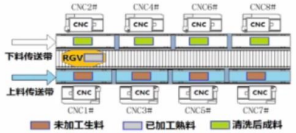
- Introduces the **robust-GSR model** constrained by both first- and second-order asymptotic stability, achieving **one-step optimization** without repeated averaging.
- Proposes a **sparse spectral peak module** to enhance discriminative frequency-domain features for **small-sample** and **imbalanced datasets**.
- Incorporates **Wasserstein loss** to align distributions and mitigate **class imbalance**, enhancing fault classification under noisy conditions.
- Achieves **99.89%** accuracy with only **0.03** training data ration and **1:10** imbalance ratio; validated across multiple noise types.



Research Summary

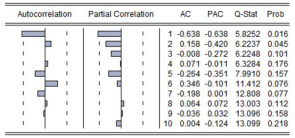
Provincial second prize of the National Undergraduate Mathematical Contest in Modeling (2018)

Introduced **heuristic approximation** to avoid exhaustive looping. Achieved faster convergence and enhanced robustness in multi-stage process control simulations.



Provincial first prize of the "Shenzhen Cup" Mathematical Modeling Competition (2019)

Constructed a **dynamic weighted regression model** integrating social, medical, and environmental factors to assess health disparities.



National University of Singapore Financial Engineering Summer Program (2020)

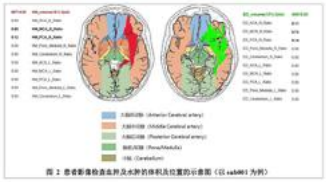
Studied Monte Carlo and deep learning frameworks (**Transformer**, **Diffusion**, **GAN**) for data-driven modeling. Enhanced Diffusion-based K-line classification via **time–frequency integration**, improving accuracy to 95.9% (+10.2%).

Internship at Deloitte Information Consulting Department (2021)

Proposed user growth insights by modeling brand traffic trends via **Bass diffusion** and **AARRR** frameworks. Compiled market intelligence reports on the top five new energy vehicle companies, summarizing key financial and consumer indicators.

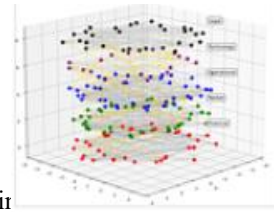
Projects and Competitions

National second prize of the 20th "Huawei Cup" Graduate Mathematical Modeling Competition (2023)



Built Transformer-based risk model for hemorrhage prediction. Applied **COX regression** + **time-series** modeling for treatment effect analysis. Produced **all major technical diagrams and flowcharts.**

Statistical Monitoring and Pathways of Industrial Synergy from Chongqing Municipal Bureau of Statistics (2024-2025)



Designed a five-dimensional enterprise data **coupling network** integrating finance, market, operation, technological innovation, and social dimensions. **Collected and merged multi-source datasets** (e.g., CSMAR, WIND, FinChina SA) for industrial risk analysis. Applied **LLMs** for processing financial reports and public opinion texts, enhancing cross-domain data integration.

CSDN Technical Blog for AI (2024-2025)



Authored **19** technical articles on CSDN platform covering fault diagnosis algorithms (TFN, BDCNN), com putational biology (ESM2, ChemBERT), and deep learning methodologies (Kernel function and bandwidth), achieving **52,000+** cumulative views and recognition in "**2048 AI Community**" and "**Flying AI Developer Community**".