Ying Fu

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EDUCATION

- **University of Wisconsin-Madison**, Madison, WI, USA
  - Ph.D. in Industrial and Systems Engineering (Advisor: Prof. Kaibo Liu)   *Aug 2022 - 2027 (Expected)*
  - M.S. in Computer Science   *Aug 2022 - 2025 (Expected)*
- **South China University of Technology**, Guangzhou, China
  - M.S. in Management Science and Engineering   *Sep 2019 - Jun 2022*
  - B.S. in Polymer Materials and Engineering and Finance (Double Major)   *Sep 2015 - Jun 2019*

Research Interests

My research focuses on leveraging machine learning, including reinforcement learning, and optimization techniques to advance manufacturing systems. Key areas of interest include:

- Modeling and prognostics of system degradation
- Maintenance decision-making and optimization

RESEARCH EXPERIENCE

Optimization

- **3D real-time Robotic Packing**
  - Developed a real-time robotic system for palletizing heterogeneous 3D cartons.
  - Improved collision-avoidance model and optimized Java algorithm for system performance.
- **Advertisement Promotion Optimization**
  - Developed an integer programming (IP) model to maximize revenue in product recommendations.
  - Converted the IP model to an equivalent network flow model, reducing time complexity from exponential to linear.

Data Analytics and Machine Learning

- **Accelerated Classification Training via Instance Selection**
  - Implemented optimized Voronoi-based instance selection in Python.
  - Achieved comparable model performance with 10% of data, verified by numerical experiments.
- **Maximum Homogeneity Grouping for High-Cardinality Categorical Variables in Classification**
  - High-cardinality categorical variables can increase complexity and lead to overfitting.
  - Formulated category grouping as an IP model, solved via dynamic programming (DP).

Data analytics and Optimization for Prognostics

- **Degradation Modeling and Prognostic Analysis Under Unknown Failure Modes**
  - An unsupervised framework using UMAP and time series clustering to identify unknown failure modes.
  - Integrated partial monotonicity into neural networks to enhance degradation modeling.
- **Sensor Selection for Remote Prognostics**
  - Developed a dynamic sensor selection framework for IoT remote prognostics using edge computing.
  - Modeled as an IP problem with local linear approximation, solved by DP.

PUBLICATIONS

Accepted

1. **Ying Fu**, Kaibo Liu, and Wenbin Zhu. "Instance Selection Via Voronoi Neighbors for Binary Classification Tasks." *IEEE Transactions on Knowledge and Data Engineering (2023)*. (The Best Paper Finalist award in the DAIS Section of Industrial and Systems Engineering Research Conference (ISERC), 2023)
2. Wenbin Zhu, **Ying Fu**, and You Zhou. "3D dynamic heterogeneous robotic palletization problem." *European Journal of Operational Research (2024)*.
3. **Ying Fu**, Ye Kwon Huh, and Kaibo Liu, "Degradation Modeling and Prognostic Analysis Under Unknown Failure Modes." *IEEE Transactions on Automation Science and Engineering (2025)*.

Under Revision/Review

1. Ye Kwon Huh, **Ying Fu**, and Kaibo Liu, "A Bayesian spike-and-slab sensor selection approach for high-dimensional prognostics." *IEEE Transactions on Automation Science and Engineering*, under revision.
2. Wenbin Zhu, Xiaoting Wu, **Ying Fu**, and Heng-Qing Ye, "Maximum homogeneity grouping for high-cardinality categorical variables in binary classification." *IEEE Transactions on Knowledge and Data Engineering*, under review.
3. Wenbin Zhu, Runwen Qiu, and **Ying Fu**. "Comparative Study on the Performance of Categorical Variable Encoders in Classification and Regression Tasks." *Artificial Intelligence*, under review.

Working Papers

1. **Ying Fu**, Ye Kwon Huh, and Kaibo Liu, "Dynamic sensor selections for remote prognostics, " in preparation.
2. **Ying Fu** and Kaibo Liu, "Reinforcement Learning-Based Strategies for Degradation and Maintenance Control," in preparation.

AWARDS AND HONORS

- Best Paper Finalist, DAIS Section, Industrial and Systems Engineering Research Conference (2023).
- ISyE Graduate Student Travel Awards, University of Wisconsin-Madison (2023)
- Chancellor's Opportunity Award, University of Wisconsin-Madison (2022)
- China National Scholarship, Ministry of Education of P. R. China (2017)

INVITED PRESENTATIONS

- INFORMS Conference, "Dynamic sensor selections for remote prognostics", Oct. 2024, Seattle, USA
- INFORMS Conference, "Degradation Modeling and Prognostic Analysis Under Unknown Failure Modes", Oct. 2023, Phoenix, USA
- Industrial and Systems Engineering Research Conference (ISERC), "Instance Selection Via Voronoi Neighbors for Binary Classification Tasks", May 2023, New Orleans, USA

PROFESSIONAL SERVICES AND ACTIVITIES

Journal reviewer

- IEEE Transactions on Automation Science and Engineering

Professional Membership

- Member of INFORMS, IISE, and SME
- Vice President of the SME Student Chapter, 2023-2025

TECHNICAL SKILLS

- **Programming Languages:** Python, GAMS, JAVA, Mathematica, R, SQL.
- **Software Tools & Packages**: Pytorch, scikit-learn, Gurobi, Git, Bash