José Carlos Hernández Azucena, Ph.D.

Postdoctoral Fellow
Department of Industrial Engineering
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Education

University of Arkansas — **Fayetteville, AR, USA**
Ph.D. in Industrial Engineering — Fall 2023
M.Sc. in Industrial Engineering — Fall 2022
Advisor: Dr. Haitao Liao

Lehigh University — **Bethlehem, PA, USA**
Gene Golub SIAM Summer School (G2S3) — Summer 2023
on Quantum Computing and Optimization

Escuela Superior de Economía y Negocios — **La Libertad, El Salvador**
Post-Graduate Diploma — Feb. 2015
Quantitative Methods for Business and Economics

Business Engineering Bachelor — Jan. 2014
Magna Cum Laude
Valedictorian

Hochschule Furtwangen University — **Baden-Württemberg, Germany**
International Engineering: Visiting student — Winter 2012

Research Interests

- Systems Reliability and Resilience
- Data Science
- Machine Learning
- Deep Learning and Reinforcement Learning
- Quantum Information Science

Information Science Expertise

- **Applications Explored** - Systems Reliability, Data Analytics, and Machine Learning
- **Programming Languages** - Python, R, Java, Scala, LaTeX, VBA, and Julia
- **Database Management** - Oracle PL/SQL, MongoDB
- **Machine Learning** - SciKit Learn, XGBoost, H2O
- **Deep Learning** - PyTorch, Tensorflow, OpenAI-Gym
- **Quantum Computing** - IBM Qiskit, D-Wave for Quantum Annealing

Professional Experience

- **Postdoctoral Fellow** **Jan. 2024 - present**
  Department of Industrial Engineering. University of Arkansas. AR
  Research activities on collaborative projects and publications. Teaching a graduate level course, Design of Industrial Experiments, for M.Sc. and Ph.D. Engineering students from multiple departments.

- **Senior Graduate Research Assistant** **Jan. 2018 - Dec. 2024**
  Department of Industrial Engineering. University of Arkansas. AR
  Research activities focused on Computational Methods applied to Systems Reliability. Topics related to Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, Statistical Analysis, and Quantum Computing for Optimization.

- **Business Intelligence Coordinator** **Nov. 2015 - Jan. 2018**
  Termoencogibles S.A. de C.V. La Libertad, El Salvador.
  Data and insights support for the B2B sales team. Automation and development of reports to provide insights into market trends and business opportunities. Supporting continuous improvement and measuring the performance of the sales team against budget and goals.

- **Management Information Systems Coordinator** **Apr. 2014 - Oct. 2015**
  Grupo Editorial Altamirano. San Salvador, El Salvador.
  Developing and automating KPI reports for the CFO and CEO. Extracting insights about productivity, efficiency, sales performance, cost analysis, and ROI.

Publications

Refereed Journal Articles

J1. **Azucena, J.C.H.**, Wang, H., Jin, Y. and Liao, H., "Modeling and analysis of two Normal populations based on an unlabeled paired sample". *Communications in Statistics - Simulation and Computation.* 2022. DOI: `https://doi.org/10.1080/03610918.2022.2134895`.

J2. **Azucena, J.C.H.**, Alkhaleel, B., Liao, H. and Nachtmann, H., "Hybrid simulation to support interdependence modeling of a multimodal transportation network", *Simulation Modelling Practice and Theory*, Vol. 107, pp. 102237, 2021. DOI: `https://doi.org/10.1016/j.simpat.2020.102237`.

Working Articles

W1. Hashemian, F., **Azucena, J.C.H.**, Liao, H. and Pohl, E.A., "Convolutional Graph Neural Networks for Reliability Improvement of All-terminal Networks". *Reliability Engineering and Systems Safety.* Forthcoming.

Articles in Refereed Conference Proceedings

C1. Aghamohammadghasem, M., **Azucena, J.C.H.**, Hashemian, F., Liao, H., Zhang, S., and Nachtmann, H.L., "System Simulation and Machine Learning-Based Maintenance Optimization for an Inland Waterway Transportation System", Proceedings of the 2023 Winter Simulation Conference. San Antonio, TX. December 10-13, 2023.

C2. Aghamohammadghasem, M., **Azucena, J.C.H.**, Hashemian, F., Liao, H., Zhang, S., and Nachtmann, H.L., "Preventive Maintenance Planning for an Inland Waterway Transportation System Using Deep Reinforcement Learning", Proceedings of the IISE Annual Conference and Expo 2023. New Orleans, LA. May 20-23, 2023.

C3. **Azucena, J.C.H.**, Hashemian, F., Liao, H. and Pohl, E.A., "Applying Machine Learning to Improve All-Terminal Network Reliability", Proceedings of the 69^{th} Annual Reliability and Maintainability Symposium. Orlando, FL. January 23-26, 2023.

C4. **Azucena, J.C.H.**, Wells, H., Liao, H., Sullivan, K. and Pohl, E.A., "Applying Deep Reinforcement Learning to Improve the Reliability of an Infrastructure Network", Proceedings of the 60^{th} ESReDA Seminar: Advances in Modelling to Improve Network Resilience. France. May 4-5, 2022.

C5. Bipasha, T., **Azucena, J.C.H.**, Alkhaleel, B., Liao, H. and Nachtmann, H., "Hybrid Simulation to Support Interdependence Modeling of a Multimodal Transportation Network", Proceedings of the 2019 Winter Simulation Conference. National Harbor, MD. December 8-11, 2019.

C6. **Azucena, J.C.H.** and Liao, H., "Prognostic Using Dual-Stage Attention-Based Recurrent Neural Networks", Proceedings of the 11^{th} International Conference on Mathematical Methods in Reliability. Hong Kong. June 3-7, 2019.

Teaching Experience

- **Instructor** **Spring 2024 (Current)**
  Department of Industrial Engineering, University of Arkansas. AR, USA
  Course: Design of Industrial Experiments
  Teaching M.Sc. and Ph.D. students in multiple engineering departments
- **Instructor** **Summer 2020 and 2021**
  Department of Industrial Engineering, University of Arkansas. AR, USA
  Course: Engineering Economic Analysis
  Instructor evaluation mean: 4.7 out of 5
- **Teaching Assistant** **Spring 2020**
  Department of Industrial Engineering, University of Arkansas. AR, USA
  Course: Engineering Economic Analysis
- **Teaching Assistant** **Fall 2019**
  Department of Industrial Engineering, University of Arkansas. AR, USA
  Courses: Production Planning and Control and, Applied Probability and Statistics II
- **Teaching Assistant** **2011-2015**
  Escuela Superior de Economía y Negocios, El Salvador.
  Selected courses: Statistical Inference and Probability, Rational Mechanics, R for Statistics

Presentations and Invited Talks

P1. Hashemian, F., **Azucena, J.C.H.**, Liao, H., and Pohl, E. "All-Terminal Network Reliability Estimation Using Graph Neural Networks". INFORMS Annual Meeting. Phoenix, AZ. October 15-18, 2023.

P2. Aghamohammad, M., **Azucena, J.C.H.**, Liao, H., Zhang, S., and Nachtmann, H. "Maintenance Optimization of Inland Waterway Transportation System via Simulation and Machine Learning". INFORMS Annual Meeting. Phoenix, AZ. October 15-18, 2023.

P3. **Azucena, J.C.H.**, and Liao, H. "Implementing a Quantum Gate Circuit to Estimate All-Terminal Network Reliability". NSF Site Visit: DART Student Poster Session. Little Rock, AR. September 18, 2023.

P4. **Azucena, J.C.H.**, Hashemian, F. and Liao, H. "Need-based Sampling and Training in Machine Learning with Application to All-terminal Network Reliability Assessment". IISE Annual Conference and Expo 2023. New Orleans, LA. May 20-23, 2023.

P5. Aghamohammad, M., **Azucena, J.C.H.**, Zhang, S., Nachtmann, H., and Liao, H. "Preventive Maintenance Planning for an Inland Waterway Transportation System Using Deep Reinforcement Learning". IISE Annual Conference and Expo 2023. New Orleans, LA. May 20-23, 2023.

P6. **Azucena, J.C.H.**, Kheirandish, M., and Hashemian, F. "Causal Inference for Predicting Treatment Outcome in Breast Cancer - DAIS Data Challenge". IISE Annual Conference and Expo 2023. New Orleans, LA. May 20-23, 2023.

P7. **Azucena, J.C.H.**, Hashemian, F., Liao, H. and Pohl, E.A. "Applying Machine Learning to Improve All-Terminal Network Reliability". The 69^{th} Annual Reliability and Maintainability Symposium. Orlando, FL. January 23-26, 2023.

P8. **Azucena, J.C.H.**, Wells, H., Liao, H., Sullivan, K. and Pohl, E.A., "Applying Deep Reinforcement Learning to Improve the Reliability of an Infrastructure Network". The 60^{th} ESReDA Seminar: Advances in Modelling to Improve Network Resilience, France, May 4-5, 2022.

P9. Harvey, W., **Azucena, J.C.H.**, Stubblefield, J. and Saldivar, C., "Reinforcement Learning with Connect Four", NSF EPSCoR Workshop: Artificial Intelligence (AI) with No-Boundary Thinking (NBT) to Foster Collaborations in Research, Education and Training, Little Rock, AR, April 3-7, 2022. `https://aicamp.us/connect4`.

P10. Bipasha, T., **Azucena, J.C.H.**, Alkhaleel, B., Liao, H. and Nachtmann, H., "Hybrid Simulation to Support Interdependence Modeling of a Multimodal Transportation Network", Winter Simulation Conference, National Harbor, MD, December 8-11, 2019.

P11. **Azucena, J.C.H.** and Liao, H., "Automatic Insect Count from Incomplete Scenes Using Convolutional Neural Networks", INFORMS Annual Meeting, Seattle, WA, October 20-23, 2019.

P12. Jin, Y., Ruiz, C. and **Azucena, J.C.H.**, "Data Augmentation for Rare Events in Multivariate Time Series - QSR Data Challenge", INFORMS Annual Meeting, Seattle, WA, October 20-23, 2019.

P13. Liao, H. and **Azucena, J.C.H.**, "Prognostic Using Dual-Stage Attention-Based Recurrent Neural Networks", MMR, Hong Kong, June 3-7, 2019.

P14. **Azucena, J.C.H.** and Liao, H., "Use of Deep Markov Models for Prognostics", ISERC, Orlando, FL, May 19-21, 2019.

P15. **Azucena, J.C.H.** and Liao, H., "Dual-stage Attention-based Recurrent Neural Networks for Prognostics and Smart Maintenance", INFORMS Annual Meeting, Phoenix, AZ, November 4-7, 2018.

Awards and Honors

A1. **Azucena, J.C.H.**, Hashemian, F., Liao, H. and Pohl, E.A. The Thomas L. Fagan, Jr. Award for Best Student Paper for "Applying Machine Learning to Improve All-Terminal Network Reliability". Presented at the 69^{th} Annual Reliability and Mantainability Symposyum. (01/2023) Orlando, FL

A2. Department of Industrial Engineering Scholarship. Fall 2023

A3. **Azucena, J.C.H.**, Kheirandish, M., and Hashemian, F. (05/2023) Finalist of IISE DAIS Data Challenge: Causal Inference for Predicting Treatment Outcome in Breast Cancer. New Orleans, LA

A4. Outstanding Graduate Student 2023. Department of Industrial Engineering, University of Arkansas. Fayetteville, AR

A5. Society of Reliability Engineers (SRE) Hans Reiche RAMS Scholarship. At the 69^{th} Annual Reliability and Mantainability Symposyum. (01/2023) Orlando, FL

A6. **Azucena, J.C.H.**, Hashemian, F., Liao, H. and Pohl, E.A. Society of Reliability Engineers (SRE) Stan Ofsthun Best Student Paper Award for "Applying Machine Learning to Improve All-Terminal Network Reliability". At the 69^{th} Annual Reliability and Mantainability Symposyum. (01/2023) Orlando, FL

A7. Harvey, W., **Azucena, J.C.H.**, Stubblefield, J. and Saldivar, C. (04/2022) Student Award Presentation at NSF EPSCoR Workshop: Artificial Intelligence (AI) with No-Boundary Thinking (NBT). Little Rock, AR

A8. Alkhaleel, B. and **Azucena, J.C.H.** (11/2019) Jack Buffington Outstanding Student Poster Award, Mack-Blackwell Transportation Center, University of Arkansas. Fayetteville, AR

A9. **Azucena, J.C.H.**, Ruiz, C., and Jin, Y. (10/2019) Finalist of INFORMS QSR Data Challenge. Seattle, WA

A10. Distinguished Doctoral Fellowship (01/2018-05/2022). University of Arkansas. Fayetteville, AR

A11. Scholarship to the Excellence (2011-2013). Escuela Superior de Economía y Negocios. Santa Tecla, El Salvador

Service

- Treasurer of the INFORMS student chapter at the University of Arkansas, Fall 2018 - Spring 2020

Professional Affiliations

- Member of Alpha Pi Mu, IISE, INFORMS, SRE, and SIAM

`Latest update in 01/2024.`