

# Jose Tupayachi

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Experienced professional in business analytics with a proven ability to design and implement data-driven solutions that drive business impact. Skilled in developing advanced machine learning systems and integrating tools like retrieval-augmented generation and vector databases to enhance chatbot applications. Proficient in Python programming, data engineering, and data vizualization with a strong focus on collaboration and delivering scalable solutions by working effectively with interdisciplinary teams.

## Education

University of Tennessee, Knoxville	PhD Candidate in Industrial and Systems Engineering	Aug 2024 - Present
Advisor: Dr. Xueping Li, Co-advised: Dr. Haowen Xu		
University of Tennessee, Knoxville	MS in Industrial and Systems Engineering	Aug 2022 - Jul 2024
GPA: 3.9		

## Publications

- **Design and Usability Testing of SmartSHOTS: A Mobile App to Reduce Vaccine Barriers for Children 0-24 Months** Wyatt Tami, Taylor Penny, Li Xueping, Lowe Sarah, Sharmin Aliza, Tupayachi Silva Jose, Wang Xudong, Mcneely Clea, Niederhauser Victoria  
*Proceedings of the 58th Hawaii International Conference on System Sciences* (2025)
- **A Simulation-Based Real-Time Deep Reinforcement Learning Approach for Fighting Wildfires**  
J Tupayachi, MM Ferguson, X Li  
*2024 Annual Modeling and Simulation Conference (ANNSIM), 1-12* (2024)
- **Drone-aided delivery methods, challenges, and the future: A methodological review**  
X Li, J Tupayachi, A Sharmin, M Martinez Ferguson  
*Drones* 7 (3), 191 (2023)
- **Towards next-generation urban decision support systems through AI-powered construction of scientific ontology using large language models—A case in optimizing intermodal freight**  
J Tupayachi, H Xu, OA Omitaomu, MC Camur, A Sharmin, X Li  
*Smart Cities* 7 (5), 2392-2421 (2024)
- **Automating Bibliometric Analysis with Sentence Transformers and Retrieval-Augmented Generation (RAG): A Pilot Study in Semantic and Contextual Search for Customized Literature**  
H Xu, X Li, J Tupayachi, JJ Lian, OA Omitaomu  
*Proceedings of the 2nd ACM SIGSPATIAL International Workshop on Advances in Urban-AI* (2024)
- **Better Efficiency on Non-performing Loans Debt Recovery and Portfolio Valuation Using Machine Learning Techniques**  
J Tupayachi, L Silva  
*Production and Operations Management: POMS Lima, Peru, December 2-4, 2021* (2022)

## Pre-Prints:

- **Empowering Cognitive Digital Twins with Generative Foundation Models: Developing a Low-Carbon Integrated Freight Transportation System**  
X Li, H Xu, J Tupayachi, O Omitaomu, X Wang  
*arXiv preprint arXiv:2410.18089* (2024)
- **Towards Next-Generation Urban Decision Support Systems through AI-Powered Generation of Scientific Ontology using Large Language Models: A Case in Optimizing Intermodal Freight Transportation**  
J Tupayachi, H Xu, O A Omitaomu, M C Camur, A Sharmin, X Li  
*arXiv preprint arXiv:2405.19255* (2024)

## Funded Projects Developer

RECOIL   Cognitive Freight Transportation Digital Twin for Resiliency and Emission Control Through Optimizing Intermodal Logistics	Jul 2024 – Present
<ul style="list-style-type: none"><li>• Designed ontology-guided optimization models for large-scale freight transportation networks, integrating data from diverse GIS-based transport modes, including road, rail, and waterways, to minimize costs and emissions while enhancing operational efficiency.</li><li>• Leveraged Convolutional Neural Networks and Graph Neural Networks to analyze the impacts of weather, traffic, and demand on EV charging behavior, enabling data-driven, real-time optimization of EV charging station operations.</li><li>• Applied large language models to power a chatbot that provides domain-specific responses for non-technical users, enabling accurate trade-off analysis between cost, time, and CO<sub>2</sub> emissions.</li><li>• Designed a real-time feedback loop for digital twins, utilizing “Simulated” sensor data and scrapping techniques to continuously optimize intermodal system performance based on real-world conditions.</li></ul>	

- Collaborated with Oak Ridge National Laboratory researchers to create industry-ready solution that reduce emissions and enhance the resilience of intermodal freight and supply chain operations.

**Funding Agency:** U.S. Department of Energy’s Advanced Research Projects Agency-Energy (ARPA-E)  
**Project Number:** #DE-AR0001780

**SmartShots** | Cross-Platform Application to Improve Childhood Vaccination Rates in Tennessee December 2023 – Present

- Enhanced vaccination tracking with real-time data updates, guardian and dependent updates, notifications, and integrated alerts for users.
- Developed a scalable backend system using Laravel. Used Dart and Flutter based on flutter to ensure smooth functionality across platforms.
- Integrated community health information to offer users real-time access to nearby vaccination providers.
- Collaborated with the Tennessee Department of Health and local health agencies to align the app with state public health objectives and needs.
- Performed user testing and incorporated feedback to improve the app’s usability.
- <https://play.google.com/store/apps/details?id=com.ilab.smartshots>  
<https://apps.apple.com/us/app/smartshots-tn/id6526502640>

**Funding Agency:** Tennessee Department of Health

**Active Caregiver’s Toolkit (ACTAPP)** | Mobile Application to Promote Physical Activity Among Rural Appalachian Caregivers at Risk for Cardiovascular Disease (CVD) Jul 2024 - Present

- Development of the ACT APP as a digital solution for rural Appalachian caregivers, aiming to reduce cardiovascular disease risks through targeted physical activity interventions.
- Implemented latest mobile development standars based on Dart 3.0 and material design including custom components and state manangement using Bloc | GetX.

**Funding Agency:** Hillman Emergent Innovation (HEI)

**Awards & Scholarships**

**51<sup>st</sup> Conference on Computers and Industrial Engineering (CIE51)** *Best Paper Award: "Emerging AI and Cognitive Digital Twin Technologies Towards Low-Carbon Multimodal Freight Transport Systems – Sustainable Transport Systems"*  
Sydney, Australia December 9–11, 2024

**IISE Data Analytics & Information Systems (DAIS) Student Mobile App Competition**  
*2024 Winners - SmartShots Project, Montreal* | <https://www.iise.org/Details.aspx?id=33697>

**Graduate Fellowships and Awards**  
*Holiday Fellowship: 2022, 2023, 2024*

**HIDA Helmholtz Visiting Researcher**  
*Year: 2024 - Awarded but not taken.*

**Work Experience**

**Data Engineer** | Indra – Full-time Jan 2022 – Aug 2022

- Developed and maintained data pipelines using Python and Shell scripting to streamline big data workflows.
- Worked with Apache Spark, Hadoop, and HQL for distributed data processing, querying, and large-scale data migration, including data migration from Oracle and SaaS to PySpark.
- Implemented Jenkins-based deployment strategies for automating ETL pipeline updates.
- Ensured data quality and performance through data governance practices and code optimization techniques.
- Managed memory allocation for distributed data processing tasks in High-performance computing.

**Data Analyst** | Enel Group – Full-time Nov 2020 – Dec 2021

- Optimized payment collection processes and client segmentation by employing advanced unsupervised clustering techniques, improving efficiency and effectiveness.
- Designed and implemented dashboards using Power BI and Tableau, providing strategic insights and actionable intelligence.
- Administered SQL and T-SQL databases alongside Salesforce, ensuring data integrity and delivering accurate, reliable reporting for Enel’s Business Partners.
- Developed a robust desktop application using PyQt to streamline invoice collection verification and automate digital invoice processing, enhancing operational efficiency.

## Community Service

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**University of Tennessee Graduate Student Senate** - Senator, Industrial and Systems Engineering, 2024–2025  
Represented students, advocated for academic and professional development opportunities, and fostered graduate student engagement.

## Conferences & Paper Review

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**Paper Reviewer:**  
Scenario Decomposition Approach for Mobile Multi-Agent Monitoring under Failure  
Submitted to *Transportation Research Part C: Emerging Technologies*  
November 2024

**Conference Presenter:**  
Federated Learning Fault Detection: Towards a Decentralized Machine Learning Framework - IISE 2023  
  
Rule-based Automated Cancer Staging from Scanned Pathology Reports - IISE 2024  
  
Empowering Simulation Modeling: An Automated Ontology Framework Enhanced by Large Language Models - INFORMS 2024  
  
Conversational Geographic Question Answering: LLMs & Continuous Retrieval-Augmented Generation - SIGSPATIAL 2024

## Technologies

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<b>Languages:</b> Python, SQL, Bash, Dart, PHP, Java, C++ , CUDA	<b>Databases:</b> PostgreSQL, MongoDB, MySQL, SQL Server
<b>Frameworks:</b> Django, Flask, TensorFlow, PyTorch, Flutter, Laravel, Wordpress	<b>DevOps:</b> Docker, Git, Jenkins, AWS, Virtualization KVM
<b>IoT:</b> Arduino, ESP32	<b>Optimization:</b> Networkx, Gurobi, cplex, AnyLogic Simulation, NetworkX
	<b>Office Tools:</b> Excel, Microsoft Office, Linux