

# Jose Tupayachi

Knoxville, TN | jtupayac@vols.utk.edu | 661 365 5289 | jtupayachi.github.io

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 applications. Proficient in Python programming, data engineering, and data visualization, with a strong focus on collaboration and delivering scalable solutions by working effectively with interdisciplinary teams. These skill sets have been applied in developing medical apps and support systems for transportation and logistics applications.

## Education

|   |                     |
|---|---------------------|
| <b>University of Tennessee, Knoxville</b>   PhD Candidate in Industrial and Systems Engineering | Aug 2024 - Present  |
| Advisor: Dr. Xueping Li, Co-advised: Dr. Haowen Xu  |                     |
| <b>University of Tennessee, Knoxville</b>   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

|  |                    |
|--|--------------------|
| <b>RECOIL</b>   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</li></ul> |                    |

accurate trade-off analysis between cost, time, and  $CO_2$  emissions.

- 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.
- Investigating the use of BERT and sentence transformers to further refine provide a domain literature for QA providing accurate and reproducible responses supported by LLM and similarity based search.
- 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.
- Development of the unified UI using Flutter at <https://portal.recoil.ise.utk.edu>.

**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 standards based on Dart 3.0 and material design including custom components and state management using Bloc | GetX.
- Initial alpha testing at <https://testflight.apple.com/join/PehxA8aW>

**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

---

**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

---

**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

---

|  |   |
|--|---|
| <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                         |