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

- **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)

- **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

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

- 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.
- Leveraged Convolutional Neural Networks and Graph Neural Networks to analyze the impacts of weather, traffic, and demand on transportation systems, enabling data-driven, real-time optimization of EV charging station operations.
- 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_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.
- Collaborated with Oak Ridge National Laboratory researchers to create industry-ready solutions 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 and Dart and Flutter based on flutter, ensuring smooth functionality across platforms ensuring a high performing application.
- Integrated community health information to offer users real-time access to nearby vaccination providers and appointment availability.
- 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 inclusivity and overall ussage.
- `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 incluiding custom components and state manangement.

Funding Agency: Hillman Emergent Innovation (HEI)

Awards & Scholarships

51st 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

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 updates.
- Ensured data quality and performance through data governance practices and code optimization techniques.
- Managed memory allocation for distributed data processing tasks to improve efficiency.

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

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