Jose Tupayachi

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Experienced professional in data analytics with a proven ability to design and implement data-driven solutions that drive business impact. Skilled in developing advanced machine learning systems, signal processing and integrating tools like retrieval-augmented generation and vector databases to enhance applications. Proficient in programming languages, 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 health-support apps and decision support systems for transportation and logistics applications.

Education

University of Tennessee, Knoxville |PhD Candidate in Industrial and Systems Engineering — Aug 2024 - Present
Advisor: Dr. Xueping Li

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

- 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 EV charging behavior, 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.
- Investigating the use of BERT and setence tranformers to further refine provide a domain literature for QA providing accurate and reproducible reponses 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.

- Developement 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.
- `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 using GetX.
- Initial alpha testing at `https://testflight.apple.com/join/PehxA8aW`

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 | `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 (Trainee) 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:
IISE 2025 Annual Conference - Logistics and Supply Chain (LSC) - 2 Papers reviewed

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, Wordpress
IoT: Arduino, ESP32
Databases: PostgreSQL, MongoDB, MySQL, SQL Server
DevOps: Docker, Git, Jenkins, AWS, Virtualization KVM
Optimization: Networkx, Gurobi, cplex, AnyLogic Simulation, NetworkX
Office Tools: Excel, Microsoft Office, Linux
GIS: WMS, GeoSever, OverPass API

Upcoming Publications

- **Reviewing 1,000 Papers in Minutes:** A Low-Cost Explainable LLM Framework for Rapid Domain Knowledge Synthesis and Enrichment to Advance Human-AI Partnership in Research and Education.
- **Federated Learning and Remaining Useful Life Predictor:** An LSTM and MLP-Based Experimental Study.
- **Predicting Electric Vehicle Charging Station Demand:** Using Spatial-Temporal Graph Neural Networks with Integrated Weather and Traffic Data.