Jose Tupayachi (Jose Alberto Tupayachi Silva)

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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 USA |PhD Candidate in Industrial Engineering — May 2024 - Present
Advisor: Dr. Xueping Li

University of Tennessee, Knoxville USA |MS in Industrial Engineering — Aug 2022 - May 2024
GPA: 3.9

Pontifical Catholic University of Peru, Lima Peru |BS in Industrial Engineering — March 2014 - May 2020

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)

Submitted Papers:

- **Towards Autonomous Urban Logistics Optimization via Generative AI and Agentic Digital Twins**
  H Xu, Y Sun, J Tupayachi, O Omitaomu, S Zlatanova, X Li
  Submitted to *International Journal of Production Research*
  Submission ID: 257622545
- **A Decentralized Learning Approach for Condition-Based Monitoring: Sub-Optimal Remaining Useful Life Prediction**
  J Tupayachi, A Kham, X Li
  Submitted to *IEEE Transactions on Automation Science and Engineering (T-ASE)*
  Submission ID: T-ASE-2025-1467

Graduate Researcher – Oak Ridge National Lab / Oak Ridge Institute for Science and Education

AI-Augmented Literature Retrieval and Exploration for Materials Research |LLM-Powered Query Pipeline with BERT Tagging June 2025 – Present

- Designing an AI-driven pipeline using large language models (LLMs) to enhance keyword-based search and retrieval for ion-irradiation research, with applications in nuclear reactor (LWR) materials.
- Developing a modular, three-phase system composed of user query intake, automated data scraping and tagging with BERT, and a responsive Q&A interface for literature distilation.
- Applying natural language processing (NLP) techniques to analyze, cluster, and summarize domain-specific research articles.
- Coordinating with nuclear materials scientists to ensure system alignment with research needs and DOE standards.
- Translating complex technical methods for multidisciplinary research teams and contributing to user-centered tool development.

Hosted Researcher - Oak Ridge National Lab

ML-Assisted Atmospheric Hazard Modeling for Effective Geospatial Risk Analysis |Frontend generation based on React and Tailwind CSS using LLMs March 2025 – Present

- Fine tuning Large Language Models to generate automated, interactive dashboards for data visualization.
- Implementing an automated continuous deployment and integration system using web-based frameworks, with React for the front end and Python for backend processing and analytics.

Graduate Research Assistant - 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 Dec 2023 – Dec 2024

- 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.
- Inclussion of ChatBot for FAQ answering.
- Tracking metric for data analysis based on page and interactions metrics.
- `https://testflight.apple.com/join/PehxA8aW`
- `https://play.google.com/apps/internaltest/4700853124143014516`

Funding Agency: Hillman Emergent Innovation (HEI)

Pathology Cancer Staging - UT Medical Center Jan 2025 - Present

- Development of Flutter UI and web map services for interactive demographic cancer visualization.

Graduate Teaching Assistant

IE406/408: Simulation – Teaching Assistant, Spring 2022

- Assisted students with their final project and Anylogic simulation use and preparation.
- Graded homework assignments and addressed questions during class sessions.

IE483: Introduction to Reliability Engineering – Teaching Assistant, Fall 2022

- Provided in-class support by answering student questions.
- Proposed new homework problems, evaluated and graded homework assignments.

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 - Karlsruhe Institute of Technology (KIT)
Year: 2024, Germany | Awarded.

Industry Work Experience

Data Engineer |INDRA SISTEMAS S.A. – Full-time March 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.

Business Intelligence Analyst |GLOBOKAS PERU S.A. – Full-time Jan 2022 – March 2022

- Developed and optimized Extract, Transform, and Load (ETL) pipelines using Transact-SQL to streamline data processing and improve efficiency.
- Designed and implemented a live platform for real-time revenue and administrative KPI monitoring, enabling data-driven decision-making.
- Leveraged Google BigQuery and custom macros to automate daily data parsing and dashboard updates, ensuring up-to-date insights.
- Enhanced data quality and integrity by applying statistical metrics to detect and mitigate inconsistencies.

Data Analyst Trainee |ENEL DISTRIBUCION PERU S.A.A. – 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.

Developer – Portfolio Valuation Project |GPS MANAGEMENT DEL PERU S.A.C. – Machine Learning Consulting Aug 2020 – Nov 2020

- Developed a predictive model for valuing non-secure and secured portfolios of non-performing loans using Machine Learning.
- Conducted data compilation, feature engineering, modeling, and validation.
- Deployed the model on a web platform using Flask.

Professional IT Intern |SUPERINTENDENCIA DE BANCA, SEGUROS Y ADMINISTRADORAS PRIVADAS DE FONDOS DE PENSIONES Sep 2020 – Oct 2020

- Automated PDF reports using Jinja-Python for user service indicators.
- Managed Help Desk tasks and Active Directory access control, complying with ITIL standards.

Plant Intern |MATMACK S.A. – Bottling Company (Brands Bells and Cencosud) Dec 2019 – Mar 2020

- Improved inventory control, supplier coordination, and established reorder points.
- Developed demand forecasting models for products per client.
- Conducted cost analysis of raw materials and determined the Economic Order Quantity.
- Built a planning application based on a Master Production Schedule.

Information Technology Intern |ADMINISTRADORA CLINICA RICARDO PALMA S.A. – Medical and Hospital Services Feb 2019 – Aug 2019

- Structured databases for the "Health and Insurance Plan" and implemented ETL workflows.
- Supported and monitored project development, scheduling, and cost evaluation.
- Developed Power BI dashboards for financial reporting and KPIs.
- Designed and structured the medical staff privilege database.

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.

Paper Reviewer

- **Journal of Sensors** (Wiley)
  - *Manufacturing and testing of novel low-cost and flexible geopolymer-based tactile sensors*
  - *Optimization of excitation coil parameters for PECT of defects in laser welding of power battery pack based on Kriging surrogate model*
- **Winter Simulation Conference 2025 – Reliability Modeling and Simulation**
  - *Simulating the dynamic interaction between fleet performance and maintenance processes based on Remaining Useful Life*
- **Winter Simulation Conference 2025 – Invited Paper Track**
  - *Reliability Assessment of Convolutional Autoencoder-Based Wind Modeling for Autonomous Drone Training*
- **IISE Annual Conference 2025 – Logistics and Supply Chain (LSC)**
  - *Analyzing the Impact of Hurricane Florence on Freight Transportation in North Carolina using Telematics Data*
  - *Distributed Programmatic Demand Forecasting in Modular Construction Through Machine Learning and Simulation*
- **IEOM 2025 – University of Central Florida**
  - *Principal Component Analysis Machine Learning Technique on the Underground Big Diameter Steel Pipelines Condition Assessment and Related Data: South African Bulk Water Distribution Utilities*
  - *Investigation of the Mechanism Failures of High Temperature Components Occurring Inside Boiler Tubes*
  - *Service Model Based on Lean Six Sigma and Queuing Theory to Increase NPS in a Healthcare Company*
  - *Blockchain-enabled Information as a Service (IaaS) for Configuration Tracking and Control of Smart Manufacturing Systems*
  - *Production Model Based on 5S to Increase Productivity in a SME in the Garment Sector*

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.
- **Automated Pattern-Based Code Generation for Web GIS Dashboards:** Using Fine-Tuned Large Language Models and Context-Aware Visual Prompting
- **Predicting Electric Vehicle Charging Station Demand:** Using Spatial-Temporal Graph Neural Networks with Integrated Weather and Traffic Data.