

# Jose Tupayachi

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Experienced Python developer and Large Language Model (LLM) specialist with a robust background in designing, implementing, and deploying machine learning systems. Proficient in leveraging Retrieval-Augmented Generation (RAG), vector databases, and API-driven solutions to optimize real-time NLP applications. Collaborator with interdisciplinary teams to create impactful, data-driven products.

## Education

University of Tennessee, Knoxville   MS in Industrial and Systems Engineering	Aug 2022 - Jul 2024
Pontifical Catholic University of Peru   BS in Industrial Engineering	Mar 2014 – Jan 2020

## 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 ...* (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)
- **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)
- **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

## Funded Projects

RECOIL   A Cognitive Freight Transportation Digital Twin for Resiliency and Emission Control Through Optimizing Intermodal Logistics	Nov 2021 – Present
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- Implemented vector search and retriever models for customer-centric chatbot solutions using LangChain and HuggingFace.
- Enhanced LLM query processing pipelines with semantic similarity matching and custom embedding models.
- Built and maintained APIs for real-time data ingestion and LLM interaction via Gradio and FastAPI.
- Conducted fine-grained data preprocessing for training multimodal ML models, improving NLP accuracy by 15%.
- Automated CI/CD pipelines with Docker and Kubernetes for scalable deployment of ML systems.

**Funding Agency:** U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E)

**Project Number:** #DE-AR0001780

SmartShots - TN Department of Health | Cross-platform application to improve childhood vaccination rates in Tennessee

May 2020 – Oct 2021

- Enhanced vaccination tracking features with real-time data updates and alert systems.

Funding Agency: Tennessee Department of Health

Awards & Scholarships

IISE Data Analytics & Information Systems (DAIS) Student Mobile App Competition  
2024 Winners, Montreal

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

HIDA Helmholtz Visiting Researcher  
Year: 2024

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 processes and job scheduling.
- Ensured data quality and performance through rigorous data governance practices and optimization techniques.
- Managed memory allocation for distributed processing tasks to optimize resource utilization and improve processing efficiency.

Data Analyst | Enel Group – Full-time

Nov 2020 – Dec 2021

- Improved collection systems using a "Payments to Customer" strategy, leveraging unsupervised clustering techniques to enhance efficiency.
- Implemented dashboards PowerBi enabling strategic insights at Enel Peru.
- Managed SQL and T-SQL databases, ensuring data quality and accurate reporting for Enel’s Business Partners in Salesforce.
- Developed a desktop application PyQT to streamline bank credit and invoice collection verification, and automated digital invoice processing.

Conferences & Service

Invited 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  
Frameworks: Django, Flask, TensorFlow, PyTorch, Flutter, Laravel, React  
ML/NLP Tools: LlamaIndex, LangChain, HuggingFace Transformers, RAG

Databases: PostgreSQL, MongoDB, Elasticsearch, MySQL  
DevOps: Docker, Kubernetes, Git, Jenkins  
Optimization: Networkx, Gurobi, cplex