Ajaykrishnan Selucca Muralidharan

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Summary

Researcher in **Operations & Maintenance Engineering** applying **machine learning and statistical modeling** to railway condition monitoring. Current work develops analytical frameworks for **wayside detectors** (WILD, HBD/HWD) including anomaly/drift detection, cross-site normalization, and fusion with **fiber-optic sensing (DAS)**. Combines AI with interpretable, context-aware methods for predictive maintenance. Previous experience includes building large-scale recommendation systems and ML APIs in cloud environments.

Work Experience

PhD Researcher — Luleå University of Technology (LTU) May 2024 — Present

- **Research Focus:** ML and statistical modeling of WILD, HBD/HWD, and Distributed Acoustic Sensing (DAS).
- **WILD Analytics:** Detector quality assessment, context-aware normalization, quantile-based scoring, unsupervised anomaly detection, and dashboarded reliability metrics.
- **HBD/HWD Modeling:** Thermal event normalization, anomaly detection, and adaptive thresholding using regression and contextual attribution.
- **Fiber-Optic Integration:** DAS alignment with WILD events for calibration and tracking; scalable processing and monitoring tools.
- **Tools:** Scikit-learn, Statsmodels, Pandera, Docker, GitHub CI, XGBoost.

Junior Associate — Primesoft Enterprise IT Services Aug 2022 — May 2024

- Delivered ML-driven personalization and churn solutions for OTT clients as modular Flask APIs.
- Built a production *"Because You Watched"* hybrid recommender (content-based + collaborative) integrated with Couchbase/Datastore; containerized and deployed on GCP (Cloud Run, GKE).
- Implemented churn and dashboard-ranking PoCs that clustered users to optimize engagement and row/item ordering.
- **Tech:** Python, Flask, Docker, GCP, Snowflake, BigQuery.

Intern — Applied Materials India Jul 2021 — Dec 2021

- Developed stabilization-detection models using sensor-based time-series learning in semiconductor tools.

Education

2024 — Present PhD, **Operations & Maintenance Engineering**, Luleå University of Technology (Sweden)

2020 — 2022 M.Tech., **Artificial Intelligence**, Amrita Vishwa Vidyapeetham (India). *Thesis: Real-Time Health Monitoring of Bolted Joints in Machines using Predictive Analytics.*

2018 — 2019 B.E., **Electronics & Communication Engineering**, St. Peter's Institute of Higher Education & Research (India)

Publications

- Selucca Muralidharan, A., Thiery, F., Chandran, P., Odelius, J., & Rantatalo, M. (2026). *Statistical analysis of hot-box and hot-wheel detector data for context-aware rolling-stock monitoring.* Manuscript submitted for presentation at *Transport Research Arena (TRA) 2026.*
- Selucca Muralidharan, A., Thiery, F., Chandran, P., Odelius, J., & Rantatalo, M. (2025, December). *Investigating the quality of Wheel Impact Load Detector (WILD) data for building predictive-maintenance strategies: A visualization and statistical approach.* In *Proceedings of the IAI 2025 Conference.* (Proceedings forthcoming.)
- Thiery, F., Selucca Muralidharan, A., Chandran, P., Odelius, J., & Rantatalo, M. (2025, December). *Standardizing wayside monitoring data via CDF rescaling: A case study on Wheel Impact Load Detectors.* In *Proceedings of the IAI 2025 Conference.* (Proceedings forthcoming.)
- Selucca Muralidharan, A. (2022). *Real-time health monitoring of bolted joints in machines using predictive analytics* (Master's thesis, Amrita Vishwa Vidyapeetham, India).

Certifications

Apr 2022 **Microsoft Certified: Azure AI Fundamentals (AI-900)** — Credential Link
Nov 2024 **Neo4j Certified Professional** — Credential Link

Skills

Machine Learning	Anomaly Detection, Clustering, Regression, Feature Engineering, Model Evaluation (Precision–Recall, ROC)
Statistical Methods	Descriptive and Inferential Statistics, Time-Series Modeling, Distribution Fitting, Uncertainty and Drift Analysis
Programming	Python (NumPy, Pandas, Scikit-learn, PyTorch, Statsmodels), SQL, PySpark for large-scale data handling
Data Analysis	Sensor Data Processing, Signal Interpretation, Context-Aware Modeling, Visualization and Pattern Exploration
Research Practices	Reproducible Notebooks, Version Control (Git), Docker-based Experiments, Structured Documentation
Computing Platforms	Google Cloud Platform (BigQuery, Cloud Run, GKE), Snowflake, Local HPC / Linux Environments
Visualization	Matplotlib, Plotly, Seaborn; LaTeX-ready figures for publication
Collaboration	Academic Writing, Literature Review, Cross-disciplinary Communication, Project Coordination