Arthur Cancellieri Pires

LinkedIn: Arthur Cancellieri Pires
GitHub: @Pirao

Email: arthur.cancellieri.pires@gmail.com
Mobile: +55-27-99986-2672

PROFESSIONAL SUMMARY

- AI research lead with 5+ years applying machine learning to sensor time-series data, primarily from instrumented railway vehicles (IRVs), for predictive maintenance and condition monitoring with a focus on anomaly detection under sparse ground truth and proxy labels (data-quality score).
- Built scalable data workflows (30k+ windows/day) and deep learning models (including autoencoder-based anomaly detection), translating model outputs into diagnostic tools used in engineering reviews.

WORK EXPERIENCE

Laboratório Ferroviário - Unicamp (Lafer) — On-site
AI Research Lead (PhD Candidate) – VALE partnership — *January 2022 - Present*

- **Sensor Defect Detection:** Developed deep learning models and batch checks to detect sensor faults and data-quality anomalies, achieving 91% precision on internally labeled events and reducing data-issue detection latency from 3 months (manual review) to 1 day; tuned and compared model variants via Optuna studies.
- **Track Defect Detection:** Built transformer-based autoencoders for anomaly detection and a repeatability metric that converts reconstruction errors into calibrated anomaly probabilities to score repeatable, location-level defect candidates under sparse ground truth.
- **Model Diagnostics (Proxy Labels):** Built a diagnostic workflow using proxy labels (data-quality score) and latent-space analysis to interpret anomaly clusters, linking them to specific sensors/channels and response signatures to support maintenance investigation.
- **Technical Leadership:** Served as the technical lead for VALE's IRV-based predictive maintenance program, translating stakeholder needs into ML deliverables and coordinating technical execution across a 10-person team (undergraduate, Master's, and PhD).

Laboratório Ferroviário - Unicamp (Lafer) — On-site
AI Researcher (M.Sc. program) – VALE partnership — *June 2020 - January 2022*

- **ML Pipeline:** Designed and operated a daily pipeline to ingest raw instrumented railway vehicle (IRV) data, engineer features, and generate model-ready time-series windows for ML experiments (30k+ windows/day); maintained the codebase in Git and reviewed outputs with maintenance engineers.
- **Supervised Learning (Regression):** Developed deep learning models to estimate vertical track geometry from IRV data, achieving $R^2 \approx 0.98$ on a held-out dataset.

Laboratório de Tribologia e Dinâmica Ferroviária - UFES (LabTDF) — On-site
Undergraduate Researcher (B.Sc.) – VALE partnership — *Jan 2019 - June 2020*

- **ML-Based Force Estimation:** Built a machine-learning pipeline to estimate the wheel–rail L/V force ratio from onboard sensor time-series, using multibody dynamics simulation to generate and validate training data, providing a cost-effective alternative to instrumented wheelsets with high predictive accuracy ($R^2 \approx 0.97$).
- **Optimization (Genetic Algorithms):** Developed a wheel–rail profile optimization methodology using measurement data and genetic algorithms; field-tested a wear-optimized profile, reducing wear by 20% while maintaining fatigue performance and improving the L/V ratio by ~35%.
- **Data Analysis / Decision Support:** Analyzed wheel reprofiling limits and recommended changing the EFVM threshold from 3 mm to 2 mm based on the wheel-profile optimization study, increasing projected wheel life by at least 29% (current profile) and 50% (proposed); recommendation adopted.

SKILLS SUMMARY

- **Programming:** Python, SQL, MATLAB
- **Machine Learning:** PyTorch, PyTorch Lightning, scikit-learn, Optuna
- **Data Engineering:** ETL, data pipelines, data quality checks, feature engineering
- **Domain Expertise:** Time-series anomaly detection and forecasting for industrial sensor data; predictive maintenance / condition monitoring
- **Languages:** Portuguese (Native), English (Fluent)

EDUCATION

State University of Campinas (UNICAMP) — Campinas, Brazil
PhD in Mechanical Engineering — *Expected February 2026*

State University of Campinas (UNICAMP) — Campinas, Brazil
Master's in Mechanical Engineering — *Jan 2022*

Federal University of Espírito Santo (UFES) — Vitória, Brazil
Bachelor's Degree in Mechanical Engineering — *May 2020*