Nishal Stanislaus Silva, *PhD*

Music Technology ML Research Engineer | Audio, DSP & Real-Time Systems
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Professional Summary

Published researcher (AES, IEEE) and Music Technology ML Engineer with a PhD and 10+ years across industry and academia spanning production ML/CV systems for manufacturing (up to 300% efficiency improvement, millions of IoT events/day) and ML-driven anomaly detection for financial risk systems. Core research specialization in smart musical instruments, musical pattern detection, and multimodal audio+sensor learning under strict latency constraints (<30ms, >90% F1). I build end-to-end pipelines from DSP feature engineering and MIR to low-latency embedded deployment. Cross-domain depth in computer vision, anomaly detection, and IoT-scale time-series systems strengthens robust ML system design. Practicing guitarist with direct performer intuition for human–AI interaction in live music.

Portfolio and Demos (full portfolio available at: *nishal.xyz/research*.)

- An Internet of Musical Things Performance Ecosystem: *https://youtu.be/jfm5L3DYIcc*
- Multisensory concert enabled by smart musical instruments: *https://youtu.be/axEHkdnxFB8*
- Hot Licks: a real-time pattern detection system for MIDI instruments: *https://youtu.be/gkOqfOT8zXM*

Core Competencies

Music Tech & Audio ML: Music Information Retrieval (MIR), Audio ML, Feature Extraction & Engineering, Musical Pattern Recognition, Real-Time Audio Processing, DSP & Signal Processing, Gesture/Motion Sensing for Performance, Multimodal Audio+Sensor Learning, Embedded & Low-Latency ML, IoMusT Systems, MIDI Workflows
ML Engineering: End-to-End ML Lifecycle, Production Deployment, Real-Time / Low-Latency Inference, MLOps, ML Orchestration, Human-in-the-Loop Systems, Benchmarking/ Ablations, Experimental Design, Prompt Engineering
Research & Cross-Domain Depth: Time-Series Analysis, Anomaly Detection, Computer Vision, Sequential Data Modeling, Cross-Functional Collaboration, Technical Writing, Peer-Reviewed Publications

Technical Stack

Languages: Python, C++, C, JavaScript, MATLAB, C#
ML / AI: TensorFlow, PyTorch, Generative AI, Anomaly Detection, Time-Series Modeling, Pattern Recognition, NLP
Audio & Signals: Librosa, SciPy, MFCC, STFT, JUCE, Elk Audio OS, MIDI
Data & Cloud: AWS (EC2, S3, ECS, MWAA, RDS), NumPy, Pandas, SQL, ETL Pipelines
MLOps & Dev: Docker, Apache Airflow, Jenkins, Git, Linux/UNIX, OpenCV

Research and Work Experience

Postdoctoral Researcher | *University of Trento, Trento, Italy* *Jan 2025 – Dec 2025*

- Led end-to-end ML pipeline development for streaming audio, sensor, and gesture data (EU-funded MUSMET), spanning data acquisition, DSP/feature engineering, model training/evaluation, and low-latency deployment with monitoring.
- Built and optimized real-time inference services achieving < 30ms latency while maintaining > 90% F1, enabling smart musical instruments and interactive/immersive performance prototypes.
- Developed and evaluated musical pattern detection approaches for real-time inference on embedded hardware, with clear benchmarks to quantify accuracy-latency tradeoffs.
- Led technical execution with academic and industry partners, translating research prototypes into maintainable components with reproducible pipelines and deployment documentation.

Visiting Researcher | *McGill University, Montreal, Canada* *May 2024 – Aug 2024*

- Prototyped and evaluated a real-time gesture detection ML system on multimodal sensor + time-series data, targeting expressive control for interactive audio and digital musical interfaces.
- Investigated synthetic data generation (VAE, Diffusion-based) to improve robustness under limited labeled data.

Visiting Researcher | *University of Visual and Performing Arts, Colombo 02, Sri Lanka* *Jan 2024 – Mar 2024*

- Ran human-centered evaluations of ML-driven interactive music systems, combining performance metrics and user feedback to produce actionable recommendations on usability and adoption.

Technical Consultant | *Forestpin (Pvt) Ltd, Colombo 05, Sri Lanka* *Aug 2020 – Feb 2021*

- Designed and deployed ML and statistical modeling pipelines for financial forensics, compliance monitoring, and risk detection on large structured datasets.
- Built SQL+Python-based backend scoring services to flag anomalies and support triage in production systems.

Research Engineer | *MAS Holdings (Pvt) Ltd, Colombo, Sri Lanka* *Jan 2015 – Jul 2020*

- Owned end-to-end development and deployment of ML/CV automation systems for manufacturing, integrating camera + sensor streams into production workflows; improved operational efficiency by up to 300%.
- Built real-time data ingestion systems and ETL pipelines for large scale IoT and operational time-series data; implemented quality checks and monitoring to maintain reliability.
- Developed ML-driven optimization and decision engines for real-time monitoring and long-term capacity planning using streaming machine and sensor data.
- Developed low-latency inspection models with human-in-the-loop decision making, increasing throughput while managing operational risk.
- Authored technical documentation and delivered internal training to accelerate adoption of ML-driven systems across engineering and operations teams.

Selected Publications (full list of publications available at: *nishal.xyz/publications*.)

- Silva, N. and Turchet, L. *Real-Time Audio Pattern Detection for Smart Musical Instruments*. Journal of the Audio Engineering Society, Mar. 2026.
- Silva, N., Wanderley, M. and Turchet, L. *Melody and Motion: Integrating Guitar Gesture Detection with Musical Patterns for Extended Control...*. IEEE International Symposium on the Internet of Sounds, Oct. 2025.
- Silva, N., Boem, A., and Turchet, L. *Interactive IoMusT-Based Concerts: Real-Time Pattern Recognition and Audience Experience*. International Conference on Immersive and 3D Audio, Sep. 2025.
- Silva, N. *Embedded Real-Time Musical Pattern Detection for Smart Musical Instruments*. PhD Thesis, Jan. 2025.

Education

Ph.D - Information Engineering and Computer Science - *University of Trento, Italy* *Jan 2025*

M.Sc - Telecommunication and Electronic Engineering - *Sheffield Hallam University, UK* *Aug 2018*

B.Eng (Hons) - Electronic Engineering - *Sheffield Hallam University, UK* *Mar 2014*

Independent Research , Awards, Volunteer Work, & Extracurriculars

- **Finalist, MIDI Innovation Awards *Sep 2023***
- Deployed a computer-vision device to digitize blood pressure readings in COVID-19 hospital wards, enabling remote vitals monitoring; recognized by the Government Medical Officers' Association (GMOA) of Sri Lanka.
- Active guitarist (performing and recording); applies direct performer intuition to applied ML research for expressive music interfaces, human-AI co-creation, and live performance tools.