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Summary

10+ years of research experience in developing **real-world deployable frameworks** on unlabeled streaming data (**video**, **audio**, and multimodal data), including 5000+ hours of uncurated audio collected across multiple cities and years. Research tackles domain shift, source-free and unsupervised settings, and **resource-constrained edge devices**, with solutions in general-purpose representation and on-device inference. Most recent work extends this to model quantization, evaluating the **cross-environment (GPU/NPU) gap** for edge-cloud VLMs. Recognition includes 13 peer-reviewed articles (150+ citations) with **4 first-author journals** (2 Top 10%, 1 Top 25%) and *ICIP* (first-author, oral), *APICTA* award (team lead, representing Taiwan), and Top 3% master's graduate honor.

Skills

- **Domain Expertise:** Computer Vision, Audio Signal Processing, Edge Deployment, Self-Supervised & Contrastive Learning, Multimodal ML, Anomaly Detection, Generative Models, Privacy-Preserving AI.
- **Tech Stack:** Python, PyTorch, TensorFlow, OpenCV, edge deployment (Qualcomm AI Hub on Hexagon NPU, NVIDIA Jetson), Docker, AWS.

Experience

Independent Researcher | Dec 2025 - Present

Python, PyTorch, LiteRT, ONNX, AIMET, TorchAO, Qualcomm AI Hub (QNN), Docker

- **Cross-environment (GPU/NPU) evaluation of edge-cloud VLM quantization:**
Evaluated **vision encoder quantization** at the on-edge embedding, downstream heads and the on-cloud LLM decoder, from development to deployment. Took 11 configurations across backends (AIMET, TorchAO) from GPU to Qualcomm NPU, 7 rejected at 3 distinct pipeline stages, delivering one at **36% lower on-device latency** retaining 99% embedding cosine. Now extending to **LiteRT** on Android devices via Google AI Edge Portal (private preview). (First-author [preprint](#) with failure-mode catalog; [repo](#))
- **Synthetic data generation:**
A controllable compositional data synthesis framework for domain transfer and bias evaluation, with applications such as **driver monitoring and identity verification**. Provides cross-environment transfer of rare cases via decoupling-and-recombination to tackle data scarcity. Proposal under review by Google TPU Research Cloud.

Doctoral Researcher | IDLab, Ghent University-imec, Sep 2019 - Nov 2025

Funded by the Flanders AI Research Program (Flemish government initiative on data-efficient and reliable AI).

- **Real-world stress test of SOTA audio models on 5000h of unlabeled streams:**
With industry partner AsaSense, stress-tested SOTA audio models under real deployment across multiple sites (2 cities, 5 sensors) and time (multiple years) periods with uncurated urban audio. Architected a context-aware, model-agnostic acoustic surveillance system combining cloud-side event tagging and **on-device anomaly detection, reducing cloud workload by 90%**. Identified lab-to-field gaps including domain shift, privacy exposure, and open-set events; summarized findings into a technical report for our industry partner.
- **Single-model audio-visual representation for multi-task edge deployment:**
Built a general-purpose, self-supervised representation learning framework supporting multi-task downstream applications, allowing efficient deployment on **resource-constrained edge devices**. Recovered false negatives in contrastive learning for more information-rich representations, yielding **~10% gain over baselines**. Tackled the gap between current benchmark assumptions and real-world audio-visual streaming data. (Published in *Frontiers in Robotics and AI*)
- **On-device opt-in audio privacy without downstream model retraining:**
Implemented the first opt-in framework in the voice privacy domain and extended it to visual modality, deployable as a plug-and-play module with real-time inference demonstrated on **Jetson TX1 (34 ms per 1s clip)**. Two CycleGAN-VC2-based models engage in adversarial learning to reduce privacy leakage to near zero. Challenged the overlooked gap between opt-out assumption in benchmarks and opt-in principle of EU General Data Protection Regulation. (Published in *IEEE Pervasive Computing and Applied Intelligence*)

- **Model selection for general-purpose transfer without sharing training data:**

Proposed a task-agnostic, **source-free, unsupervised** transferability assessment for efficient domain adaptation prior to model fine-tuning. Forms unbiased reference embeddings with an ensemble of randomly initialised neural networks, then ranks pretrained models by embedding similarity, achieving **0.95 Kendall's tau** against fully supervised ranking without source data and target label. Bridged the overlooked gap between EU Data Act's model-sharing mandate and industry concerns over data sovereignty and IP. (Published in *Sensors*)

Teaching Assistant (Applied Machine Learning) | Ghent University, Sep 2021 - Feb 2023

- **Collaborated with Sony DepthSensing Solutions:**

Co-designed an [RGB-D hand gesture recognition project](#) with Sony DepthSensing Solutions, from depth sensor data acquisition to PoC delivery.

Pre-PhD Research | NCKU and Academia Sinica, Sep 2014 - Jun 2016, Sep 2017 - Jul 2019

Tensorflow, C++, OpenCV, MATLAB

- **Turned research into an award-winning prototype, pitched to industry and academic juries:**

Spun off the research direction into a startup pitch. Engineered the core prototype (video event analysis) and presented business plans to industry and academic juries; won **1st at InnoServe Awards** and **Top 3 at APICTA**.

- **Facial video analysis for driver monitoring with national automotive R&D partner:**

Built a driver monitoring system fusing facial video descriptors with ECG signals, in collaboration with ARTC (Automotive Research and Testing Center, Taiwan). (Published in *IEEE TITS*, **60+** citations).

- **Vision research at National Cheng Kung University (NCKU) and Academia Sinica:**

Conducted research on trajectory clustering and superpixel. (Published in *IEEE TIP*; *IEEE ICIP*)

Selected [Publications](#)

13 peer-reviewed (**150+ citations**): **4 first-author journals** (2 Top 10%, 1 Top 25%), **4 first-author conferences** (2 oral), 3 co-author journals (2 Top 10%, 1 Top 25%), 1 co-author conference and 1 co-author workshop.

[Source-free model transferability assessment for smart surveillance via randomly initialized networks](#)

Sensors, 2025 (journal, **first-author**)

[Embedding-based pair generation for contrastive representation learning in audio-visual surveillance data](#)

Frontiers in Robotics and AI, 2025 (journal, **first-author**)

[Privacy-preserving visual analysis: Training video obfuscation models without sensitive labels](#)

Applied Intelligence, 2024 (journal)

[Selective manipulation of disentangled representations for privacy-aware facial image processing](#)

4th Workshop on Machine Learning for CyberSecurity at ECML PKDD, 2022 (workshop)

[An opt-in framework for privacy protection in audio-based applications](#)

IEEE Pervasive Computing, 2022 (journal, **first-author**)

[Driver monitoring using sparse representation with part-based temporal face descriptors](#)

IEEE Transactions on Intelligent Transportation Systems (TITS), 2020 (journal, **60+ citations**)

[Clustering trajectories in heterogeneous representations for video event detection](#)

IEEE International Conference on Image Processing (ICIP), 2018 (conference, **first-author, oral**)

[USEAQ: Ultra-fast superpixel extraction via adaptive sampling from quantized regions](#)

IEEE Transactions on Image Processing (TIP), 2018 (journal)

[Event based surveillance video synopsis using trajectory kinematics descriptors](#)

IAPR International Conference on Machine Vision Applications (MVA), 2017 (conference, **first-author**)

[Spatiotemporal coherence-based annotation placement for surveillance videos](#)

IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), 2016 (journal, **first-author**)

[Video gender recognition using temporal coherent face descriptor](#)

IEEE/ACIS SNPD, 2015 (conference, **first author**)

[Trajectory kinematics descriptor for trajectory clustering in surveillance videos](#)

International Symposium on Circuits and Systems (ISCAS), 2015 (conference, **first-author, oral**)

Education

Ph.D. in Computer Science Engineering, Ghent University, Belgium (Sep 2019 - Nov 2025)

Master of Science in Computer and Communication Engineering, NCKU, Taiwan (Sep 2014 - Jun 2016)

Bachelor of Science in Electrical Engineering, NCKU, Taiwan (Sep 2010 - Jun 2014)