

# Wei-Cheng Wang, Ph.D.

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## Summary

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PhD researcher identifying where lab-validated models **break in the field**, specialized in **building solutions** that remain **valid as models improve**. Research topics emerged from findings validated on **5000+ hours** of **uncurated, unlabeled audio** streaming and extended **video** from multiple sites. Addressed these limitations at the **mechanism** level, with **solutions** targeting **privacy, domain drift, and source data inaccessibility** across **self-supervised learning, transfer learning, and privacy-preserving ML**. Recognition includes 12 peer-reviewed articles (**7 journals, ICIP oral**), **140+ citations**, *APICTA* awards, and Top 3% master's graduate honor.

## Skills

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- **Domain Expertise:** Machine Learning, Deep Learning, Multimodal ML (Audio/Video), Self-Supervised Learning, Contrastive Learning, Transfer Learning, Anomaly Detection, Privacy-Preserving AI, Generative Models.
- **Tech Stack:** Python, PyTorch, TensorFlow, scikit-learn, OpenCV, C++, Docker, AWS (ECS, S3), Git, LLM APIs, ChromaDB.

## Experience

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### **Independent Researcher (extending PhD line)** | Self-initiated, *Dec 2025 - Present*

*Python, AWS (ECS, S3), Docker, LLM APIs, ChromaDB*

- **Cost-efficient multi-agent LLM orchestration pipeline:**  
Built a **multi-agent orchestration** pipeline on **AWS (ECS, S3, Docker)** as a proof of concept for the synthetic data generation research extended from my PhD line, aiming to **identify compute bottlenecks** before conducting GPU-intensive workloads. Implemented **Mixture-of-Agents** architecture, ChromaDB-backed semantic indexing, and **HDBSCAN clustering** to avoid **context pollution**, **optimize LLM API usage**, and **leverage models** at different **scales**.
- **Extending PhD research, Google TRC under review:**  
Addressing data and label scarcity via synthetic data generation, with the aim of **transferring real-world event patterns** across data domains to avoid being bounded by human prior, like **scripted scenarios**. The proposed decoupling-and-recombination approach separates real behaviours into objective, quantifiable attributes, then reconstructs synthetic samples with real-world patterns and extensive annotation for free. **Extends the PhD line** to cross-environment **event and behaviour transfer** (surveillance, defect detection) and person-level robustness testing for deepfake detection. Submitted a **Google TPU Research Cloud** proposal for extended compute.

### **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:**  
In collaboration with **AsaSense**, examined where SOTA audio models break under **real deployment conditions** across multiple sites. Architected a context-aware, **model-agnostic** acoustic system to support this evaluation at **5000h** scale. Given the cost of cloud-side event tagging at this scale, the deployed pipeline runs on-device anomaly detection as a first-pass filter, escalating only flagged events to cloud-side analysis and **reducing downstream** event-tagging **workload** by 90%. Surfaced concrete lab-to-field failure modes that benchmark evaluation had missed, including **context drift** across deployment sites, unaddressed **privacy exposure** in real-world streams, and **events outside** the predefined **taxonomy**. These observations motivated the method-level directions below.
- **Single-model audio-visual representation for multi-task edge deployment:**  
Built a single representation model supporting **multiple downstream tasks** with around 10% gain over temporal-alignment baselines, motivated by the cost of deploying one model per task on **resource-constrained** devices. Reformulated **contrastive pair selection** in embedding space to **recover false negatives** as positives, and adapted the contrastive loss to include **multiple positives**, relaxing **minimal sufficient bottleneck**.

**Addressed a failure mode** benchmark evaluation overlooked: on streaming surveillance data, recurrent but unpredictable events (such as an ambulance reappearing hours later) violate the time-window assumption that current-frame alignment defines positive pairs. (Published in *Frontiers in Robotics and AI*)

- **On-device opt-in audio privacy without downstream model retraining:**

Implemented the **first opt-in privacy framework** in the audio domain, deployable as a **plug-in without retraining** the downstream model, with **real-time inference** demonstrated on **Jetson TX1** (34 ms per 1-second audio clip). A **CycleGAN-VC2**-based obfuscator feeds the pretrained downstream model while **adversarial learning** against a deobfuscator suppresses sensitive attributes, **reducing** unauthorized attribute **extraction** to **near-random** with downstream utility preserved. Reframed the problem from opt-out defense, which cannot enumerate an open-ended attack surface and conflicts with GDPR data minimization, to opt-in exposure. (Published in *IEEE Pervasive Computing and Applied Intelligence*)

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

Targeted a recurring deployment scenario: **selecting** among multiple pretrained **models** for **target domain transfer without** access to **source data** (blocked by data sovereignty, GDPR, IP) or **target labels**. Proposed a **task-agnostic** estimator that uses randomly initialised neural networks as **unbiased reference embeddings**, then ranks pretrained models by **embedding similarity** to these references. Achieved Kendall's tau up to 0.95 (1 = perfect aligned) against fully supervised ranking baselines. (Published in *Sensors*)

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

- **Collaborated with Sony Depthsensing Solutions:**

Co-designed a [computer-vision project](#) with **Sony Depthsensing Solutions**, translating industrial scripts and hardware capabilities into project scopes from sensor data acquisition to gesture-recognition PoC delivery.

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

*C++, Tensorflow, OpenCV, MATLAB*

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

Identified a commercialisation opportunity around a lab research direction, structured a spin-off plan, and used **innovation-oriented competitions** as the funding mechanism: won 1st at *InnoServe Awards* (international ICT competition) and Top 3 at *APICTA* (Asia-Pacific startup, representing Taiwan), **pitching to industry and academic jury**. **Engineered** the core implementation of the **prototype** for police investigation, supporting rapid event identification and suspect tracking. System subsequently licensed for commercial use.

- **Multimodal driver monitoring with national automotive R&D partner:**

Originated the core temporal face descriptor (*SNPD*) within an ARTC (Automotive Research and Testing Center, Taiwan) collaboration on **driver monitoring** integrating **facial** and **ECG** signals. The descriptor was later extended by collaborators into a full sparse-representation system. (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*)

Full Portfolio & PhD Research Details: [Personal Website](#)

## Publications

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**12** peer-reviewed (**140+ citations**), 7 journals (4 first-author) and **ICIP** (first-author, oral). First-author venues span IEEE **TCSVT** (Top 10%), **Sensors** (Top 25%), and *Frontiers in Robotics and AI* (Top 25%); co-author venues include *Applied Intelligence* (Top 25%), IEEE **TIP** (Top 10%), IEEE **TITS** (Top 10%, 60+ citations).

Full publication list: [Google Scholar](#).

## Education

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**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*)