INDRA IMANUEL

Seoul, South Korea · indraimanuel145@gmail.com · +82 10-9704-3145
indraimanuel.github.io · linkedin.com/in/indra-imanuel

RESEARCH INTERESTS

Multimodal vision-language models, with a current focus on **Mixture-of-Experts architectures for efficient VLMs**, fine-grained visual understanding (minimal visual-change discrimination), diagnosis, repair, and evaluation methodology for multimodal models. **Background in generative models (GAN, diffusion) for image restoration**: super-resolution, demosaicing, and compression. Additional active research in **multimodal document understanding** (hierarchical structure recovery, self-supervised training signals).

EDUCATION

Ph.D. in Computer Engineering, Dongseo University, Busan, South Korea Sep 2021 – Aug 2024
Thesis: Image Compression and Demosaicing based on Denoising Diffusion Null-Space Model

- Advisor: Prof. Suk-Ho Lee · GPA 4.33/4.50 · Fully funded through research grants (NRF, ETRI, Dongseo)
- Proposed diffusion-based algorithms for image demosaicing and compression, including a novel Color Filter Array (CFA) pattern and a CFA optimization scheme for jointly optimal demosaicing quality and compression rate.

M.Sc. in Computer Engineering, Dongseo University, Busan, South Korea Sep 2019 – Aug 2021
Thesis: Super-Resolution with Adversarial Loss on the Feature Maps of the Generated High-Resolution Image

- Advisor: Prof. Suk-Ho Lee · GPA 4.50/4.50
- Proposed a GAN training scheme that applies adversarial loss on the feature maps of the generated high-resolution image (via pre-trained networks), improving over prior GAN-based super-resolution methods.
- Outperformed the state-of-the-art CVPR method on a real-world low-resolution super-resolution benchmark (at time of publication).

B.Comp. in Informatics, University of Surabaya, Surabaya, Indonesia Aug 2015 – Mar 2019
Thesis: Committee Management System for Dept. of Informatics in University of Surabaya

- Summa Cum Laude, Best Graduate of the department · GPA 3.94/4.00 · Graduated in 3.5 years.

RESEARCH & PROFESSIONAL EXPERIENCE

Independent Researcher & Project Lead: Vision-Language Models Jan 2026 – Present

- Initiated and lead an independent research project on training-free diagnosis and repair of fine-grained visual-discrimination failures in Mixture-of-Experts VLMs, evaluated on the VisMin benchmark and, zero-shot, on Winoground and ColorSwap.
- Diagnosed a severe answer-position bias underlying much of this failure and introduced a zero-cost diagnostic that quantifies it across eight MoE VLMs.
- Established a "calibration law" relating repair success to bias-index calibration: a label-free, training-free recipe greatly improves the overall VisMin group score.
- Manuscript in preparation for submission to ICML 2027.

AI Research Engineer, Laputa, Inc. (AI subsidiary of Sapyoung publisher), Seoul Dec 2025 – Present

- One of a two-person AI team building Unibook: an LLM-based multimodal Q&A system over Korean university textbooks; responsible for LLM research, the RAG and agentic workflow around a 26B VLM MoE model, database, and cloud infrastructure.
- Redesigned the production RAG pipeline, agentic workflow, and database; benchmarked and quantized local LLMs; own the cloud-GPU deployment stack (RunPod, Docker, EC2).
- Reworked the PDF-extraction pipeline behind the RAG database; this surfaced a research gap in document extraction that I proposed and now lead as a research project.
- Designed a self-supervised 115M pointer model for second-pass document-hierarchy repair, trained without human annotation and benchmarked against rules, a 26B LLM, and the supervised 4B multimodal SOTA on three benchmarks. Manuscript in preparation for submission to ICDAR 2027.

AI Research Engineer, STANS, Inc. (MDS Intelligence subsidiary), Seoul Oct 2024 – Nov 2025

- Fine-tuned and deployed crowd-density and object-detection models for AWAS-Insight intelligent CCTV system under real-time constraints (ONNX, TensorRT); systems run at Seoul subway stations and other public areas; also developed rule-based intrusion and loitering detection.
- Reimplemented action-recognition and optical-flow action-recognition models in PyTorch, integrated them with a real-time object detector, and quantized them; prepared the violence-detection system for KISA (Korea Internet & Security Agency) school-safety certification.
- Built auto-labeling pipelines and annotation guidelines; fine-tuned and evaluated models on company datasets including LiDAR-camera data.
- Conducted early-stage R&D for a real-time construction-site translation system: speech-to-text, neural machine translation, TTS, and LLM fine-tuning/RAG; covering Korean construction jargon across multiple Asian languages.

Graduate Student Researcher, Image Processing Lab, Dongseo University Sep 2019 – Aug 2024

- Conducted research on generative models (GAN, diffusion) for image restoration: super-resolution, denoising, demosaicing, and compression, under Prof. Suk-Ho Lee; published five first-author papers.
- Executed lab projects beyond thesis research: medical image segmentation of blood vessels (U-Net), crowd counting (CSRNet), and a separately funded commissioned implementation of DeepView multi-plane view synthesis for ETRI.
- Fully funded through NRF, ETRI, and Dongseo University research grants; presented research at conferences and lab seminars.

Android App Developer, PT. Mat Ali Teknologi, Surabaya, Indonesia Feb 2019 – Jul 2019

- Developed an Android chat application (Android Studio, Kotlin, Node.js).

PUBLICATIONS (FIRST AUTHOR)

Imanuel, I., Yang, H., Lee, S. (2024). *Optimized Color Filter Array for Denoising Diffusion Null-Space Model-Based Demosaicing*. IEEE Access, 12, 117335–117344. doi:10.1109/ACCESS.2024.3448451 **(SCIE, Scopus Q1)**

Imanuel, I., Kang, D., Lee, S. (2024). *Denoising Diffusion Null-Space Model and Colorization based Image Compression*. International Journal of Internet, Broadcasting and Communication, 16(2), 22–30. doi:10.7236/IJIBC.2024.16.2.22 **(KCI)**

Imanuel, I., Lee, S. (2023). *Demosaicing based Image Compression with Channel-wise Decoder*. International Journal of Internet, Broadcasting and Communication, 15(4), 74–83. doi:10.7236/IJIBC.2023.15.4.74 **(KCI)**

Imanuel, I., Lee, S. (2022). *Image Compression with Channel-wise Decoder*. IEEE International Conference on Consumer Electronics-Asia (ICCE-Asia), pp. 1–3. doi:10.1109/ICCE-Asia57006.2022.9954761 **(Best Paper Award, Silver Prize)**

Imanuel, I., Lee, S. (2022). *Super-resolution with adversarial loss on the feature maps of the generated high-resolution image*. Electronics Letters, 58, 47–49. doi:10.1049/ell2.12360 **(SCIE, Scopus Q2)**

Manuscripts in Preparation

Imanuel, I., et al. *The Calibration Law: Diagnosing and Repairing Answer-Position Bias in Mixture-of-Experts Vision-Language Models*. Project lead. In preparation for submission to ICML 2027.

Imanuel, I., et al. *When Can a Second Pass Fix Document Structure? An End-to-End Anatomy of Hierarchy Repair*. Project lead. In preparation for submission to ICDAR 2027.

AWARDS & HONORS

- Excellent Researcher Award, Dongseo University Graduate School.
- Best Paper Award (Silver Prize), ICCE-Asia 2022.
- Full scholarship recipient across all degrees: B.Comp (University of Surabaya); M.Sc. and Ph.D. with research-grant funding (Dongseo University).
- Summa Cum Laude and Best Graduate, Department of Informatics, University of Surabaya.

TALKS & TEACHING

- Guest Lecturer, “Vision-Language Models: Trends, Applications, and Implementation,” Indonesian undergraduate webinar (ProjekinAja), Nov 2025.
- Speaker, International Symposium on Management (INSYMA) 2025, University of Surabaya & Ho Chi Minh University of Banking, AI applications and data-generation trends, May 2025.
- Guest Lecturer, graduate students, Department of Informatics, University of Surabaya, computer vision and image generation (CNNs, GANs, diffusion), Sep 2024.
- Teaching Assistant, Department of Informatics, University of Surabaya (Sep 2016 – Jan 2018): Algorithms & Programming (C#), Web Design, Web Programming.

SKILLS & LANGUAGES

Frameworks & tools: PyTorch, TensorFlow, ONNX, TensorRT, OpenCV; vLLM, Unsloth, Qdrant, Docker, Hugging Face Transformers, bitsandbytes; MLOps and production model deployment.

Languages: English (IELTS 8.0), Korean (KIIP Level 5 / TOPIK 4 equivalent), Indonesian (native).

SERVICE & OUTREACH

- Field surveyor and translator, Hansung University immigration research — surveyed working and living conditions of Indonesian and East Timorese laborers on remote Korean islands; translated interviews and co-wrote reports (Jul–Aug 2021).
- Built an interactive physics learning app for Indonesian high-school students (volunteer education program; Unity/C#).