Hah Min **Lew**

AI Researcher · Klleon

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"Bridging AI research and scalable solutions for measurable real-world impact."

Professional Summary

AI Researcher with 2+ years at Klleon, specializing in Generative AI for digital humans. M.S. in Electrical Engineering and Computer Science, with expertise in Machine/Deep Learning, Signal/Image Processing, and Data Analysis.

Currently leading research in audio-driven 3DMM generation, enabling lifelike avatar movements and lip-sync. Exploring multimodal-driven 3DMM generation and leveraging Gaussian Splatting for photorealistic rendering.

Projects: Audio-driven 3DMM Generation • Multimodal 3DMM Generation • Photorealistic Human Head Rendering • Virtual Human Dialogue System

Skills

Programming	**Python**, Bash, MATLAB, C, Java
Frameworks	**PyTorch**, TensorFlow, Keras, Scikit-learn, Pytorch3D
CV & Audio Tools	OpenCV, FFmpeg, librosa
DevOps	Docker, Containerd, Git
Back-end Basics	Node.js
Front-end Basics	HTML, CSS, JavaScript
Languages	Korean, English

Education

DGIST (Daegu Gyeongbuk Institute of Science and Technology)

Daegu, South Korea

M.S. in Electrical Engineering and Computer Science — *Mar. 2019 - Aug. 2021*

- Advisor: Prof. Jae Youn Hwang

DGIST (Daegu Gyeongbuk Institute of Science and Technology)

Daegu, South Korea

B.E. in School of Undergraduate Studies — *Mar. 2014 - Feb. 2019*

- Best Project Award

Experience

Klleon AI Research

Seoul, South Korea

AI Researcher — *Aug. 2022 - Present*

- Researching audio- and text-driven 3DMM generation for virtual avatars with natural human-like expressions and movements.
- Developed photorealistic head rendering model using Gaussian Splatting, outperforming 5 state-of-the-art models.
  (MSE ↓59.96%, PSNR ↑4.41dB, SSIM ↑3.85%, LPIPS ↓38.16%)
- Developed a Head Swap AI model with 212.7x speedup, reducing annual GPU costs by 99.53% (from $2.2M to $10.5K).
- Built large-scale multimodal data pipelines (4.86M+ frames from in-the-wild videos).
- Integrated external APIs (NVIDIA Audio2Face, OpenAI ChatGPT, TTS) into a streaming avatar system, achieving 25-28 FPS performance.

Multimodal Biomedical Imaging and System Lab, DGIST

Daegu, South Korea

Graduate Researcher — *Mar. 2019 - Aug. 2022*

- Achievements: 6 SCIE publications, 7 international conferences, 9 projects, 4 patents, and 2 awards.
- Designed machine learning-based anomaly detection systems and generative models for biomedical imaging, focusing on multimodal, class-imbalance, and multi-task learning.
- Developed hardware-software integrated systems for application-specific use cases.
- Collaborative research with medical doctors from hospitals, including SNUH, SNUDH, and Yonsei Severance.

LANTERN

Daegu, South Korea

Co-founder — *Nov. 2016 - Jul. 2017*

- Founded a data-driven personalized tutor matching service company in collaboration with Class101.
- Designed a matching database system and established tutor evaluation metrics for personalized recommendations.

Projects

Multimodal 3DMM for Realistic Facial Expressions and Motion
Seoul, South Korea

Project Lead — *Dec. 2024 - Present*

- Developing a multimodal 3D Morphable Model (3DMM) framework for lifelike facial expressions and motion driven by audio-text inputs.
- Used skills: Python, PyTorch, Git.

Real-time Expressive 3D Chat Avatar System
Seoul, South Korea

Project Lead — *Apr. 2024 - Dec. 2024*

- Integrated NVIDIA Audio2Face, OpenAI ChatGPT, and TTS APIs into a streaming avatar dialogue system with 25-28 FPS performance.
- Designed an emotion message queue protocol to enable natural emotional transitions and realistic facial expressions in avatars.
- Optimized Numpy-to-Tensor conversion and computations for live streaming, achieving a 13.5% speed improvement.
- Used skills: Python, PyTorch, Docker, Containerd, Git.

High-performance Real-time Head Swapping System
Seoul, South Korea

Project Lead — *Aug. 2022 - Apr. 2024*

- Led the development of a state-of-the-art head swapping framework, including data preprocessing pipelines, multi-GPU training, and efficient inference mechanisms.
- Built a high-quality dataset from 15,354 videos of 3,592 identities, processing 2.6M frames.
- Achieved a 212.7x inference speedup (from 10s/frame to 47ms/frame), reducing GPU resource requirements by 99.53%.
  - Reduced annual GPU costs from $2.2M+ (assuming 213 AWS EC2 g4dn.4xlarge instances) to approximately $10.5K (using a single instance).
- Achieved significant performance improvements over the SOTA method:
  - Metrics: PSNR ↑55.5%, LPIPS ↓91.8%, L1 ↓88.8%, SSIM ↑21.8%
  - Inference speed: 60.57 FPS (↑53.6%)
  - Computational efficiency: Parameters 8.92M (↓63.4%), MACs ↓33.0%
- Used skills: Python, PyTorch, Docker, Git, JavaScript, HTML, CSS.

Custom Dataset Creation and Text-to-Image Model Finetuning
Seoul, South Korea

Project Lead — *Oct. 2023 - Nov. 2023*

- Built an end-to-end pipeline for fashion product dataset creation, integrating ML-based image captioning and text-to-image model finetuning.
- Open-sourced the pipeline on GitHub and the trained models and dataset on Hugging Face.
  - Dataset: Total 26,335 downloads.
  - Models: Total 2,124 downloads. (as of January 3, 2025.)
- Used skills: Python, PyTorch, Git.
- Repositories: [GitHub], [Dataset], [Model].

Optimized Biomedical Monitoring System with a Time-efficient Algorithm
Daegu, South Korea

Project Lead — *Mar. 2019 - Mar. 2021*

- Achieved an average error rate of $\pm$1.77%, outperforming commercial products with errors of $\pm$1-5%.
- Developed a cost-efficient time-series processing algorithm with a time complexity of $O(N \log N)$.
- Integrated hardware and software for real-time biomedical monitoring.
- Used skills: MATLAB, LabView, VHDL.

AI-powered Smartphone Imaging for Early Dental Caries Detection
Daegu, South Korea

Project Lead — *Apr. 2020 - Feb. 2022*

- Developed an ML-based smartphone image analysis system achieving 0.952 recall and 0.953 precision in early dental caries detection.
- Utilized convolutional neural networks (CNNs) to optimize classification performance for multimodal imaging data.
- Used skills: Python, TensorFlow.

ML-based Smartphone Imaging for Otitis Media Diagnosis
Daegu, South Korea

Project Member — *Feb. 2020 - Jan. 2022*

- Constructed multimodal human clinical datasets (4.98B+ pixels) and optimized image classification models for clinical validation.
- Enhanced diagnostic accuracy with a multi-layer perceptron (MLP) model achieving 80% accuracy, outperforming expert clinicians at 73%.
- Used skills: Python, TensorFlow, Scikit-learn.

Additional Projects

Image-to-Image Translation for High-resolution Gastrointestinal Imaging Project Lead — *Feb. 2021 - Sep. 2023*

Multitask Learning-based Network for Rotator Cuff Tear Segmentation Project Member — *Dec. 2021 - Dec. 2022*

Low-voltage CMUT-based Ultrasound Imaging for Medibots Project Member — *Sep. 2020 - Dec. 2022*

2021 Laboratory-specialized Start-up Leader University Project Project Member — *Aug. 2021 - Jan. 2022*

Smart Monitoring System for Hip Implants Project Member — *Feb. 2019 - May. 2021*

Technical Commercialization Activity Support for Bio Society Leadership Project Member — *May. 2020 - Dec. 2020*

Multimodal Data Registration and Analysis for Tumor Detection Project Member — *Mar. 2019 - Oct. 2020*

Ultrasonic Capsule Endoscopy Project Member — *Jun. 2019 - Jun. 2020*

Publications

GeoAvatar: Adaptive Geometrical Gaussian Splatting for 3D Head Avatar — *First Author*

S. Moon*, **Hah Min Lew***, S. Lee, J. Kang, and G. Park. — *Under Review*

Towards High-fidelity Head Blending with Chroma Keying for Industrial Applications — *First Author*

Hah Min Lew*, S. Yoo*, H. Kang*, and G. Park. WACV 2025 — *Feb. 2025*

Deep Learning-based Synthetic High-Resolution In-Depth Imaging Using an Attachable Dual-element Endoscopic Ultrasound Probe — *First Author*

Hah Min Lew*, J. S. Kim*, M. H. Lee, J. Park, S. Youn, H. M. Kim, J. Kim, and J. Y. Hwang. Arxiv Preprint — *Sep. 2023*

CSS-Net: Classification and Substitution for Segmentation of Rotator Cuff Tear — *Co-Author*

K. Lee, **Hah Min Lew**, M. H. Lee, M. Kang, J. Kim, and J. Y. Hwang. ACCV 2022 — *Dec. 2022*

Deep Learning-based Framework for Fast and Accurate Acoustic Hologram Generation — *Co-Author*

M. H. Lee, **Hah Min Lew**, S. Youn, T. Kim, and J. Y. Hwang. IEEE TUFFC (IF: 3.267) — *Nov. 2022*

Multi-task and Few-shot Learning-based Fully Automatic Deep Learning Platform for Mobile Diagnosis of Skin Diseases — *Co-Author*

K. Lee, T. C. Cavalcanti, S. Kim, **Hah Min Lew**, D. H. Lee, and J. Y. Hwang. IEEE JBHI (IF: 7.021) — *Jul. 2022*

Speckle Reduction via Deep Content-Aware Image Prior for Precise Breast Tumor Segmentation in an Ultrasound Image — *Co-Author*

H. Lee, M. H. Lee, S. Youn, K. Lee, **Hah Min Lew**, and J. Y. Hwang. IEEE TUFFC (IF: 3.267) — *Jul. 2022*

Intelligent Smartphone-based Multimode Imaging Otoscope for the Mobile Diagnosis of Otitis Media — *Co-Author*

T. C. Cavalcanti, **Hah Min Lew**, K. Lee, S. Lee, M. K. Park, and J. Y. Hwang. Biomedical Optics Express (IF: 3.562) — *Nov. 2021*

Ultrasonic Blood Flowmeter with a Novel Xero Algorithm for a Mechanical Circulatory Support System — *First Author*

Hah Min Lew, H. Shin, M. H. Lee, S. Youn, H. C. Kim, and J. Y. Hwang. Ultrasonics (IF: 4.062) — *Aug. 2021*

Forward-Looking Multimodal Endoscopic System Based on Optical Multispectral and High-Frequency Ultrasound Imaging Techniques for Tumor Detection — *Co-Author*

J. Kim, **Hah Min Lew**, J. Kim, S. Youn, H. A. Faruque, A. N. Seo, S. Y. Park, J. H. Chang, E. Kim, and J. Y. Hwang. IEEE TMI (IF: 11.037) — *Oct. 2020*

Patents

BLADDER MONITORING APPARATUS AND METHOD FOR CONTROLLING BLADDER MONITORING APPARATUS — *Application*

J. Y. Hwang, M. H. Lee, **Hah Min Lew** (US17-516850, KR10-0145463) — *Nov. 2021*

ULTRASONIC BLOOD FLOW MEASURING APPARATUS AND METHOD THEREOF — *Application*

J. Y. Hwang, **Hah Min Lew**, H. C. Kim (KR10-2021-0062321) — *May 2021*

MOBILE OTOSCOPE SYSTEM — *Application*

J. Y. Hwang, T. C. Cavalcanti, **Hah Min Lew** (KR10-2021-0049885) — *Apr. 2021*

THREE-DIMENSIONAL DIAGNOSTIC SYSTEM — *Application*

J. Y. Hwang, J. Kim, **Hah Min Lew**, K. Lee (PCT-KR2020-015460, KR10-2019-0141198) — *Nov. 2020*

Awards & Scholarships

Awards

2021	**Outstanding Poster Award**, 2021 Student Conference at DGIST	*Daegu, South Korea*
2021	**Best Paper Award**, 2021 Spring Conference at KOSOMBE	*Remote, South Korea*
2017	**Best Project Award**, 2016 Undergraduate Group Research Project (UGRP) Program at DGIST	*Daegu, South Korea*

Scholarships

2022	**Full Government Scholarships**, Full tuition exemptions and school expenses support in M.S.	*Daegu, South Korea*
2021	**Full Government Scholarships**, Full tuition exemptions and school expenses support in M.S.	*Daegu, South Korea*
2020	**Full Government Scholarships**, Full tuition exemptions and school expenses support in M.S.	*Daegu, South Korea*
2019	**Full Government Scholarships**, Full tuition exemptions and school expenses support in M.S.	*Daegu, South Korea*
2018	**Full Government Scholarships**, Full tuition exemptions and school expenses support in B.E.	*Daegu, South Korea*
2016	**Full Government Scholarships**, Full tuition exemptions and school expenses support in B.E.	*Daegu, South Korea*
2015	**Full Government Scholarships**, Full tuition exemptions and school expenses support in B.E.	*Daegu, South Korea*
2014	**Full Government Scholarships**, Full tuition exemptions and school expenses support in B.E.	*Daegu, South Korea*