



# Hah Min Lew

AI RESEARCHER · KLEON

Personal Website: [hahminlew.github.io](https://hahminlew.github.io)

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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 Multimodal Data Analysis in biomedical fields.

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

Current Projects: 3D Avatar Generation • Photorealistic Human Head Rendering • Virtual Human Dialogue System

## Skills

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

## Education

### DGIST (Daegu Gyeongbuk Institute of Science and Technology)

M.S. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

- Advisor: Prof. Jae Youn Hwang

Daegu, South Korea

Mar. 2019 - Aug. 2021

### DGIST (Daegu Gyeongbuk Institute of Science and Technology)

B.E. IN SCHOOL OF UNDERGRADUATE STUDIES

- Best Project Award

Daegu, South Korea

Mar. 2014 - Feb. 2019

## Experience

### Klleon AI Research

AI RESEARCHER

- Developing audio-driven 3DMM generation for virtual avatars with natural human-like expressions and movements. (LVE ↓27.5%, FDD ↓28.9%, MEE ↓27.1%, CE ↓24.1%, Diversity ↑17.7%)
- 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 (9.41M+ frames from in-the-wild videos).
- Integrated external APIs (NVIDIA Audio2Face, OpenAI ChatGPT, TTS) into a streaming avatar system, achieving 25-28 FPS performance.

Seoul, South Korea

Aug. 2022 - Present

### Multimodal Biomedical Imaging and System Lab, DGIST

GRADUATE RESEARCHER

- 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.

Daegu, South Korea

Mar. 2019 - Aug. 2022

### LANTERN

CO-FOUNDER

- 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.

Daegu, South Korea

Nov. 2016 - Jul. 2017

<b>Audio-driven 3D Facial Animation for Realistic Facial Expressions and Motion</b>	<i>Seoul, South Korea</i>
PROJECT LEAD	<i>Dec. 2024 - Present</i>
<ul style="list-style-type: none"><li>Developing a 3D facial animation framework for lifelike facial expressions and motion driven by audio inputs.</li><li>Constructed a large-scale paired dataset of audio and 3DMM parameters (6.81M+ frames).</li><li>Achieved superior performances compared to the SOTA method (LVE ↓27.5%, FDD ↓28.9%, MEE ↓27.1%, CE ↓24.1%, Diversity ↑17.7%).</li><li>Used skills: Python, PyTorch, Git.</li></ul>	
<b>Real-time Expressive 3D Chat Avatar System</b>	<i>Seoul, South Korea</i>
PROJECT LEAD	<i>Apr. 2024 - Dec. 2024</i>
<ul style="list-style-type: none"><li>Integrated NVIDIA Audio2Face, OpenAI ChatGPT, and TTS APIs into a streaming avatar dialogue system with 25-28 FPS performance.</li><li>Designed an emotion message queue protocol to enable natural emotional transitions and realistic facial expressions in avatars.</li><li>Optimized Numpy-to-Tensor conversion and computations for live streaming, achieving a 13.5% speed improvement.</li><li>Used skills: Python, PyTorch, Docker, Containerd, Git.</li></ul>	
<b>High-performance Real-time Head Swapping System</b>	<i>Seoul, South Korea</i>
PROJECT LEAD	<i>Aug. 2022 - Apr. 2024</i>
<ul style="list-style-type: none"><li>Led the development of a state-of-the-art head swapping framework, including data preprocessing pipelines, multi-GPU training, and efficient inference mechanisms.</li><li>Built a high-quality dataset from 15,354 videos of 3,592 identities, processing 2.6M frames.</li><li>Achieved a 212.7x inference speedup (from 10s/frame to 47ms/frame), reducing GPU resource requirements by 99.53%.<ul style="list-style-type: none"><li>Reduced annual GPU costs from \$2.2M+ (assuming 213 AWS EC2 g4dn.4xlarge instances) to approximately \$10.5K (using a single instance).</li></ul></li><li>Achieved significant performance improvements over the SOTA method:<ul style="list-style-type: none"><li>Metrics: PSNR ↑55.5%, LPIPS ↓91.8%, L1 ↓88.8%, SSIM ↑21.8%</li><li>Inference speed: 60.57 FPS (↑53.6%)</li><li>Computational efficiency: Parameters 8.92M (↓63.4%), MACs ↓33.0%</li></ul></li><li>Used skills: Python, PyTorch, Docker, Git, JavaScript, HTML, CSS.</li></ul>	
<b>Custom Dataset Creation and Text-to-Image Model Finetuning</b>	<i>Seoul, South Korea</i>
PROJECT LEAD	<i>Oct. 2023 - Nov. 2023</i>
<ul style="list-style-type: none"><li>Built an end-to-end pipeline for fashion product dataset creation, integrating ML-based image captioning and text-to-image model finetuning.</li><li>Open-sourced the pipeline on GitHub and the trained models and dataset on Hugging Face.<ul style="list-style-type: none"><li>Dataset: Total 27,182 downloads.</li><li>Models: Total 2,214 downloads.</li></ul></li><li>Used skills: Python, PyTorch, Git.</li><li>Repositories: [GitHub], [Dataset], [Model].</li></ul>	
<b>Optimized Biomedical Monitoring System with a Time-efficient Algorithm</b>	<i>Daegu, South Korea</i>
PROJECT LEAD	<i>Mar. 2019 - Mar. 2021</i>
<ul style="list-style-type: none"><li>Achieved an average error rate of ±1.77%, outperforming commercial products with errors of ±1-5%.</li><li>Developed a cost-efficient time-series processing algorithm with a time complexity of <math>O(N \log N)</math>.</li><li>Integrated hardware and software for real-time biomedical monitoring.</li><li>Used skills: MATLAB, LabView, VHDL.</li></ul>	
<b>AI-powered Smartphone Imaging for Early Dental Caries Detection</b>	<i>Daegu, South Korea</i>
PROJECT LEAD	<i>Apr. 2020 - Feb. 2022</i>
<ul style="list-style-type: none"><li>Developed an ML-based smartphone image analysis system achieving 0.952 recall and 0.953 precision in early dental caries detection.</li><li>Utilized convolutional neural networks (CNNs) to optimize classification performance for multimodal imaging data.</li><li>Used skills: Python, TensorFlow.</li></ul>	
<b>ML-based Smartphone Imaging for Otitis Media Diagnosis</b>	<i>Daegu, South Korea</i>
PROJECT MEMBER	<i>Feb. 2020 - Jan. 2022</i>
<ul style="list-style-type: none"><li>Constructed multimodal human clinical datasets (4.98B+ pixels) and optimized image classification models for clinical validation.</li><li>Enhanced diagnostic accuracy with a multi-layer perceptron (MLP) model achieving 80% accuracy, outperforming expert clinicians at 73%.</li><li>Used skills: Python, TensorFlow, Scikit-learn.</li></ul>	
ADDITIONAL PROJECTS	
<b>Image-to-Image Translation for High-resolution Gastrointestinal Imaging</b>	PROJECT LEAD
	<i>Feb. 2021 - Sep. 2023</i>
<b>Multitask Learning-based Network for Rotator Cuff Tear Segmentation</b>	PROJECT MEMBER
	<i>Dec. 2021 - Dec. 2022</i>
<b>Low-voltage CMUT-based Ultrasound Imaging for Medibots</b>	PROJECT MEMBER
	<i>Sep. 2020 - Dec. 2022</i>
<b>2021 Laboratory-specialized Start-up Leader University Project</b>	PROJECT MEMBER
	<i>Aug. 2021 - Jan. 2022</i>
<b>Smart Monitoring System for Hip Implants</b>	PROJECT MEMBER
	<i>Feb. 2019 - May. 2021</i>
<b>Technical Commercialization Activity Support for Bio Society Leadership</b>	PROJECT MEMBER
	<i>May. 2020 - Dec. 2020</i>
<b>Multimodal Data Registration and Analysis for Tumor Detection</b>	PROJECT MEMBER
	<i>Mar. 2019 - Oct. 2020</i>
<b>Ultrasonic Capsule Endoscopy</b>	PROJECT MEMBER
	<i>Jun. 2019 - Jun. 2020</i>

## Publications

### GeoAvatar: Adaptive Geometrical Gaussian Splatting for 3D Head Avatar

S. MOON\*, **HAH MIN LEW\***, S. LEE, J. KANG, AND G. PARK.

First Author

Under Review

### SMAGA: Secondary Motion-Aware Animatable 3D Gaussian Avatars for Modeling Dynamic Clothed Humans from a Single Video

S. LEE, S. MOON, **HAH MIN LEW**, J. KANG, AND G. PARK.

Co-Author

Under Review

### A Probe-in-the-Loop Continual Test-Time Adaptation Framework for High-Resolution Deep Tissue Imaging with a Dual-Frequency Endoscopic Ultrasound Probe

M. H. LEE, J. S. KIM, **HAH MIN LEW**, H. LEE, H. M. KIM, AND J. Y. HWANG.

Co-Author

Under Review

### Towards High-fidelity Head Blending with Chroma Keying for Industrial Applications

**HAH MIN LEW\***, S. YOO\*, H. KANG\*, AND G. PARK. **WACV 2025**

First Author

Feb. 2025

### Deep Learning-based Synthetic High-Resolution In-Depth Imaging Using an Attachable Dual-element Endoscopic Ultrasound Probe

**HAH MIN LEW\***, J. S. KIM\*, M. H. LEE, J. PARK, S. YOUN, H. M. KIM, J. KIM, AND J. Y. HWANG. **ARXIV PREPRINT**

First Author

Sep. 2023

### CSS-Net: Classification and Substitution for Segmentation of Rotator Cuff Tear

K. LEE, **HAH MIN LEW**, M. H. LEE, M. KANG, J. KIM, AND J. Y. HWANG. **ACCV 2022**

Co-Author

Dec. 2022

### Deep Learning-based Framework for Fast and Accurate Acoustic Hologram Generation

M. H. LEE, **HAH MIN LEW**, S. YOUN, T. KIM, AND J. Y. HWANG. **IEEE TUFFC** (IF: 3.267)

Co-Author

Nov. 2022

### Multi-task and Few-shot Learning-based Fully Automatic Deep Learning Platform for Mobile Diagnosis of Skin Diseases

K. LEE, T. C. CAVALCANTI, S. KIM, **HAH MIN LEW**, D. H. LEE, AND J. Y. HWANG. **IEEE JBHI** (IF: 7.021)

Co-Author

Jul. 2022

### Speckle Reduction via Deep Content-Aware Image Prior for Precise Breast Tumor Segmentation in an Ultrasound Image

H. LEE, M. H. LEE, S. YOUN, K. LEE, **HAH MIN LEW**, AND J. Y. HWANG. **IEEE TUFFC** (IF: 3.267)

Co-Author

Jul. 2022

### Intelligent Smartphone-based Multimode Imaging Otoscope for the Mobile Diagnosis of Otitis Media

T. C. CAVALCANTI, **HAH MIN LEW**, K. LEE, S. LEE, M. K. PARK, AND J. Y. HWANG. **BIOMEDICAL OPTICS EXPRESS** (IF: 3.562)

Co-Author

Nov. 2021

### Ultrasonic Blood Flowmeter with a Novel Xero Algorithm for a Mechanical Circulatory Support System

**HAH MIN LEW**, H. SHIN, M. H. LEE, S. YOUN, H. C. KIM, AND J. Y. HWANG. **ULTRASONICS** (IF: 4.062)

First Author

Aug. 2021

### Forward-Looking Multimodal Endoscopic System Based on Optical Multispectral and High-Frequency Ultrasound Imaging Techniques for Tumor Detection

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)

Co-Author

Oct. 2020

## Patents

### BLADDER MONITORING APPARATUS AND METHOD FOR CONTROLLING BLADDER MONITORING APPARATUS

J. Y. HWANG, M. H. LEE, **HAH MIN LEW** (US17-516850, KR10-0145463)

Application

Nov. 2021

### ULTRASONIC BLOOD FLOW MEASURING APPARATUS AND METHOD THEREOF

J. Y. HWANG, **HAH MIN LEW**, H. C. KIM (KR10-2021-0062321)

Application

May 2021

### MOBILE OTOSCOPE SYSTEM

J. Y. HWANG, T. C. CAVALCANTI, **HAH MIN LEW** (KR10-2021-0049885)

Application

Apr. 2021

### THREE-DIMENSIONAL DIAGNOSTIC SYSTEM

J. Y. HWANG, J. KIM, **HAH MIN LEW**, K. LEE (PCT-KR2020-015460, KR10-2019-0141198)

Application

Nov. 2020

## Awards & Scholarships

### AWARDS

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

### SCHOLARSHIPS

2014-2022 **Full Government Scholarships**, Full tuition exemptions and school expenses support

Daegu, South Korea