

Hyojoon Park

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Introduction

My research focuses on the synergistic application of machine learning to enhance physics-based animations and advance medical imaging analysis. I am passionate about developing cutting-edge AI models across diverse domains, including computer graphics, physics-based simulations, computer vision, VR/AR, and healthcare.

Education

University of Wisconsin-Madison

Wisconsin, USA

Ph.D. Candidate in Computer Sciences

Sep. 2021 - current

- **Research area:** Synergistic application of machine learning in physics-based simulation for computer graphics and medical image
- **Advisor:** Professor Eftychios Sifakis

Seoul National University

Seoul, Korea

M.S. in Mechanical Engineering

Mar. 2017 - Feb. 2019

- **Research area:** Rendering and transparent control of high-performance haptic system
- **Thesis:** Dental Simulator with Increased Z-width of Haptic Rendering (presented in AsiaHaptics 2018)
- Selected for Outstanding MS Thesis Presentation Award [M.S. thesis presentation]
- **Advisor:** Professor Dongjun Lee

Korea University

Seoul, Korea

B.S. in Mechanical Engineering

Mar. 2010 - Feb. 2017

- Military service: Jun. 2011 - Mar. 2013

Technical University of Munich (TUM)

Munich, Germany

B.S. Exchange Student in Mechanical Engineering

Spring 2014

Publications

• Near-realtime Facial Animation by Deep 3D Simulation Super-Resolution

Hyojoon Park, Sangeetha Grama Srinivasan, Matthew Cong, Doyub Kim, Byungsoo Kim, Jonathan Swartz, Ken Museth, Eftychios Sifakis
ACM Transactions on Graphics, 2024 (Presented at SIGGRAPH ASIA 2024) [paper] [github]

- Achieves high-resolution facial animation 115x faster (18.46 FPS) than traditional method (0.16 FPS) while maintaining similar quality.
- Novel deep learning architecture to enhance low-resolution simulations and generalize to unseen expressions.

• Collagen Fiber Centerline Tracking in Fibrotic Tissue via Deep Neural Networks with Variational Autoencoder-based Synthetic Training Data Generation

Hyojoon Park*, Bin Li*, Yuming Liu, Michael S. Nelson, Helen M. Wilson, Eftychios Sifakis, and Kevin W. Eliceiri (*equal contributions)
Medical Image Analysis, 2023 [paper] [github]

- Introduces DuoVAE, a Variational Autoencoder framework designed to generate synthetic collagen fiber centerline masks with controllable properties, including orientation, alignment, density, waviness, and length variations.
- Facilitates the creation of diverse synthetic datasets, addressing the challenge of limited annotated data for training deep learning models.

• Capturing Detailed Deformations of Moving Human Bodies

He Chen, **Hyojoon Park**, Kutay Macit, and Ladislav Kavan
SIGGRAPH, 2021 [paper] [multi-camera calibration codes]

- Introduces a novel motion capture system using a multi-camera calibration method, enhanced with machine learning-based anomaly detection, and a specially designed low-cost suit, enabling the accurate capture of detailed 3D deformations in moving human bodies.
- Uses deep neural networks and geometric algorithms for accurate corner detection, labeling, and 3D reconstruction.

• Adaptive Precision-Enhancing Hand Rendering for Wearable Fingertip Tracking Devices

Hyojoon Park and Jung-Min Park

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2020 [paper] [video]

- Introduces 3D hand rendering framework in VR for wearable fingertip tracking devices, focusing on reconstructing realistic hand poses using only fingertip positions.
- Key contributions include motion retargeting and new hinge constraints for real-time inverse kinematics to enhance visual plausibility and precision.

• Stretchable Skin-Like Cooling/Heating Device for Reconstruction of Artificial Thermal Sensation in Virtual Reality

Jinwoo Lee, Heayoun Sul, Wonha Lee, Kyung Rok Pyun, Inho Ha, Dongkwan Kim, **Hyojoon Park**, Hyeonjin Eom, Yeosang Yoon, Jinwook Jung, Dongjun Lee, and Seung Hwan Ko

Advanced Functional Materials, 2020 [paper]

- Introduces a stretchable, bi-functional skin-like thermo-haptic (STH) device for VR, capable of precise cold and hot sensations with a single structure and 230% stretchability.

- **Dental Simulator with Increased Z-width of Haptic Rendering**

Hyojoon Park, Myungsin Kim, and Dongjun Lee

AsiaHaptics, 2018 [paper][video]

- Introduces a dental simulator with haptic feedback capable of rendering stiff virtual teeth using commercially available haptic devices.
- Employs a passive midpoint integrator (PMI) and virtual coupling with passive decomposition to significantly increase the maximum achievable stiffness (Z-width).

- **Rigid-body Collaborative Manipulation among Remote Users with Wearable Cutaneous Haptic Interfaces**

Myungsin Kim, WonHa Lee, Hyojoon Park, Junghan Kwon, Yong-Lae Park, and Dongjun Lee

AsiaHaptics, 2018 [paper][video]

- Introduces a remote multiuser collaboration system via wearable cutaneous haptic interfaces, leveraging passivity-based simulations for stable and realistic interactions.

- **Wearable Cutaneous Haptic Interface with Soft Sensors and IMUs**

Yongjun Lee, Myungsin Kim, Yongseok Lee, Hyojoon Park, and Dongjun Lee

Korea Robotics Society Annual Conference, 2018

- **Design and Performance Evaluation of Wearable Haptic Interfaces**

WonHa Lee, Myungsin Kim, Hyojoon Park, and Dongjun Lee

International Conference on Control, Automation and Systems, 2018

Work Experience

NVIDIA

Graduate Research Intern

Santa Clara, CA, USA

May 2024 - Aug. 2024

University of Utah

Graduate Research Assistant

Salt Lake City, UT, USA

Sep. 2019 - May 2021

- Developed a multi-camera calibration framework augmented with machine learning-based anomaly detection for checkerboard corner detections, contributing to a publication at SIGGRAPH 2021.

- [github] [paper]

Korea Institute of Science and Technology (KIST)

Intern Researcher

Seoul, Korea

Mar. 2019 - Aug. 2019

- Developed a VR hand rendering framework for wearable fingertip tracking devices, designed to effectively enhance grasping accuracy (published in IROS 2020).

- [paper] [video]

Republic of Korea Army (ROKA)

Military Service

Seoul, Korea

Jun. 2011 - Mar. 2013

- Served 21 months as a military English interpreter.

Korea Advanced Institute of Science and Technology (KAIST)

Instructor for KAIST New Education

Seoul, Korea

Sep. 2014 - Feb. 2015

- Taught "Arduino-based Exploration Robot" and "Developing Android Service App" classes to middle and high school students.

Teaching Assistant

Computer Graphics (CS559) *University of Wisconsin-Madison*

Spring 2022

Computer Graphics (CS559) *University of Wisconsin-Madison*

Fall 2021

Interactive Computer Graphics (CS6610) *University of Utah*

Spring 2021

Computer Graphics (CS4600) *University of Utah*

Fall 2020

System Analysis in Mechanical Engineering *Seoul National University*

Spring 2018

Achievements

AWARD

Outstanding MS Thesis Presentation Award

Seoul National University

Topic: Dental Simulator with Increased Z-width of Haptic Rendering; access the [video] and [slides]

Dec. 2018

Award of Excellence

Korea University

English-Mediated Course Tutor: Writing

Fall 2013

SCHOLARSHIP

Merit-based Scholarship *Seoul National University*

Spring 2018

National Scholarship *Korea University*

Fall 2016

Future Scholarship *Korea University*

Spring 2016

Other Experience

Guest Presenter at NAVER LABS Seminar

Seongnam, Korea

Topic: Dental Simulator with Increased Z-width of Haptic Rendering

Dec. 2018

Independent Mobile Application Development

Loop Timer MacOS [[project page](#)]

2021 - current

- Repeatable timer app that resides in the menu bar, floats above other windows, provides notifications, supports infinite repetitions, and offers customization options for size, color, and multiple timer items.
- Created this app after experiencing deteriorating eyesight from prolonged monitor use, aiming to encourage regular eye rests.
- Developed using *Swift*.

Quick Clipboard MacOS [[project page](#)]

2021 - current

- Tool to add frequently used texts to the clipboard, enabling quick copy-paste functionality via keyboard shortcuts.
- Created this app to streamline workflows after frequently typing lengthy and repetitive command-line codes.
- Developed using *Swift*.

Korean Subway iOS, Android [[facebook](#)] [[instagram](#)]

2017 - discontinued

- First Korean subway app, covering all five cities, featuring satellite-based maps with real-time arrival and departure information.
- Created this app to better understand distances and geographical locations while traveling on subways that operate underground.
- Developed using *KDijkstra's shortest path algorithm, Kd-Tree data structure, Swift, Java, PHP-cURL, SQLite, AWS, Photoshop, Illustrator*.

KUSchedule iOS, Android [[archive page](#)]

2015 - discontinued

- Server-based lecture timetable app that auto-generates schedules from a single login, designed for Korea University students.
- Created this app to simplify obtaining lecture schedules with consistent visualization and easy generation, eliminating the need to manually input all lecture information.
- Developed using *AES-256 encryption, Objective-C, Java, PHP-cURL, DOM parser/regex, Photoshop, Illustrator*.

Space Shoot RPG iOS, Android [[facebook](#)] [[archive page](#)]

2016 - discontinued

- Arcade-RPG game where players choose between warrior and magician-type jets, leveling up and unlocking new skills to defend against intruding enemies.
- Created this app to practice and refine object-oriented programming skills.
- Developed using *C/C++, Cocos2d-x, SQLite, Photoshop, Illustrator*.

Falling Moon iOS, Android [[archive page](#)]

2016 - discontinued

- Physics-based arcade game where players tap to shoot Earths at falling Moons.
- Plays an additive ping-pong sound, triggered whenever an Earth hits a Moon, making the gameplay more enjoyable.
- Developed using *C/C++, Cocos2d-x's physics engine, Photoshop, Illustrator*.

Group Alarm iOS, Android [[archive page](#)]

2015 - discontinued

- Socket-based multi-user alarm app enabling real-time chat and synchronized global alarms, allowing users to support each other in waking up successfully.
- Created this app to gain hands-on experience in implementing a chatting framework using UDP and to develop my first web app compatible with multiple mobile platforms, including iOS and Android.
- Developed using *Node.js, UDP, Javascript, jQuery, Ajax, HTML, CSS, MySQL, Cordova, AWS, Photoshop, Illustrator*.