

# Hyojoon Park

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## Introduction

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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

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### 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

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### • 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 setup and a specially designed low-cost suit to capture detailed 3D deformations of moving human bodies, including fine details like breathing and muscle contractions.
- 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

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### 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 16-camera calibration framework, available on [github].
- Contributed to a publication in SIGGRAPH 2021, accessible [here].

### 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; access the [paper] and [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*

*Jun. 2011 - Mar. 2013*

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

## Teaching Assistant

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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

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### 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

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## 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*.