

Saekwang Nam

Haptic Intelligence Department, Max Planck Institute for Intelligent Systems

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EDUCATION

- present** **Ph.D. candidate in Computer Science**, Eberhard Karls University of Tübingen, Tübingen, Germany
 Affiliated with Max Planck Institute for Intelligent Systems, Stuttgart, Germany
 Advisor: Katherine J. Kuchenbecker, Ph.D.
- 2013** **M.S. in Computer Science**, University of California, San Diego, La Jolla, USA
 Academic concentration: Artificial Intelligence
- 2011** **B.E. in Human & Mechanical Systems Engineering**, Kanazawa University, Kanazawa, Japan
 Academic concentration: Mechatronics
Summa Cum Laude

EXPERIENCE

Max Planck Institute for Intelligent Systems

Ph.D. student

Sep. 2017 - present

Stuttgart, Germany

Theme I: Hardware developments for catching physical variables of human finger, for which I

- built an apparatus to measure three-dimensional finger contact forces, contact images, and fingerpad moisture ([link](#), [paper](#)).
- improved the apparatus for better data synchronization, better resolution of fingerprint images, and better ambient temperature controls.
- developed a thin and transparent capacitive-type moisture sensor providing continuous moisture measurements based on laser lithography.

Theme II: Software skills such as image processing, simulations, and optimization

- I implemented a processing algorithm to extract the contact area from contact fingerprint images based on intensity gradient and adaptive threshold methods.
- I constructed a variable optimization system using particle swarm optimization to find the material properties of the human finger through repetitive finger-pressing simulations in COMSOL Multiphysics ([paper](#)).
- I am implementing a fast parameter optimization algorithm to quickly extract a human finger's moisture level from optimized electrochemical impedance spectroscopy.

Electronics and Telecommunications Research Institute (ETRI)

Researcher

Apr. 2013 - Aug. 2017

Daejeon, South Korea

Theme I: Developing transparent and soft actuators, particularly focusing on

- Developing soft actuators based on electro-active polymers
- Figuring out the mechanical properties of dielectric elastomers
- Developing a bio-inspired varifocal lens and a thin-film mirror deformed by electrostatic force ([paper](#)).

Theme II: Connecting users to haptic applications that includes

- Developing a glass-plate actuator vibrating with the electrostatic force created between the stacked glass plates
- Building a graphic user interface to continuously present contact force measured from an optical waveguide-based transparent & flexible sensor array film ([paper](#))
- Generating diverse input signals to haptic devices for the evaluation of a newly developed film-type sensor ([paper](#)).

Samsung Electronics Co., Ltd.

Jul. - Sep. 2012

Software intern

Suwon, South Korea

I was selected one of the worldwide interns as Samsung's global internship program, targeting excellent foreigners (including Koreans who study overseas) to work at the company in South Korea. In the Device Solutions department, I

- analyzed the traffic congestion of wafer-transferring vehicles in the semiconductor factories based on their log data files,
- computed the vehicle's maximum and average velocity in real-time and updated the information to the database.

DENSOTECHNO Co., Ltd.

Aug. 2009

Intern

Obu, Japan

- Learned a computer-aided design program (NX),
- Designed a radiator loaded on a Toyota's,
- Conducted simulations under diverse external disturbance conditions,
- Analyzed the areas of the radiator in which the disturbance could cause critical stresses.

AWARDS AND HONORS

2021	Honorable Mention for the Best ToH Short Paper Award (with co-authors), World Haptics Conference
2021	Finalist for the Best Video Presentation Award (with co-authors), World Haptics Conference
2020	KIST Europe Scholarship Award (€1,000), Korean Scientists and Engineers Association in Germany
2020	Best Work-in-progress Poster Award (with co-authors), EuroHaptics Conference
2017 - present	A full funding for Ph.D. studies, International Max Planck Research School for Intelligent Systems
2015	Creativity and Innovation Award (with co-authors), ETRI
2015	Outstanding Paper Award (with co-authors), ETRI
2015	Outstanding Idea Award, ETRI
2014	Best Demonstration Award (with co-authors), Asia Haptics Conference
2014	The Most Popular Demonstration Award (with co-authors), Asia Haptics Conference
2014	Outstanding Paper Award (with co-authors), Institute of Control, Robotics and Systems domestic conference
2011	Hatakeyama Award, The Japan Society of Mechanical Engineers

- 2010 Kanazawa-kogyokai Award, Alumni Association in Engineering Departments of Kanazawa University
- 2009 Special Award, The Japan Society for Precision Engineering Hokuriku-Shinetsu Branch
- 2006 - 2011 A full funding for undergraduate studies, Korea-Japan Government Scholarship Program for the Students in Science and Engineering Departments (A stipend of ¥125,000/month and tuition fees)

SKILLS

- Software** Matlab, Python, LabVIEW, SolidWorks, COMSOL Multiphysics, L^AT_EX, C/C++/C#, Unity, Origin, NX
- Hardware** Laser lithography, Metal sputter, Optical microscope, Scanning electron microscope, Laser scanning vibrometer, Phantom haptic devices, Data acquisition board, 3D optical profilometer, Signal generators, 3D printers, Laser cutters
- Language** English (*fluent*), Korean (*native*), Japanese (*excellent*), German (*beginner(A2)*)

RECENTLY COMPLETED COURSES

- 2021 Machine Learning for and with Dynamical Systems from University of Tübingen
Deep Learning from Coursera
- 2020 Data Literacy from University of Tübingen
Probabilistic Machine Learning from University of Tübingen
Machine Learning from Coursera
- 2018 Mathematics for Machine Learning: Multivariate Calculus from Coursera
- 2018 Mathematics for Machine Learning: Linear Algebra from Coursera

PUBLICATIONS

Unpublished Papers (In Preparation and Under Review)

- [U1] **Saekwang Nam** and Katherine J. Kuchenbecker. The Importance of Sweat in Object Grasping: Why Is Dry Finger Slippery? In preparation for submission.
- [U2] **Saekwang Nam**, Katherine J. Kuchenbecker, and the other collaborators. In vivo Transparent Sensor for the Continuous Hydration Measurement of Finger. In preparation for submission.

Journal Articles (Including Impact Factors in the year of publications)

- [J1] Seung Koo Park, Sungryul Yun, Geonwoo Hwang, Meejeong Choi, Dong Wook Kim, Jong-Moo Lee, Bong Je Park, **Saekwang Nam**, Heeju Mun, Seongcheol Mun, Jeong Mook Lim, Eun Jin Shin, Ki-Uk Kyung, and Suntak Park. Highly contrastive, real-time modulation of light intensity by reversible stress-whitening of spontaneously formed nanocomposites: application to wearable strain sensors. *Journal of Materials Chemistry C*, 9:8496–8505, 2021.
- [J2] **Saekwang Nam** and Katherine J. Kuchenbecker. Optimizing a viscoelastic finite element model to represent the dry, natural, and moist human finger pressing on glass. *IEEE Transactions on Haptics*, 14(2):303–309, 2021. Finalist for the Best Video Presentation Award, Second Honorable Mention for the Best ToH Short Paper Award at World Haptics Conference 2021.

- [J3] **Saekwang Nam**, Yasemin Vardar, David Gueorguiev, and Katherine J. Kuchenbecker. Physical variables underlying tactile stickiness during fingerpad detachment. *Frontiers in Neuroscience*, 14:235, 2020 (*Impact Factor* = 4.677).
- [J4] **Saekwang Nam**, Sungryul Yun, Jae Woong Yoon, Suntak Park, Seung Koo Park, Seongcheol Mun, Bongje Park, and Ki-Uk Kyung. A robust soft lens for tunable camera application using dielectric elastomer actuators. *Soft Robotics*, 5(6):777–782, 2018. PMID: 30156468 (*Impact Factor* = 6.403).
- [J5] Seongcheol Mun, Sungryul Yun, **Saekwang Nam**, Seung Koo Park, Suntak Park, Bong Je Park, Jeong Mook Lim, and Ki-Uk Kyung. Electro-active polymer based soft tactile interface for wearable devices. *IEEE Transactions on Haptics*, 11(1):15–21, 2018 (*Impact Factor* = 2.757).
- [J6] Suntak Park, Bongje Park, **Saekwang Nam**, Sungryul Yun, Seung Koo Park, Seongcheol Mun, Jeong Mook Lim, Yeonghwa Ryu, Seok Ho Song, and Ki-Uk Kyung. Electrically tunable binary phase fresnel lens based on a dielectric elastomer actuator. *Optics Express*, 25(20):23801–23808, 2017 (*Impact Factor* = 3.356).
- [J7] Seung Koo Park, Young-Je Kwark, **Saekwang Nam**, Jaehyun Moon, Dong Wook Kim, Suntak Park, Bongje Park, Sungryul Yun, Jeong-Ik Lee, Byounggon Yu, et al. A variation in wrinkle structures of uv-cured films with chemical structures of prepolymers. *Materials Letters*, 199:105–109, 2017 (*Impact Factor* = 2.687).
- [J8] Sungryul Yun, Suntak Park, **Saekwang Nam**, Bongje Park, Seung Koo Park, Seongcheol Mun, Jeong Mook Lim, and Ki-Uk Kyung. An electro-active polymer based lens module for dynamically varying focal system. *Applied Physics Letters*, 109(14):141908, 2016 (*Impact Factor* = 3.411).
- [J9] Seung Koo Park, Young-Je Kwark, **Saekwang Nam**, Suntak Park, Bongje Park, Sungryul Yun, Jaehyun Moon, Jeong-Ik Lee, Byounggon Yu, and Ki-Uk Kyung. Wrinkle structures formed by formulating uv-crosslinkable liquid prepolymers. *Polymer*, 99:447–452, 2016 (*Impact Factor* = 3.684).
- [J10] **Saekwang Nam**, Suntak Park, Sungryul Yun, Bongje Park, Seung Koo Park, and Ki-Uk Kyung. Structure modulated electrostatic deformable mirror for focus and geometry control. *Optics Express*, 24(1):55–66, 2016 (*Impact Factor* = 3.307).
- [J11] Bong Je Park, Suntak Park, Sungryul Yun, **Saekwang Nam**, and Ki-Uk Kyung. A transparent visuo-haptic input device with optical waveguide based thin film display, sensor and surface actuator. *Sensors and Actuators A: Physical*, 233:47–53, 2015 (*Impact Factor* = 2.201).
- [J12] Sungryul Yun, Suntak Park, Bongje Park, **Saekwang Nam**, Seung Koo Park, and Ki-Uk Kyung. A thin film active-lens with translational control for dynamically programmable optical zoom. *Applied Physics Letters*, 107(8):081907, 2015 (*Impact Factor* = 3.142).
- [J13] Suntak Park, Bong Je Park, Sungryul Yun, **Saekwang Nam**, Seung Koo Park, and Ki-Uk Kyung. Thin film display based on polymer waveguides. *Optics express*, 22(19):23433–23438, 2014 (*Impact Factor* = 3.488).
- [J14] Sungryul Yun, Suntak Park, Bongje Park, Youngsung Kim, Seung Koo Park, **Saekwang Nam**, and Ki-Uk Kyung. Polymer-waveguide-based flexible tactile sensor array for dynamic response. *Advanced Materials*, 26(26):4474–4480, 2014 (*Impact Factor* = 17.493).

- [J15] Ki-Uk Kyung, Sungryul Yun, Suntak Park, Bongje Park, Seung Koo Park, **Saekwang Nam**, Harsha Prahlad, and Philip von Guggenberg. Flexible visuo-haptic display. *Journal of Korea Robotics Society*, 8:156–163, 2013 (*No Impact Factor Available*).

Peer-Reviewed Conference Papers, posters, and demo presentations

- [C1] **Saekwang Nam**, David Gueorguiev, and Katherine J. Kuchenbecker. Finger contact during pressing and sliding on a glass plate. Poster presented at “Skin mechanics and its role in manipulation and perception” workshop held at EuroHaptics, May 2022
- [C2] **Saekwang Nam** and Katherine J. Kuchenbecker. Sweat softens the outermost layer of the human finger pad: evidence from simulations and experiments. Work-in-progress poster presented at EuroHaptics Conference, September 2020. **Award for the Best Work-in-progress poster**
- [C3] **Saekwang Nam** and Katherine J. Kuchenbecker. Understanding the pull-off force of the human fingerpad. Work-in-progress paper (2 pages) presented at the IEEE World Haptics Conference (WHC), July 2019
- [C4] Maria-Paola Forte, Rachael L’Orsa, Mayumi Mohan, **Saekwang Nam**, and Katherine J. Kuchenbecker. The haptician and the alphamonsters. Student Innovation Challenge on Implementing Haptics in Virtual Reality Environment presented at the IEEE World Haptics Conference, July 2019. Maria Paola Forte, Rachael L’Orsa, Mayumi Mohan, and Saekwang Nam contributed equally to this publication
- [C5] Seongcheol Mun, Sungryul Yun, **Saekwang Nam**, Seung-Koo Park, and Ki-Uk Kyung. Initial progress toward a surface morphable tactile interface. In Shoichi Hasegawa, Masashi Konyo, Ki-Uk Kyung, Takuya Nojima, and Hiroyuki Kajimoto, editors, *Haptic Interaction*, pages 113–114, Singapore, 2018. Springer Singapore
- [C6] **Saekwang Nam**, Suntak Park, Sungryul Yun, Bong Je Park, Seung Koo Park, and Ki-Uk Kyung. Influence on deformed shape of electrostatic deformable mirror by the geometry of electrode. In *Conference on Lasers and Electro-Optics*, page JTh2A.7. Optical Society of America, 2016
- [C7] Suntak Park, Jin Tae Kim, **Saekwang Nam**, Bong Je Park, Sungryul Yun, Seung Koo Park, and Ki-Uk Kyung. Pressure sensor using vertical coupling of optical waveguides. In *Conference on Lasers and Electro-Optics*, page JTu5A.144. Optical Society of America, 2016
- [C8] **Saekwang Nam**, Suntak Park, Sungryul Yun, Bong Je Park, Seung Koo Park, Mijeong Choi, and Ki-Uk Kyung. *Highly Flexible and Transparent Skin-like Tactile Sensor*, pages 187–189. Springer Japan, Tokyo, 2015
- [C9] **Saekwang Nam** and Tetsuyou Watanabe. The development of robot hand capable of expressing the movement of the palm(biorobotics). *Proceedings of the robotics and mechatronics conference in Japan*, 2011:1P1–P04(1–4), May 2011

PATENTS

- [P1] Seung Koo Park, Sung Ryul Yun, Ki Uk Kyung, Mi Jeong Choi, Bong Je Park, Suntak Park, **Saekwang Nam**, Seongcheol Mun, Eun Jin Shin, Jeong Mook Lim, et al. Light transmittance control film and composition for the light transmittance control film, June 22 2021. US Patent 11,041,055

- [P2] Ki-uk Kyung, Bong Je Park, Sang-youn Kim, **Saekwang Nam**, Sun Tak Park, and Sung Ryul Yun. Auto focusing device, May 12 2020. US Patent 10,649,116
- [P3] Ki-uk Kyung, **Saekwang Nam**, Bong Je Park, Sun Tak Park, and Sung Ryul Yun. Imaging apparatus with adjustable lens and method for operating the same, December 3 2019. US Patent 10,495,843
- [P4] Ki Uk Kyung, **Saekwang Nam**, Sung Ryul Yun, Bong Je Park, Sun Tak Park, and Seung Koo Park. Varifocal lens module, July 2 2019. US Patent 10,338,280
- [P5] Ki-uk Kyung, Bong Je Park, Sang-youn Kim, **Saekwang Nam**, Sun Tak Park, and Sung Ryul Yun. Auto focusing device, June 26 2018. US Patent 10,007,034
- [P6] Sun Tak Park, Ki Uk Kyung, Sae Kwang Nam, Bong Je Park, Seung Koo Park, and Sung Ryul Yun. Optical imaging device, June 26 2018. US Patent 10,009,546
- [P7] Sun Tak Park, Ki-uk Kyung, **Saekwang Nam**, Bong Je Park, Seung Koo Park, and Sung Ryul Yun. Image processing apparatus and control method thereof, June 5 2018. US Patent 9,992,433
- [P8] Sung-Ryul Yun, Ki-uk Kyung, Sun-tak Park, Bong-Je Park, and **Saekwang Nam**. Microlens array and method for fabricating thereof, February 6 2018. US Patent 9,885,874
- [P9] Sun Tak Park, Ki Uk Kyung, Sung Ryul Yun, **Saekwang Nam**, and Bong Je Park. Display apparatus and manufacturing method thereof, December 12 2017. US Patent 9,841,621
- [P10] Ki-uk Kyung, Sung-Ryul Yun, Sun-tak Park, Bong-Je Park, and **Saekwang Nam**. Shape-variable optical element, August 29 2017. US Patent 9,746,587
- [P11] Sung Ryul Yun, Ki Uk Kyung, **Saekwang Nam**, Bong Je Park, and Sun Tak Park. Artificial muscle, May 30 2017. US Patent 9,662,197
- [P12] Sun-tak Park, Bong-Je Park, Ki-uk Kyung, Sung-Ryul Yun, and **Saekwang Nam**. Active diffuser for reducing speckle and laser display device having active diffuser, May 2 2017. US Patent 9,638,928
- [P13] Sung Ryul Yun, Ki Uk Kyung, Sun Tak Park, **Saekwang Nam**, and Bong Je Park. Thin active optical zoom lens and apparatus using the same, April 4 2017. US Patent 9,612,362
- [P14] **Saekwang Nam**, Sun Tak Park, Ki Uk Kyung, Bong Je Park, and Sung Ryul Yun. Active reflective lens and apparatus using the same, September 15 2016. US Patent App. 15/065,856
- [P15] Sun Tak Park, Ki Uk Kyung, Bong Je Park, Sung Ryul Yun, and **Saekwang Nam**. Variable fresnel lens, April 12 2016. US Patent 9,310,532
- [P16] Sun Tak Park, Sung Ryul Yun, Bong Je Park, **Saekwang Nam**, and Ki Uk Kyung. Reflective varifocal lens and imaging system including the same, August 20 2015. US Patent App. 14/618,282
- [P17] **Saekwang Nam**, Ki-uk Kyung, Sung-Ryul Yun, Sun-tak Park, and Bong-Je Park. Shape-variable optical element and optical read/write device including the same, July 28 2015. US Patent 9,091,810
- [P18] **Saekwang Nam**, Ki Uk Kyung, Sung Ryul Yun, Bong Je Park, and Sun Tak Park. Tunable lens system, July 23 2015. US Patent App. 14/600,369

- [P19] Ki-uk Kyung, Sung-Ryul Yun, Sun-tak Park, Bong-Je Park, and **Saekwang Nam**. Variable-shape optical element, February 12 2015. US Patent App. 14/316,083

REVIEWER

2021	IEEE World Haptics Conference
2020	IEEE International Conference on Robotics and Automation (ICRA)

TEACHING AND MENTORING

Jan. 2012 -	He had taught Japanese to undergraduate students at UCSD for four quarters .
Mar. 2013	Although he was not a native Japanese speaker, the lecturers kindly gave me continuous chances to have the TA role based on students' evaluations and the Japanese Language Proficiency Test certificate with the highest level.
November 2020	He taught the concept of impedance measurements, how to measure the impedance, and how to find the equivalent electrical circuit based on the electro-chemical impedance spectroscopy to Carolyn Anna Both , a student at Friedrich-Abel-Gymnasium, for one week.
May 2022	He introduced the sensing principle of the transparent moisture sensor and ways of impedance measurement and microscope usage to Tsujii Manon , a Gymnasium student, for a week.

TALKS AND MEDIA HIGHLIGHTS

- Dec. 15th 2021 A report titled "The artificial intelligence in the sense of touch: The present and future of haptic technologies" has been published in [KIC Europe Issue 2021/12: Artificial intelligence & Robotics](#) (Korean).
- May 27th 2021 A method to optimize the parameters in a model using measured data and a case example in modeling finger-pressing behaviors, organized by Korean Scientist and Engineers Association in Germany (Online presentation)
- May 24th 2021 Designing, Sensing, and Data-processing for Understanding Human Fingers, hosted by the Embodied Dexterity Group at University of California Berkeley
- November 2020 He was invited for the interview with Tech GangJeong, a youtube channel focusing on new technologies. He introduced [the procedures of doctoral studies in Max Planck Institute, my research, and current challenges in object grasping by robots](#).
- Oct. 17th 2020 Reasons for the secure object-grasping by fingers, organized by Korean Scientist and Engineers Association in Germany (Online presentation)
- October 2020 Max Planck Institute for Intelligent Systems published an [article](#) on how well several members in our department participated in the EuroHaptics conference in the COVID-19 outbreak. News of receiving the Best Poster Prize featured in the article.
- May 2017 HelloDD published an [article](#) about the importance of the Technical Research Personnel Program, an alternative means of conducting mandatory military service in Korea.
- January 2017 Chungcheong Today published [Saekwang's opinion](#) about the importance of developing path-breaking technologies.
- June 2014 Many broadcasting companies in South Korea released news about the development of transparent tactile sensor array ([KBS](#), [Daejeon MBC](#), [TJB](#), [Yonhap News](#), [YTN](#), and [Arirang](#)).