

Youngjae Chang

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1 Research Interests

My research interest lies in opening up new possibilities to improve everyday environments where people live and interact with others.

Technically, my research interest covers the broad areas of machine learning, mobile IoT systems, and service and experience design. Based on the knowledge in these areas, my research focuses on building novel intelligent systems and applications that immerse into human life. We can wear them (as wearables), accompany them (as robots), or live in them (as smart homes). Each platform is very different in form and computing power, but they can be connected to a single platform that supports people throughout their lives. At the heart of my interest is the belief that good technology should serve to build great community.

2 Education

Ph.D. Student in Computer Science, KAIST, Daejeon, KR.	Current
M.Sc. in Computer Science, KAIST, Daejeon, KR. Under the supervision of Prof. Junehwa Song	Jun. 2018
B.Sc. in Computer Science, KAIST, Daejeon, KR. Advanced Major in CS.	Feb. 2017

3 Work Experiences

Nokia Bell Labs, Cambridge, United Kingdom Research Intern, Pervasive Systems Group (Mentor: Akhil Mathur)	Jul. – Sep. 2018
Elice, Daejeon, South Korea Undergraduate Intern, Mobile & Backend Development	Jun. 2016 – Mar. 2017
Artificial Intelligence & Probabilistic Reasoning Lab, KAIST, KR Undergraduate Research Intern (Advisor: Prof. Kee-Eung Kim)	Jun. – Sep. 2016

4 Publications

All publications listed below are peer-reviewed.

4.1 Journals

2020 [J.01] Youngjae Chang*, Akhil Mathur*, Anton Isopoussu, Junehwa Song, Fahim Kawsar. **“A Systematic Study of Unsupervised Domain Adaptation for Robust Human-Activity Recognition”**, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT). ACM, 2020

(*Both authors contributed equally to this research)

4.2 Conferences

2021 [C.03] Wonjung Kim, Seungchul Lee, Youngjae Chang, Taegyeong Lee, In-seok Hwang, Junehwa Song. **“Hivemind: Social Control-and-Use of IoT towards Democratization of Public Spaces”**, Proceedings of the 19th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys '21). ACM, 2021

Demo video: <https://www.youtube.com/watch?v=ZwhVyRvZc4o>

- 2019 [C.02] Seungchul Lee, Chulhong Min, Alessandro Montanari, Akhil Mathur, Youngjae Chang, Junehwa Song, and Fahim Kawsar. **"Automatic Smile and Frown Recognition with Kinetic Earables"**, Proceedings of the 10th Augmented Human International Conference 2019 (AH2019).
- 2018 [C.01] Bumsoo Kang, Inseok Hwang, Jinho Lee, Seungchul Lee, Taegyeong Lee, Youngjae Chang, Min Kyung Lee. **"My Being to Your Place, Your Being to My Place: Co-present Robotic Avatars Create Illusion of Living Together"**, Proceeding of the 11th annual international conference on Mobile systems, applications, and services (MobiSys '18). ACM, 2018
Demo video: <https://www.youtube.com/watch?v=p9P9bBwIP54>

4.3 Workshops

- 2016 [W.01] Youngsoo Jang, Jiyeon Ham, Byung-Jun Lee, Youngjae Chang, Kee-Eung Kim, **"Neural dialog state tracker for large ontologies by attention mechanism."** Spoken Language Technology Workshop (SLT 2016). IEEE, 2016

4.4 Adjuncts (Demos and Posters)

- 2021 [A.05] Wonjung Kim, Seungchul Lee, Youngjae Chang, Taegyeong Lee, Inseok Hwang, Junehwa Song. **"Facilitating in-situ shared use of IoT actuators in public spaces (demo)."** Proceedings of the 19th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys '21). ACM, 2020
- 2020 [A.04] Jaejun Park, Saumay Pushp, Youngjae Chang, Hailu Belay Kahsay, Jeongho Won, Seungwoo Kang, and Junehwa Song. 2020. **"IMception: camouflaging sensitive-apps' chat-screens with deceptive UIs (poster)."** Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers (UbiComp-ISWC '20). ACM, 2020
- 2020 [A.03] Wonjung Kim, Youngjae Chang, and Junehwa Song. 2020. **"DeepPower: fast and scalable energy assessment of mobile sensing applications (poster)."** Proceedings of the 18th Conference on Embedded Networked Sensor Systems (SenSys '20). ACM, 2020
Teaser video: https://www.youtube.com/watch?v=jChsU10Gw_c
- 2019 [A.02] Bumsoo Kang, Inseok Hwang, Jinho Lee, Seungchul Lee, Taegyeong Lee, Youngjae Chang, Min Kyung Lee. **"Towards Peripheral Awareness of Remote Family Member's Context Using Self-mobile Robotic Avatars (demo)."** In Proceedings of the 17th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys '19). ACM, 2019
👉 Best demo award !
- 2018 [A.01] Bumsoo Kang, Inseok Hwang, Jinho Lee, Seungchul Lee, Taegyeong Lee, Youngjae Chang, Min Kyung Lee. **"HomeMeld: Co-present Robotic Avatar System for Illusion of Living Together (demo)."** In Proceedings of the 16th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys'18). ACM, 2018

Social Appropriateness Guardian — Socially-aware use of everyday devices (2022)

In a densely populated modern city, the moderate noises from a device could incur severe strain and even conflicts within a community. It is important to develop a new approach to incorporate the social appropriateness into the design of everyday devices. This project aims to develop a novel socio-physical system to empower a socially-blind device to become socially-aware.

Hivemind — Social Control-and-Use of IoT devices and Democratization of Public Spaces [C.03, A.05] (2021)

Sharing a public space is the basis of a modern urban life. Many public spaces are equipped with public actuators such as HVAC, lighting, speakers, or televisions to ensure the comfort of their visitors. However, many public controls rarely allow visitors to adjust their operation, limiting their usefulness and fairness. In addition, the social bar is often too high to voice one's preference and attempt to change the operation of an actuator. We envision social control and use of IoT devices as a new, underexplored direction of research.

Boosting "Robustness" using the Unlabeled Data — Systematic Study of Unsupervised Domain Adaptation on Human Activity Recognition [J.01] (2020)

How robust are human activity detectors? – Human activity recognition has been a key module in the implementation of pervasive computing in the real world. A watch nudges its owner to get up. A phone encourages you to walk for another 3 minutes. But all these proactive functions can stop if someone wears them in an unexpected way. We envision a system that generalizes to such wearer diversity using only the unlabeled dataset collected in the wild. As a first step, we adopted unsupervised domain adaptation techniques from the ML literature and compared their performance over more than 100 experimental settings simulating different adaptation scenarios. We derived practical guidelines for UbiComp practitioners on how to train more accurate and robust HAR models.

- I was the principal investigator of the project. I formalized the problem of wearing diversity, implemented UDA techniques, and designed/conducted the experiments.
- This work was done in part when I was on internship at Nokia Bell Labs, Cambridge, 2018.

Automatic Smile/Frown Recognition with Kinetic Earables [C.02] (2019)

Facial expressions are the primary interface to convey our emotions to others. We prototyped an earable equipped with an inertial sensor that recognizes two key facial expressions: smile and frown.

- I designed and implemented the ConvAttention network, which comprises CNN encoder, LSTM, and an attention mechanism.

HomeMeld — My Being to Your Place, Your Being to My Place [C.01, A.01, A.02] (2018)

Can we live together, apart? – We envision a system that gives the illusion of living together for families that live apart, using a telepresence robot.

- One of the main challenges of the project was to replicate one's location at home in the other's place, preserving and recreating the life contexts of the other family member.
- I designed and implemented a system that maps two heterogeneous floor plans. Based on the notion of functionally equivalent places, I tried to map places where people do similar in-home activities. I calculated the semantic similarity of regions using the word embedding of the furniture and used the Voronoi diagram to decide their boundaries.

DSTC5 — Extracting Key Information from a Human-Human Dialogue [W.01] (2016)

We participated in a challenge to design a dialog tracker. The dialog tracker should

understand the topic of a conversation and extract meaningful information, such as the name and price of a hotel to be booked and nearby attractions, from a given dialog, i.e., a conversation between a travel agent and a customer. We proposed a tracker that captures meaningful words based on the attention mechanism and bidirectional long short-term memory (LSTM).

- Done as an undergraduate research project.
- The main challenge was that a given dataset was too small to train a deep neural network. To solve the issue, I crawled 13 million sentences conversed on the TripAdvisor forum. The crawled corpus boosted the performance of Word2Vec, resulting in the good semantic embedding of the domain-specific words. Our model showed comparable performance while being simpler in its design.
- Took 3rd place on the Fifth Dialog State Tracking Challenge.

IMception — Deceiving the instant messenger usage from others [A.04] (2020)

We care about our social identity. Consider Alice, a newly hired elementary school teacher who wants to be perceived as a credible, professional teacher. She is naturally reluctant to use a counseling or dating app in public spaces because she worries about shoulder-surfers who might spread a negative comment about her. The project explores such a privacy concern and aims to develop a deception mechanism that disguises sensitive apps as mundane apps.

- As one of the lead investigators, I implemented IMception service that automatically changes the look and feel of the privacy-sensitive messaging app. It crawls chat messages from target applications' UI tree and overlays an fake instant messenger UI on top of the target application.

CommBetter — Enabling Parent-driven Speech Therapy for Children with Communication Developmental Delays (2018)

How well do we talk to our child? - This is a critical question for all parents. We have tried to build a real-time system that deeply understands how a parent plays and talks with their child who has a developmental delay.

- Not to attach any sensors to a child, a vision-based approach had been selected. Having multiple cameras at home, I used landmark detection, object tracking, and pose estimation to track interactions between a parent and child. The modules were further optimized to work in real-time, even with multiple camera streams.

Hearth — Boosting Up Family Interactions through Family-sourcing for Older Adult Members Living Apart (2017)

When a definition of family changed from its extended form to a nuclear form, people have sacrificed a great deal of emotional well-being, especially from our older adults. So we built a family-sourcing app that collects fragmented memories of the family, gives kinship to family members, and increases calls to our older adults.

- I took charge of the full-stack development of the service. The concept was simple, but the service should have functionalities that we take for granted: personalized timelines, push notifications, curated contents, user roles, administrator interfaces, authentication, and so on. Having two full iterations over the design, we were able to deploy it to 3 families for 3 weeks. The total lines of code were 5150 lines.

Oing — Facilitating Lecturer's Interaction in a Large Class via Observing Students' Contexts (2017)

Focus! - With hundreds of people in a classroom, a lecture can easily lose its interactivity and become a solo performance that no one pays attention to. Here, we designed and implemented a tool for novice lecturers that provides an adversarial view of the audience, highlighting regions of a class that are drifting away from a lecture.

- I was one of the lead investigators of the project. We collected 80,000 images by taking picture of a classroom, every second. The 30,000 faces were extracted and manually using a custom-built data labeling tool. A random forest classified whether a detected face is paying attention to a lecture or not. We also built a visualization that highlights the non-attentive region of the classroom.

Other Projects

Service Design/Implementation:

- Hangtag — BLE Hanger for the seamless shopping experience.
- HEBA — GPS-based activity-sharing social network.
- Avocado — Family meal-planning for the Diabetes. (MSR Design Expo)
- Colorful History — Visualizing your web surfing routines.

Qualitative Research:

- A Picture for a Thousand Words — Understanding a Slide-capturing Behavior at a Conference.
- Can doodle convey an emotion? — Designing emojis for the blind.

6 Patents

- “Perspective-adaptive Information Provision”
Korea Patent Pending 10-2021-0191260 (December 29, 2021)
- “System and method for individual-level accounting of shared space resource use”
Korea Patent Pending 10-2021-0190115 (December 28, 2021)
- “System and method of social control-and-use of IoT device, control server supporting social control-and-use of IoT device and mobile device used for social control-and-use of IoT device”
U.S. Patent Pending 17/562137 (December 27, 2021)
- “A System, Method, Architecture for Social Control-and-Use of Devices”
Korea Patent Pending 10-2021-0155437 (November 12, 2021)

7 Awards & Honors

Best Demo Award, ACM MobiSys 2019 Jun. 2019

8 Academic Services

IMWUT 2022 May Reviewer
 IMWUT 2021 May Reviewer
 • Special Recognition for an Outstanding Review
 ACM TIoT 2020 Reviewer
 IMWUT 2020 May Reviewer
 ACM MobiSys 2019, Seoul, South Korea Student Volunteer
 • Publicized the conference to researchers in the Asia region
 • Managed the conference website
 • Organized social events for conference attendees
 IEEE MDM 2017, Daejeon, South Korea Student Volunteer

9 Teaching Experiences

TA, Operating Systems and Lab Fall, 2020
TA, Operating Systems and Lab Spring, 2020
 • Built a reference implementation of FAT file system for PintOS-KAIST
TA, Mobile-IoT Systems for Computational Social Science Fall, 2019
Head TA, Introduction to Programming (Z) Spring 2019
 • Completely redesigned the CS101 course to focus on a hands-on experience.
 • Built three multiplayer game projects that are designed to teach iterative refinement.
 • Succeeded in transforming a novice into a competent AI programmer.

TA, Operating Systems and Lab	Fall 2018
• Introduced a face-to-face demo-based project evaluation.	
TA, Introduction to Programming	Spring 2018
• Built a new assignment based on a snake game, comprising game engine implementation (single-player and multi-player) and an AI agent design.	
TA, Operating Systems and Lab	Fall 2017
TA, Programming Principle	Spring 2017

10 Personal Experiences	Summer Student, University of California, Santa Cruz	Jul. – Aug. 2015
	Next Journalism School, Google & Bloter	Feb. 2015
	Reporter, KAIST Times	Mar. 2013 – Mar. 2014
	Conference Organizing Committee, ICISTS-KAIST	Mar. 2013 – Aug. 2014
	• Organized the Asia's biggest student-driven international conference ('13, '14).	

11 Technical Skills

Programming languages

- **Python (Proficient)**
Experience in: Backend, Data Analysis, ML/AI, Computer Vision, and more.
- **Experience in:** Kotlin, Java, Scala, C/C++, JavaScript

Hardware prototyping

- **Tiny devices:** Arduino, Raspberry Pi, Tasmota, Embedded OS (Zephyr)
- **Robotics platforms:** DoubleRobotics Double2

Software prototyping

- **Backend:** Docker, PostgreSQL, MongoDB, MQTT/ZeroMQ/Kafka
- **AI/ML:** Tensorflow, scikit-learn, NLP (nltk, gensim)
- **Mobile/IoT/Web:** Android (Proficient), AOSP, HomeAssistant/OpenHAB, React

Design Tools: Figma, Adobe Suite (Premiere, Photoshop, Illustrator, InDesign)