Alan Dingtian ZHANG
Senior Scientist @ Hyperfine

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Overview: I am a Senior Scientist at Hyperfine, working on human sensing and electromagnetic interference (EMI) suppression technologies for portable magnetic resonance imaging (MRI) systems. I received my Computer Science Ph.D. at Ubicomp Group, Georgia Tech. My Ph.D. thesis is *Ubiquitous Self-Powered Ambient Light Sensing Surfaces* that enable implicit activity detection and explicit interactions on everyday surfaces.

EMPLOYMENT

Present 2021

Hyperfine
Senior Scientist (2022-present)
Research Scientist (2021-2022)
• Leading the research & development of new hardware and software design for EMI cancellation of portable MRI. Developed, evaluated, and deployed core algorithms for EMI removal, which received the U.S. Food and Drug Administration (FDA) 510(k) clearance in 2023. Improved overall image signal-to-noise ratio (SNR) against various types of EMI sources compared to the previous software. Invented patent-pending hardware and software solutions of EMI cancellation in low-field MRI.
• Leading the research & development of MR-compatible motion sensing technologies for patient motion tracking and compensation. Explored various sensing modalities for subtle (e.g., respiratory, cardiovascular) and bulk motion tracking, developed functional prototypes, and evaluated their field compatibility and usability.

`Hardware prototyping` `Human sensing` `Signal processing` `Machine learning`

2021 2015

Georgia Institute of Technology, School of Interactive Computing
Graduate Research Assistant. Faculty Collaborators: Gregory D. Abowd, Canek Fuentes-Hernandez, Thad Starner, Sauvik Das, and Hyunjoo Oh.
• Founding fellow of the computational materials (COSMOS) project at Georgia Tech, an unconventional post-Moore computing initiative to weave computation into the fabric of everyday surfaces and address its grand challenges such as scale, power, form factors, and privacy.
• Demonstrated novel techniques for ubiquitous and wearable computing through 10+ peer-reviewed publications, patents, and awards on self-powered computational surfaces and activity/gesture recognition.

`Ubiquitous computing` `Human-computer interaction` `Self-powered sensing` `Rapid prototyping` `Machine learning`

Summer 2018

Facebook
PhD Intern. Groups Team.
• Researched machine learning algorithms for building meaningful connections between users and groups. Developed features, metrics, and models that improved existing content recommendation performance. Visualized and analyzed key factors in predicting user's online social behavior.

`Machine learning` `Ranking` `Content recommendation` `Feature engineering` `Big data`

Summer 2017

Disney Research
Research Associate. Collaborators: Alanson Sample and Scott Hudson.
• Worked on design and fabrication of interactive board books with embedded interactivity. Developed a fabrication pipeline that produces paper-based board books with a variety of sensing and actuation elements for storytelling.

`3D printing` `Paper electronics` `Sensing & actuation`

Summer 2016

Technicolor Research
Research & Innovation Intern. Mentor: Kent Lyons.
• Explored continuous finger tracking with 5 degrees of freedom using magnetic sensing and permanent magnets. Developed a wearable prototype for passive sensing of finger-mounted magnets with wrist-worn magnetometers. Researched mathematical models based on over-constrained nonlinear equations.

`Finger-tracking` `Wearable input` `Magnetic tracking`

Summer 2014

2Dme
Technical Co-Founder.
• Co-founded the startup and coordinated the effort in admission to the incubator Bizdom. Led development of 2D avatar-based chatting technology featuring real-time facial expression syncing. Extracted facial feature points from live video and developed mapping mechanisms to animated vector graphic faces in Unity.

`Entrepreneurship` `Mixed-reality` `Face-driven animation`

EDUCATION

2021 2015	**Georgia Institute of Technology,** School of Interactive Computing Ph.D. Computer Science Ubicomp Group. Advisor: Dr. Gregory D. Abowd Thesis: Ubiquitous self-powered ambient light sensing surfaces
2015 2013	**Georgia Institute of Technology** M.S. Computer Science
2013 2009	**Tsinghua University** B.S. Computer Science and Technology

AWARDS

2021	Distinguished Paper Award at ACM Ubicomp 2021
2020	Center for Research into Novel Computing Hierarchies (CRNCH) Ph.D. Research Fellowship

RESEARCH PROJECTS

COMPUTATIONAL PHOTODETECTORS FOR SELF-POWERED ACTIVITY SENSING (npj FLEXIBLE ELECTRONICS '22)   2020 - 2021

Computational photodetectors use in-sensor computation to extract mid-level vision features in the analog domain for low power and latency ubiquitous sensing applications. They are designed to compress higher-dimensional signal space to a single analog output, encoding specific information related to the motion, position, and orientation of objects without capturing or storing digital images. We adopt emerging organic semiconductor (OSC) devices in developing privacy-compliant large-scale sensing surfaces for implicit activity detection and explicit user interactions.

Computational material | In-sensor computation | Activity recognition | Interactive surfaces

OptoSense: TOWARDS UBIQUITOUS SELF-POWERED AMBIENT LIGHT SENSING SURFACES (UBICOMP '20)   2018 - 2020

OptoSense is a general-purpose self-powered sensing system which senses ambient light at the surface level of everyday objects to infer user activities and interactions. We presented a design framework of ambient light sensing surfaces, enabling implicit activity sensing and explicit interactions in a wide range of use cases with varying sensing dimensions (0D, 1D, 2D), fields of view (wide, narrow), and perspectives (egocentric, allocentric), which supports applications ranging from object use and indoor traffic detection, to liquid sensing and multitouch input.

Computational material | Activity recognition | Multitouch and hover input | Self-powered sensing

SERPENTINE: A SELF-POWERED REVERSIBLY DEFORMABLE CORD SENSOR FOR HUMAN INPUT (CHI '19)   2018 - 2019

Serpentine is a self-powered reversibly deformable cord capable of sensing a variety of human input such as pluck, twirl, stretch, pinch, wiggle, and twist. The sensor operates without external power source based on the principle of Triboelectric Nanogenerators (TENG), and can be employed in wearable and playful interfaces. We employed machine learning for gesture recognition and demonstrated applications such as smart garments and game controllers.

Computational material | Wearable gesture input | Machine learning | Self-powered sensing

SKILLS

Research	Sensing, signal processing, machine learning, ubiquitous devices, interaction design & prototyping
Software	Python (PyTorch, Jupyter, OpenCV, Open3D), C/C++, Java (Android), C# (Unity3D), Javascript, Docker
Hardware	Electronic prototyping (EagleCAD), embedded systems (ARM), Inkjet & 3D printing, robotic arms (Epson)

TEACHING EXPERIENCE

Teaching Assistant	Human-Computer Interaction — Summer 2020 Mobile and Ubiquitous Computing — Fall 2019, Fall 2018, Spring 2015 Computer Graphics — Fall 2015 Data and Visual Analytics — Spring and Fall 2014

MICELLANEOUS

Piano	Certified nonprofessional pianist (Grade 9), multiple-time choir accompanist
Outdoor Activity & Martial Arts	Avid hobbyist of snowboarding, hiking, swimming, and Muay Thai kickboxing
Language	Mandarin (Native), English (Fluent)

Publications

[1]   **Zhang, D.**, Fuentes-Hernandez, C., Vijayan, R., Zhang, Y., Li, Y., Park, J.W., Wang, Y., Zhao, Y., Arora, N., Mirzazadeh, A., Do, Y., Cheng, T., Swaminathan, S., Starner, T., Andrew, T.L. and Abowd, G.D.. 2022. Flexible Computational Photodetectors for Self-Powered Activity Sensing. *Npj Flexible Electronics* **6**(1), 1-8 (2022).

[2]   Do, Y., Park, J.W., Wu, Y., Basu, A., **Zhang, D.**, Abowd, G.D. and Das, S.. 2022. Smart Webcam Cover: Exploring the Design of an Intelligent Webcam Cover to Improve Usability and Trust. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*. IMWUT '21. ACM, New York, NY.

[3]   Park, J.W., Cheng, T., **Zhang, D.**, Zhao, Y., Arriaga, R.I., Starner, T., Gupta, M., Zhang, Y. and Abowd, G.D.. 2021. Applying Compute-proximal Energy Harvesting to Develop Self-Sustained Systems for Automobiles. *IEEE Pervasive Computing*.

[4]   **Zhang, D.**, Park, J.W., Zhang, Y., Zhao, Y., Wang, Y., Li, Y., Bhagwat, T., Chou, W.F., Jia, X., Fuentes-Hernandez, C., Kippelen, B., Starner T. and Abowd, G.D.. 2020. OptoSense: Towards Ubiquitous Self-Powered Ambient Light Sensing Surfaces **(Distinguished Paper Award)**. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*. IMWUT '20. ACM, New York, NY.

[5]   Waghmare, A., Xue, Q., **Zhang, D.**, Zhao, Y., Mittal, S., Arora, N., Byrne, C., Starner, T. and Abowd, G.D.. 2020. UbiquiTouch: Self sustaining ubiquitous touch interfaces. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*. IMWUT '20. ACM, New York, NY.

[6]   Shahmiri, F., Chen, C., Waghmare, A., **Zhang, D.**, Mittal, S., Zhang, S.L., Wang, Y.C., Wang, Z.L., Starner, T. and Abowd, G.D.. 2019. Serpentine: A self-powered reversibly deformable cord sensor for human input. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. CHI '19. ACM, New York, NY.

[7]   Reyes, G., **Zhang, D.**, Ghosh, S., Shah, P., Wu, J., Parnami, A., Bercik, B., Starner, T., Abowd, G.D. and Edwards, W.K.. 2016. Whoosh: non-voice acoustics for low-cost, hands-free, and rapid input on smartwatches. In *Proceedings of the 2016 ACM International Symposium on Wearable Computers*. ISWC '16. ACM, New York, NY.

[8]   MacIntyre, B., **Zhang, D.**, Jones, R., Solomon, A., Disalvo, E. and Guzdial, M.. 2016. Using projection ar to add design studio pedagogy to a cs classroom. In *2016 IEEE Virtual Reality (VR)*.

[9]   Zhang, C., Guo, A., **Zhang, D.**, Li, Y., Southern, C., Arriaga, R.I. and Abowd, G.D.. 2016. Beyond the touchscreen: an exploration of extending interactions on commodity smartphones. In *ACM Transactions on Interactive Intelligent Systems (TiiS)*. TiiS '16. ACM, New York, NY.

[10]   Zhang, C., Guo, A., **Zhang, D.**, Southern, C., Arriaga, R. and Abowd, G.D.. 2015. Beyondtouch: Extending the input language with built-in sensors on commodity smartphones. In *Proceedings of the 20th International Conference on Intelligent User Interfaces* (pp. 67-77).

[11]   Davis, N.M., Popova, Y., Sysoev, I., Hsiao, C.P., **Zhang, D.** and Magerko, B.. 2014. Building Artistic Computer Colleagues with an Enactive Model of Creativity. In *2014 International Conference on Computational Creativity (ICCC)*.

Patents

[1]   Hamidi-Rad, S., Lyons, K., and **Zhang, A.**. 2020. Method and apparatus for providing immersive reality content.

[2]   Shahmiri, F., Chen, C., Abowd, G.D., Mittal, S., Starner, T., Wang, Y.C., Wang, Z.L., **Zhang, D.**, Zhang, S.L., and Waghmare, A.. 2020. Flexible sensing interface systems and methods.

[3]   Hamidi-Rad, S., Lyons, K., Pushparaja, A., Agarwal, G., **Zhang, A.**, Kanchinadam, T., and Khurana, R.. 2018. Determining full-body pose for a virtual reality environment.