Dingtian **Zhang**

Research Scientist @ Hyperfine

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Overview: I am a Research Scientist at Hyperfine working on human sensing and machine learning. 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**
Research Scientist
Developing novel human sensing technologies for portable magnetic resonance imaging (MRI) systems.

2021 2015 | **Georgia Institute of Technology,** School of Interactive Computing
Graduate Research Assistant Faculty Collaborators: Gregory D. Abowd, Thad Starner, Sauvik Das, Canek Fuentes-Hernandez (ECE), Hyunjoo Oh (Design), Blair MacIntyre, and Melody Jackson.
Explored novel techniques for computational material, ubiquitous and wearable computing, and machine learning.

Summer 2018 | **Facebook**
PhD Intern. Groups Team.
Explored building meaningful connections between users and groups with applied machine learning techniques. Developed features, metrics, and algorithms 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.
Explored design and fabrication of interactive board books with embedded sensing and actuation. See "BlockPrint" project for detailed description.
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

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 | **Georgia Institute of Technology,** School of Interactive Computing
Ph.D. Computer Science
Ubicomp Group. Advisor: *Dr. Gregory D. Abowd*

2015 | **Georgia Institute of Technology**
M.S. Computer Science

2013 | **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

Projects

Computational Photodetectors For Self-Powered Activity Sensing 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. 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

UbiquiTouch: Self Sustaining Ubiquitous Touch Interfaces (Ubicomp '20) 2019 - 2020

UbiquiTouch is an ultra low power wireless touch interface. With an average power consumption of less than 50 uW, UbiquiTouch can run on energy harvested from ambient light. It encodes touch events on a printable surface and passively communicates to a nearby smartphone using ambient FM backscatter. This approach minimizes the need for additional infrastructure for communication.

Computational Material | Ubiquitous touch 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.

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

Whoosh: Non-voice Acoustics for Low-Cost, Hands-Free, and Rapid Input on Smartwatches (ISWC '16) 2015 - 2016

Whoosh is an interaction technique using non-voice acoustic input including blows, sip-and-puff, and directional air swipes to enable low-cost, hands-free, and rapid input on smartwatches. Inspired by the design of musical instruments, we also developed a 3D-printed custom watch case to introduce directional and bezel blows without additional electronics. With the variety of vocabulary, Whoosh enables real-time discreet microinteractions on smartwatch.

Wearables | Machine learning | Acoustic sensing

Skills

Software	Machine learning (including deep learning), signal processing, wearable & mobile development, mixed reality
Programming	Python (Numpy, Scipy, PyTorch, Keras, OpenCV), C++, Java, C#, SQL, PHP, Javascript
Hardware	Electronic prototyping, embedded systems, circuit design & fabrication, 2D and 3D additive manufacturing

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, surfing, hiking, Muay Thai, and kickboxing
Language	Mandarin (Native), English (Fluent), Russian (Basic)

Publications

[1] 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*.

[2] **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. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*. IMWUT '20. ACM, New York, NY. **Distinguished Paper Award.**

[3] 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.

[4] 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.

[5] 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.

[6] 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)*.

[7] 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.

[8] 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] Lyons, K., **Zhang, A.**, and Khurana, R.. 2018. Method and apparatus for providing a virtual reality scene.

[4] 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.