

# Bing Zhou

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## RESEARCH AREA

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- Human motion generation, mobile computing and perception, especially in the applications of animations and content creation for augmented reality.

## EMPLOYMENT

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- **Snap Research** New York, NY  
Staff Research Engineer Oct 2024 - Present  
Senior Research Engineer Oct 2021 - Oct 2024
- **IBM Research** Yorktown Heights, NY  
Research Staff Member May 2019 - Oct 2021  
Research Intern May 2018 - Aug 2018

## EDUCATION

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- **Stony Brook University** Stony Brook, NY  
Ph.D. in Electrical and Computer Engineering Aug 2014 – May 2019
- **University of Chinese Academy of Sciences** Beijing, China  
M.S. in Electronic and Communication Engineering Sept 2011 – May 2014
- **University of Science and Technology of China** Hefei, China  
B.S. in Applied Physics (School of the Gifted Young) Sept 2007 – May 2011

## HONORS AND AWARDS

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- Best Paper Award, Systems Track, IEEE ICHI IEEE ICHI, 2021
- Best Student Paper Award, SIGBio ACM-BCB ACM BCB, 2021
- Outstanding Technical Achievement Award IBM Research, 2021
- Invention Achievement Award IBM Research, 2020
- Outstanding Technical Achievement Award IBM Research, 2019
- Entrepreneur Challenge First Prize Stony Brook University, 2019
- Finalist Award, Hackathon@CEWIT Stony Brook University, 2018
- Finalist Award, Hackathon@CEWIT Stony Brook University, 2017
- NSF Student Travel Grant Award ACM MobiCom, 2017
- ACM SigMobile Travel Grant Award ACM SenSys, 2017

## SELECTED PUBLICATIONS AND PREPRINTS

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- [1] Riku Arakawa, **Bing Zhou\***, Gurunandan Krishnan, Mayank Goel, and Shree Nayar MI-Poser: Human Body Pose Tracking using Magnetic and Inertial Sensor Fusion with Metal Interference Mitigation. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT'23). [\* Corresponding author]
- [2] Qijia Shao, Jian Wang, **Bing Zhou**, Vu An Tran, Gurunandan Krishnan and Shree Nayar N-euro Predictor: A Neural Network Approach for Smoothing and Predicting Motion Trajectory. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT'23).
- [3] Chenhan Xu, **Bing Zhou\***, Gurunandan Krishnan and Shree Nayar. AO-Finger: Hands-free Fine-grained Finger Gesture Recognition via Acoustic-Optic Sensor Fusing. The ACM CHI Conference on Human Factors in Computing Systems (CHI'23). [\* Corresponding author]
- [4] **Bing Zhou**, Matias Aiskovich and Sinem Guven Kaya. Sparse depth completion with mesh deformation optimization. In *arXiv preprint arXiv:2112.05498*, 2021.
- [5] Zongxing Xie, **Bing Zhou**, Xi Cheng, Elinor Schoenfeld and Fan Ye. VitalHub: robust, non-touch multi-user vital signs monitoring using depth camera-aided UWB. In *2020 IEEE International Conference on Healthcare Informatics (ICHI)*. IEEE, 2021. (**Best Paper Award**)

- [6] Zongxing Xie, **Bing Zhou**, and Fan Ye. Signal quality detection towards practical non-touch vital sign monitoring. In *Proceedings of the 12th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics*. ACM, 2021. (**Best Student Paper Award**)
- [7] **Bing Zhou**, Zongxing Xie, Yinuo Zhang, Jay Lohokare, Ruipeng Gao, and Fan Ye. Robust human face authentication leveraging acoustic sensing on smartphones. *IEEE Transactions on Mobile Computing (TMC)*, 2021.
- [8] **Bing Zhou**, Matias Aiskovich and Sinem Guven Kaya. Acoustic sensing-based hand gesture detection for wearable device interaction. In *arXiv preprint arXiv:2112.05986*, 2021.
- [9] Kaya Sinem Güven, **Bing Zhou**, Rohan R. Arora, Noah Zheutlin, Gerard Vanloo, and Elif K. Eyigoz. Dynamic content generation for augmented technical support. In *2021 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*, 2021.
- [10] **Bing Zhou** and Sinem Guven Kaya. Fine-grained visual recognition in mobile augmented reality for technical support. In *IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, 2020. (**Selected for IEEE TVCG special issue, 18 out of 302, acceptance rate 6%.**)
- [11] **Bing Zhou**, Mohammed Elbadry, Ruipeng Gao, and Fan Ye. Towards scalable indoor map construction and refinement using acoustics on smartphones. *IEEE Transactions on Mobile Computing (TMC)*, 2019.
- [12] **Bing Zhou**, Zongxing Xie, and Fan Ye. Multi-modal face authentication using deep visual and acoustic features. In *IEEE International Conference on Communications*. IEEE, 2019.
- [13] Ruipeng Gao, **Bing Zhou**, Fan Ye, and Yizhou Wang. Fast and resilient indoor floor plan construction with a single user. *IEEE Transactions on Mobile Computing (TMC)*, 2018.
- [14] **Bing Zhou**, Jay Lohokare, Ruipeng Gao, and Fan Ye. Echoprint: Two-factor authentication using vision and acoustics on smartphones. In *Proceedings of the 24th Annual International Conference on Mobile Computing and Networking (MobiCom)*, 2018. (**Acceptance rate: 22.4%**)
- [15] **Bing Zhou**, Sinem Guven, Shu Tao, and Fan Ye. Poster: Pose-assisted active visual recognition in mobile augmented reality. In *Proceedings of the 24th Annual International Conference on Mobile Computing and Networking*, 2018.
- [16] Mohammed Elbadry, **Bing Zhou**, Fan Ye, Peter Milder, and YuanYuan Yang. Poster: A raspberry pi based data-centric mac for robust multicast in vehicular network. In *Proceedings of the 24th Annual International Conference on Mobile Computing and Networking*, 2018.
- [17] **Bing Zhou**, Mohammed Elbadry, Ruipeng Gao, and Fan Ye. Demo: Acoustic sensing based indoor floor plan construction using smartphones. In *Proceedings of the 23rd Annual International Conference on Mobile Computing and Networking*, pages 519–521. ACM, 2017.
- [18] **Bing Zhou**, Mohammed Elbadry, Ruipeng Gao, and Fan Ye. Battracker: high precision infrastructure-free mobile device tracking in indoor environments. In *Proceedings of the 15th ACM Conference on Embedded Network Sensor Systems (SenSys)*, page 13. ACM, 2017. (**Acceptance rate: 17%**)
- [19] **Bing Zhou**, Mohammed Elbadry, Ruipeng Gao, and Fan Ye. Batmapper: acoustic sensing based indoor floor plan construction using smartphones. In *Proceedings of the 15th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys)*, pages 42–55. ACM, 2017. (**Acceptance rate: 18%**)
- [20] Ruipeng Gao\*, **Bing Zhou\***, Fan Ye, and Yizhou Wang. Knitter: fast, resilient single-user indoor floor plan construction. In *INFOCOM 2017-IEEE Conference on Computer Communications*, pages 1–9. IEEE, 2017. (**Equal contribution, acceptance rate: 20.9%**)
- [21] **Bing Zhou** and Fan Ye. Explore hidden information for indoor floor plan construction. In *IEEE International Conference on Communications*, pages 1–6. IEEE, 2017.
- [22] Wenjuan Song, **Bing Zhou**, and Shijie Ni. Intelligent environment monitoring and control system for plant growth. In *International Conference on Mobile Ad-Hoc and Sensor Networks*, pages 473–482. Springer, Singapore, 2017.
- [23] Xianxiang Chen, Xinyu Hu, Ren Ren, **Bing Zhou**, Xiao Tan, Jiabai Xie, Zhen Fang, Yangmin Qian, Huaiyong Li, Lili Tian, et al. Noninvasive ambulatory monitoring of the electric and mechanical function of heart with a multifunction wearable sensor. In *Computer Software and Applications Conference Workshops (COMPSACW), 2014 IEEE 38th International*, pages 662–667. IEEE, 2014.
- [24] Jiabai Xie, Xianxiang Chen, **Bing Zhou**, Xinyu Hu, Xiao Tan, Ren Ren, Yangmin Qian, Huaiyong Li, Lili Tian, and ShanHong Xia. A reconfigurable wireless health monitoring system with undecimated wavelet transform implemented. In *Electronics, Computer and Applications, 2014 IEEE Workshop on*, pages 848–851. IEEE, 2014.
- [25] Xinyu Hu, Xianxiang Chen, Ren Ren, **Bing Zhou**, Yangmin Qian, Huaiyong Li, et al. Portable health monitoring device for electrocardiogram and impedance cardiography based on bluetooth low energy. *Journal of Fiber*

*Bioengineering and Informatics*, 7(3):397–408, 2014.

- [26] Xiao Tan, Xianxiang Chen, Xinyu Hu, Ren Ren, **Bing Zhou**, Zhen Fang, and Shanhong Xia. Emd-based electrocardiogram delineation for a wearable low-power eeg monitoring device. *Canadian Journal of Electrical and Computer Engineering*, 37(4):212–221, 2014.
- [27] Ren Ren, Xian Xiang Chen, Xin Yu Hu, **Bing Zhou**, Xiao Tan, Yu Wang, and Shan Hong Xia. A bluetooth-based portable design device with wireless power module for electrocardiogram and respiration measurement. In *Applied Mechanics and Materials*, volume 441, pages 129–132. Trans Tech Publ, 2014.
- [28] Xinyu Hu, Xianxiang Chen, Ren Ren, **Bing Zhou**, Yangmin Qian, Huaiyong Li, and Shanhong Xia. Adaptive filtering and characteristics extraction for impedance cardiography. *Journal of Fiber Bioengineering and Informatics*, 7(1):81–90, 2014.
- [29] **Bing Zhou**, Xianxiang Chen, Xinyu Hu, Ren Ren, Xiao Tan, Zhen Fang, and Shanhong Xia. A bluetooth low energy approach for monitoring electrocardiography and respiration. In *e-Health Networking, Applications & Services (Healthcom), 2013 IEEE 15th International Conference on*, pages 130–134. IEEE, 2013.
- [30] Xiao Tan, Xianxiang Chen, Ren Ren, Xinyu Hu, **Bing Zhou**, Zhen Fang, and Shanhong Xia. Real-time baseline wander removal in eeg signal based on weighted local linear regression smoothing. In *Information and Automation (ICIA), 2013 IEEE International Conference on*, pages 453–456. IEEE, 2013.

## PATENTS

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- [1] **Bing Zhou**, Shu Tao, and Sinem Guven Kaya. Fine-grained visual recognition in mobile augmented reality. In *U.S. Patent 11,023,730, issued June 1, 2021. (Granted)*
- [2] **Bing Zhou**, Shu Tao, and Sinem Guven Kaya. Active visual recognition in mobile augmented reality. In *U.S. Patent 10,943,401, issued March 9, 2021. (Granted)*
- [3] Hongtan Sun, Larisa Shwartz, Rohit Madhukar Khandekar, Qing Wang, and **Bing Zhou**. Assessing Technical Risk In Information Technology Service Management Using Visual Pattern Recognition. In *US Patent 11,223,642, 11 Jan, 2022. (Granted)*
- [4] **Bing Zhou** and Fan Ye. System and Method Associated with Expedient Determination of Location of One or More Object (s) Within a Bounded Perimeter of 3D Space Based on Mapping and Navigation to a Precise POI Destination Using a Smart Laser Pointer Device. In *U.S. Patent Application 17/055,876, filed July 8, 2021.*
- [5] **Bing Zhou** and Fan Ye. System and Method Associated with User Authentication Based on an Acoustic-Based Echo-Signature. In *U.S. Patent Application 16/754,416, filed October 1, 2020.*
- [6] **Bing Zhou** and Sinem Guven Kaya. System and Method for Depth Map Generation from Sparse Depth Samples in Augmented Reality. In *U.S. Patent No. 17,202,839. 16 Mar. 2021.*
- [7] **Bing Zhou** and Sinem Guven Kaya. System and Method for Automatic 3D Model Generation and Tracking in Augmented Reality. In *U.S. Patent No. 17,101,870. 23 Nov. 2020.*

## RESEARCH EXPERIENCE

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- **Augmented Reality & Computer Vision**

- **Human Egocentric Sensing.** Sense and represent all aspects of your digital self in the virtual/augmented world in real-time using only on-body sensors.
- **Snapcode Scan.** Develop machine learning based Snapcode scanning algorithms which demonstrated high robustness compared to existing snapcode scan feature in Snapchat APP.
- **On-device Visual Recognition.** Build visual recognition pipeline on mobile devices, which enables ultra fine-grained visual recognition in mobile AR for real-time hardware repair status analysis.
- **Depth Prediction.** Develop machine learning models and optimization algorithms for depth prediction from RGB image and sparse depth samples obtained from AR/LiDar for fast 3D environment sensing.
- **3D Reconstruction.** Develop the core algorithms for 3D model reconstruction from AR session meta data, work with engineers to deploy it on IBM cloud as a service.
- **3D Segmentation and Tracking.** Develop algorithms for segmenting hardware components in AR video and generate sparse 3D representation of the component, which is further used for tracking and animation rendering.
- **AR Content Creation.** Consolidate remote assist AR session data and create AR experience at scale for reuse.

- **Mobile Computing & Human Computer Interaction**

- **Human Health Sensing.** I develop wireless sensing systems for indoor human vital sign sensing and activity monitoring. It enables concurrent non-contact multi-user monitoring leveraging depth camera and mmWave/UWB radio sensing.
- **3D Face Authentication.** I design *EchoPrint*, a “FaceID alternative” system, which leverages acoustics and vision for secure user authentication. A two-stream network architecture is designed to take both acoustic and visual features for robust authentication.
- **Device Motion Tracking.** I design *BatTracker*, a sensor fusion algorithm which incorporates inertial and acoustic data for infrastructure-free mobile device tracking. It leverages echoes from nearby objects and uses distance measurements from them to correct error accumulation in inertial based device position prediction.
- **Driver Upper Body Tracking.** I develop a non-contact wireless sensing system for human upper body gesture tracking in driving scenarios. It leverages mmWave signals and machine learning to tracking the head, torso and arms movements when driving.
- **Location Based Services**
  - **Indoor Mapping (Vision).** We propose *Knitter*, a system which extracts floor layout information from single images and inertial data. It uses a multi-hypothesis map fusion framework that updates landmark positions/orientations and accessible areas incrementally according to evidences from each measurement.
  - **Indoor Mapping (Acoustic).** I develop *BatMapper*, a mobile application which leverage acoustics on commodity smartphones for fast, fine-grained and low cost floor plan construction. This project was funded by a Google Faculty Research Award.
  - **AR Indoor Navigation.** I design a software/hardware system for indoor navigation and fast object finding. Augmented reality tracking is used for map building and localization, a Raspberry Pi controlled laser pointer highlights the target object under your voice commands.

## TALKS

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- Paper presentation in IEEE ISMAR’20 Virtual, 2020
- Paper presentation in ACM MobiCom’18 New Delhi, India, 2018
- Demo presentation in ACM MobiCom’17 Snowbird, Utah, USA, 2017
- Paper presentation in ACM MobiSys’17 Niagara Falls, NY, USA, 2017
- Paper presentation in ACM SenSys’17 Delft, The Netherlands, 2017

## PROFESSIONAL ACTIVITIES

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- **Professional Services**
  - **Guest Editor:** Special issue “Sensing Technologies Applied in Mobile Perception and Intelligence” in Sensors journal (IF 3.576). Sensors is the leading international, peer-reviewed, open access journal on the science and technology of sensors.
  - **Guest Editor:** Special issue “Sensing Technologies in Human Centered Computing” in Frontiers in Computer Science journal. Frontiers is the 3rd most cited publisher, with many of the journals ranked as the most influential in their academic fields. (In progress)
  - **Technical Program Committee:** IEEE/ACM CHASE 2022, HEALTHINFO 2022, IEEE CSNT 2022, IEEE CICC 2022.
- **External Reviewer**
  - IEEE Transaction on Mobile Computing (15 reviews)
  - IEEE Internet of Things Journal (4 reviews)
  - IEEE International Conference on Distributed Computing Systems (ICDCS) 2022 (3 reviews)
  - The Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT) 2019 (2 review)
  - Electronics Journal (2 reviews)
  - IEEE Sensors Journal (2 review)
  - IEEE International Symposium on Mixed and Augmented Reality (ISMAR) 2021 (1 review)
  - ACM CHI Conference on Human Factors in Computing Systems 2019 (1 review)
  - IEEE Transactions on Human-Machine Systems (1 review)
  - IEEE Access (1 review)

- IEEE Sensors Letters (1 review)

- **Grant Activity**

- Contributed to proposal ideas and drafting (neither PI or Co-PI) in an awarded NSF grant “Opportunistic Learning on Wheels: Peer-wise Training of Machine Learning Models among Connected Vehicles” 10/1/20-9/30/23.
- PI of the project, wrote proposal and gave presentations (Small Business Development Center, Stony Brook University). Easy-Find: A Comprehensive Solution for Fast Object Finding, Indoor Navigation, and Store Inventory Management. Awarded \$10,000. April, 2019.

## TECHNICAL SKILLS

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- **Programming Language** Python, Java, Swift, MatLab, C, C++, Latex
- **Tools & Libraries** Pytorch, Tensorflow, Keras, Scikit-learn, OpenMVG, OpenMVS, OpenCV, Pandas, Spark

## TEACHING EXPERIENCE

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- **Teaching Assistant**

- Modern Circuit Board Design and Prototyping (ESE323) Stony Brook University, Fall 2018
- Computer Techniques for Electronic Design II (ESE224) Stony Brook University, Spring 2016
- Introduction to Electrical and Computer Engineering (ESE123) Stony Brook University, Fall 2015
- Embedded Microprocessor Systems Design II (ESE381) Stony Brook University, Spring 2015
- Embedded Microprocessor Systems Design I (ESE380) Stony Brook University, Fall 2014