Bing Zhou

 1 Peck Ave - 13B, Rye, NY 10580
✉ bzhou@snapchat.com 📱 +1 631-7216031 🔗 homepage 🎓 google scholar

RESEARCH AREA

- Mobile Computing; Augmented Reality; Human Computer Interaction; Computer Vision.

EMPLOYMENT

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

EDUCATION

- **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

- Best Paper Award, Systems Track, IEEE ICHI 2021.   IEEE ICHI, 2021
- Best Student Paper Award, SIGBio ACM-BCB 2021.   ACM BCB, 2021
- Outstanding Technical Achievement Award   IBM Research, 2021
- Outstanding Technical Achievement Award   IBM Research, 2020
- Invention Achievement Award   IBM Research, 2020
- IBM Research Accomplishment 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

[1] **Bing Zhou**, Matias Aiskovich and Sinem Guven Kaya. Sparse depth completion with mesh deformation optimization. In *arXiv preprint arXiv:2112.05498*, 2021.

[2] 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)**

[3] 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)**

[4] **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.

[5] **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.

[6] 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.

[7] **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%.)**

[8] **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.

[9] **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.

[10] 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.

[11] **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%)**

[12] **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.

[13] 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.

[14] **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.

[15] **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%)**

[16] **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%)**

[17] 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%)**

[18] **Bing Zhou** and Fan Ye. Explore hidden information for indoor floor plan construction. In *IEEE International Conference on Communications*, pages 1–6. IEEE, 2017.

[19] 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.

[20] 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.

[21] 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.

[22] 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.

[23] Xiao Tan, Xianxiang Chen, Xinyu Hu, Ren Ren, **Bing Zhou**, Zhen Fang, and Shanhong Xia. Emd-based electrocardiogram delineation for a wearable low-power ecg monitoring device. *Canadian Journal of Electrical and Computer Engineering*, 37(4):212–221, 2014.

[24] 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.

[25] 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.

[26] **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.

[27] Xiao Tan, Xianxiang Chen, Ren Ren, Xinyu Hu, **Bing Zhou**, Zhen Fang, and Shanhong Xia. Real-time baseline wander removal in ecg signal based on weighted local linear regression smoothing. In *Information and Automation (ICIA), 2013 IEEE International Conference on*, pages 453–456. IEEE, 2013.

Patents

[1] **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.*

[2] **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.*

[3] **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.*

[4] **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.*

[5] **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.*

[6] **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.*

[7] Hongtan Sun, Larisa Shwartz, Rohit Madhukar Khandekar, Qing Wang, and **Bing Zhou**. A system and method to assess technical risk in it service management using visual pattern recognition. In *U.S. Patent No. 95,645,683. 14 Sep. 2019.*

[8] Fan Ye, **Bing Zhou** and Yuanyuan Yang. High precision infrastructure-free mobile device tracking in indoor environments. In *US provisional patent application 62/578,641.*

[9] Fan Ye and **Bing Zhou**. Method for acoustic based accurate, low cost indoor map creation using mobile devices. In *US provisional patent application 62/518,649.*

Research Experience

- **Augmented Reality & Computer Vision**
  - ○ ***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**
  - ○ ***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.

- ○ ***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.
- **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

- Paper presentation in IEEE ISMAR'19 — Virtual, 2019
- Research presentation in IBM Research — Yorktown Heights, NY, 2018
- 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

- **External Reviewer**
  - ○ IEEE Transaction on Mobile Computing
  - ○ IEEE Internet of Things Journal
  - ○ IEEE Access
  - ○ IEEE Sensors Letters
  - ○ Advances in Science, Technology and Engineering Systems Journal
  - ○ The Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT) 2019
  - ○ International Conference on Control, Electronics, Renewable Energy, and Communications (ICCEREC) 2016

- **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, writing proposal and give 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

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

Teaching Experience

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