Bing Zhou

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EDUCATION

- **Stony Brook University** — Stony Brook, NY
  Ph.D. in Electrical and Computer Engineering (Advisor: Dr. Fan Ye) — *August 2014 – Present*
- **University of Chinese Academy of Sciences** — Beijing, China
  M.E. in Electronic and Communication Engineering — *September 2011 – May 2014*
- **University of Science and Technology of China (USTC)** — Hefei, China
  B.S. in Applied Physics (School of the Gifted Young) — *September 2007 – May 2011*

RESEARCH AREA

- **Mobile Computing/Sensing**: smartphone authentication, 3D tracking (SLAM), and human activity sensing.
- **Active Visual Recognition**: fine-grained visual recognition in augmented reality, video recognition.
- **Location Based Services**: indoor map construction, indoor localization/navigation, and context aware services.

PROJECTS

- **Active Visual Recognition in Augmented Reality**: I designed an on-device deep learning pipeline that recognizes *fine-grained* appearance changes of 3D objects. We leverage the 6-DOF device tracking in augmented reality to aggregate multiple views and enhance visual recognition robustness. An iOS-based mobile app was developed to demonstrate its practicality of in AR-assisted hardware repair. *[IBM Research Intern project.]*
- **Smartphone Authentication**: I proposed and implemented a "FaceID alternative" system, which leverages acoustics and vision for secure and convenient user authentication, without requiring any special hardware. It actively emits inaudible acoustic signals from the earpiece speaker to "illuminate" the user's face and authenticates the user by the unique features extracted from the echoes bouncing off the 3D facial contour. *[Published in MobiCom'18.]*
- **Indoor Navigation and Fast Object Finding**: I designed software/hardware system for indoor navigation and fast object finding. Augmented reality tracking is used for map building and localization, a Raspberry Pi based hardware points out the object under your voice commands. *[Entrepreneur Challenge 1st Prize, $10,000 awards.]*
- **Mobile Device Tracking**: I designed 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. *[Published in SenSys'17.]*
- **Indoor Mapping (Acoustics)**: We leverage acoustics on commodity smartphones for fast, fine-grained and low cost floor plan construction. A few minutes' walk can produce fine-grained corridor shapes, detect doors with about 90% precision. Compared to latest work, BatMapper builds fine grained maps of comparable accuracy at 1-2 orders of magnitude less data amounts and user efforts. *[Sponsored by a Google Research Award, published in MobiSys'17.]*
- **Indoor Mapping (Vision)**: We designed a system that 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. *[Published in INFOCOM'17.]*

WORK EXPERIENCE

- **IBM Thomas J. Watson Research Center** — Yorktown Heights, NY
  Research Intern (Project: Active Visual Recognition in Augmented Reality) — *May 2018 - August 2018*

MAJOR PUBLICATIONS

[1] **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'18)*, 2018.

[2] 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.

[3] **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 Networked Sensor Systems (SenSys'17)*, 2017.

[4] **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'17)*, pages 42–55. ACM, 2017.

[5] Ruipeng Gao*(co-primary), **Bing Zhou*(co-primary)**, Fan Ye, and Yizhou Wang. Knitter: Fast, resilient single-user indoor floor plan construction. In *IEEE Conference on Computer Communications (INFOCOM'17)*, pages 1–9. IEEE, 2017.

Filed Patents

[1] **Bing Zhou** and Fan Ye. Smart device controlled laser pointer for fast object finding. In *US provisional patent application xx/xxx,xxx*.

[2] Fan Ye and **Bing Zhou**. Two-factor user authentication using vision and acoustics for smart devices. In *US provisional patent application 62/578,724*.

[3] 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*.

[4] 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*.

Awards

- **Entrepreneur Challenge First Prize**: $10,000 Awards, Stony Brook University
- **Finalist Award**: Hackathon'18 @ CEWIT
- **Finalist Award**: Hackathon'17 @ CEWIT
- **NSF Student Travel Grant Award**: ACM MobiCom'17
- **ACM SigMobile Travel Grant Award**: ACM SenSys'17

Full Publications

[1] 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'18)*, 2018.

[2] 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 (MobiCom'18)*, 2018.

[3] 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 (MobiCom'18)*, 2018.

[4] 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*, 2018.

[5] 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*, page 13. ACM, 2017.

[6] 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*, pages 42–55. ACM, 2017.

[7] 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, IEEE*, pages 1–9. IEEE, 2017.

[8] 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.

[9] 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.

[10] 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.

[11] 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.

[12] 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.

[13] 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.

[14] 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.

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

[16] 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.

[17] 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.

[18] 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.