

# Ming Li

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## Skills

**Languages** Java, C++, Python, Bash, Matlab, C, R.

**Techniques** Digital Signal Processing, Android Programming, Machine Learning, Algorithm Design, Speech Recognition, Computer Vision, Object-Oriented Programming, ROS Robot Programming, Arduino Programming, Game Theory, Git Version Control, LaTeX Writing.

## Research Interests

Machine Learning, Digital Signal Processing, Security and Privacy in Mobile IoT Sensing, Computer Vision, Algorithmic Game Theory, Incentive Mechanism Design, Networks, Crowdsourcing.

## Education

**Colorado School of Mines**  
GOLDEN, USA

**Ph.D. in Computer Science** **GPA: 3.98**  
*Aug. 2015 - Aug. 2020*

**Colorado School of Mines**  
GOLDEN, USA

**M.S. in Computer Science** **GPA: 3.94**  
*Jan. 2014 - May. 2015*

**Peking University**  
BEIJING, CHINA

**B.S. in Geochemistry** **GPA: 3.57**  
*Sep. 2009 - Jul. 2013*

## Projects

### 2019-2020 SpyPhone : EAVESDROPPING ON SMARTPHONE SPEAKERS WITH MOTION SENSORS

- Identified a security issue on smartphones that **motion sensors** (access granted to any app) can **eavesdropping on speakers**.
- Developed an **Android** app to collect motion sensor (accelerometer and gyroscope) data while playing sounds through speakers.
- Reconstructed the high frequency (16,000 Hz) sound information from low frequency (400 Hz) motion data by building **K-SVD dictionaries** and recognized the speech using **Bi-LSTM networks**.
- Utilized: Recurrent Neural Networks, Compressed Sensing, Android Programming.

### 2019-2020 UltraUnlock : SMARTPHONE AUTHENTICATION USING GESTURES IN THE AIR

- Implemented a novel smartphone authentication system so that the user draw gestures in the air to unlock the phone.
- Adopted **active acoustic sensing** technique where the smartphone actively sends near-ultrasound baseband and classified hand gestures using the received modulated signals.
- Extracted **in-phase/quadrature components** using **CIC Decimation filter** and feed the I/Q data to train the **SVM**.
- Utilized: Digital Signal Processing, Machine Learning.

### 2018-2019 MotionVoice : A SPOOF-PROOF VOICE AUTHENTICATION SYSTEM FOR SMARTPHONES

- Proposed a new **voice authentication** system that is immune to **replay attacks** by leveraging the self demodulation and acoustic attenuation effect when sound signals transmitted through human body.
- Designed an Android app to collect the **body-borne vibration** and **sound data** simultaneously.
- Applied signal processing techniques such as syllable separation to sound data and using **sequence-to-sequence LSTM** network on vibration data to identify users.
- Utilized: Machine learning, Digital Signal Processing, Android Programming.

### 2018 DriverDetect : USING ATMOSPHERIC PRESSURE SENSORS TO DETERMINE WHETHER THE USER IS THE DRIVER OR A PASSENGER

- Proposed a new driver detection system based on the fact that each seat in the vehicle is expected to experience differences in **atmospheric pressure** for each vehicle acceleration dynamic.
- Designed a circuit with **Arduino** and **barameters** to test the system.
- Utilized: Arduino programming, Digital Signal Processing.

### 2016-2017 QUAC : QUALITY-AWARE CONTRACT-BASED INCENTIVE MECHANISMS FOR CROWDSENSING

- Design two quality-aware contract-based **incentive mechanisms** for crowdsensing, named QUAC-F and QUAC-I, under full information model and incomplete information model, respectively, which differ in the level of users' information known to the system.
- Mathematically proved that both QUAC-F and QUAC-I are guaranteed to maximize the platform utility while satisfying individual rationality and incentive compatibility.
- Utilized: Algorithm Design, Contract Theory.

### 2016 TurtleBot : USING RTAB-MAP AND A TURTLEBOT TO CREATE A FLOOR MAP

- Used a **TurtleBot** to perform graph-based simultaneous localization and mapping (**SLAM**) by using **RTAB-Map**.
- Programmed speech control and voice feedback on the TurtleBot.
- Utilized: ROS Robot Programming, Computer Vision.

## 2015-2017 SpecWatch : SOLVING ADVERSASIAL SPECTRUM USAGE MONITORING PROBLEM WITH UNKNOWN STATISTICS IN CRNs.

- Modeled the monitoring problem as an **adversarial multi-armed bandit** problem with switching cost.
- Designed an asymptotically optimal online algorithm, termed SPECWATCH, and prove its normalized expected weak regret is  $O(1/\sqrt[3]{T})$ , which converges to 0 as time horizon  $T$  approaches to  $\infty$ .
- Utilized: Algorithm Design, Game Theory.

## Publications

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- Yuhui Zhang, **Ming Li**, Dejun Yang, Jian Tang, Guoliang Xue, and Jia Xu. Trade-off Between Location Quality and Privacy in Crowdsensing: An Optimization Perspective. *IEEE Internet of Things Journal*, 7(4): 3535-3544, 2020.
- Yuhui Zhang, **Ming Li**, Dejun Yang, Guoliang Xue. A Budget Feasible Mechanism for k-Topic Influence Maximization in Social Networks. *IEEE Global Communications Conference (GLOBECOM)*, 2019.
- Yuhui Zhang, **Ming Li**, Dejun Yang, Jian Tang, and Guoliang Xue. Optimizing Location Quality in Privacy Preserving Crowdsensing. *IEEE Global Communications Conference (GLOBECOM)*, 2019.
- Jian Lin, Dejun Yang, **Ming Li**, Jia Xu, and Guoliang Xue. Frameworks for Privacy-Preserving Mobile Crowdsensing Incentive Mechanisms. *IEEE Transactions on Mobile Computing (TMC)*, 17(8): 1851-1864, 2018.
- **Ming Li**, Dejun Yang, Jian Lin, Ming Li, and Jian Tang. SpecWatch: A Framework For Adversarial Spectrum Monitoring With Unknown Statistics. *Computer Networks (COMNET)*, 143: 176-190, 2018.
- Jian Lin, **Ming Li**, Dejun Yang, and Guoliang Xue. Sybil-Proof Online Incentive Mechanisms for Crowdsensing. *IEEE International Conference on Computer Communications (INFOCOM)*, 2438-2446, 2018.
- **Ming Li**, Jian Lin, Dejun Yang, Guoliang Xue, and Jian Tang. QUAC: Quality-Aware Contract-Based Incentive Mechanisms for Crowdsensing. *IEEE International Conference on Mobile Ad Hoc and Sensor System (MASS)*, 72-80, 2017.
- Jian Lin, **Ming Li**, Dejun Yang, Guoliang Xue, and Jian Tang. Sybil-Proof Incentive Mechanisms for Crowdsensing. *IEEE International Conference on Computer Communications (INFOCOM)*, 2017.
- Michael Brown, Colin Marshall, Dejun Yang, **Ming Li**, Jian Lin, Guoliang Xue. Maximizing Capacity in Cognitive Radio Networks Under Physical Interference Model. *IEEE/ACM Transactions on Networking (TON)*, 25(5): 3003-3015, 2017.
- Yuhui Zhang, Dejun Yang, Jian Lin, **Ming Li**, Guoliang Xue, Jian Tang, and Lei Xie. Spectrum Auctions Under Physical Interference Model. *IEEE Transactions on Cognitive Communications and Networking (TCCN)*, 3(4): 719-728, 2017.
- **Ming Li**, Dejun Yang, Jian Lin, Ming Li, and Jian Tang. SpecWatch: Adversarial Spectrum Usage Monitoring in CRNs with Unknown Statistics. *IEEE International Conference on Computer Communications (INFOCOM)*, 2016
- Jian Lin, Dejun Yang, **Ming Li**, Jia Xu, and Guoliang Xue. BidGuard: A Framework for Privacy-Preserving Crowdsensing Incentive Mechanisms. *IEEE Conference on Communications and Network Security (CNS)*, 145-153, 2016.

## Experience

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### Course Instructor

CSCI 358: DISCRETE MATH

Colorado School of Mines

Fall 2019 Semester

### Course Instructor

CSCI 561: THEORY TO COMPUTATION

Colorado School of Mines

Fall 2016 Semester

### Research Assistant

NEMOS LAB

Colorado School of Mines

Fall 2015 - now

## Presentations

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### The 35th Annual IEEE International Conference on Computer Communications

Presenter for "SpecWatch: A framework for adversarial spectrum monitoring with unknown statistics."

San Francisco, USA

Apr. 2016

### The 14th IEEE International Conference on Mobile Ad hoc and Sensor Systems

Presenter for "QUAC: quality-aware contract-based incentive mechanisms for crowdsensing."

Orlando, USA

Oct. 2017