Mobile System and Wearable Computing

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CSE, SUSTech

Mobile System and Wearable System

Cyber-Physical

Health

Human-Machine

Wearables

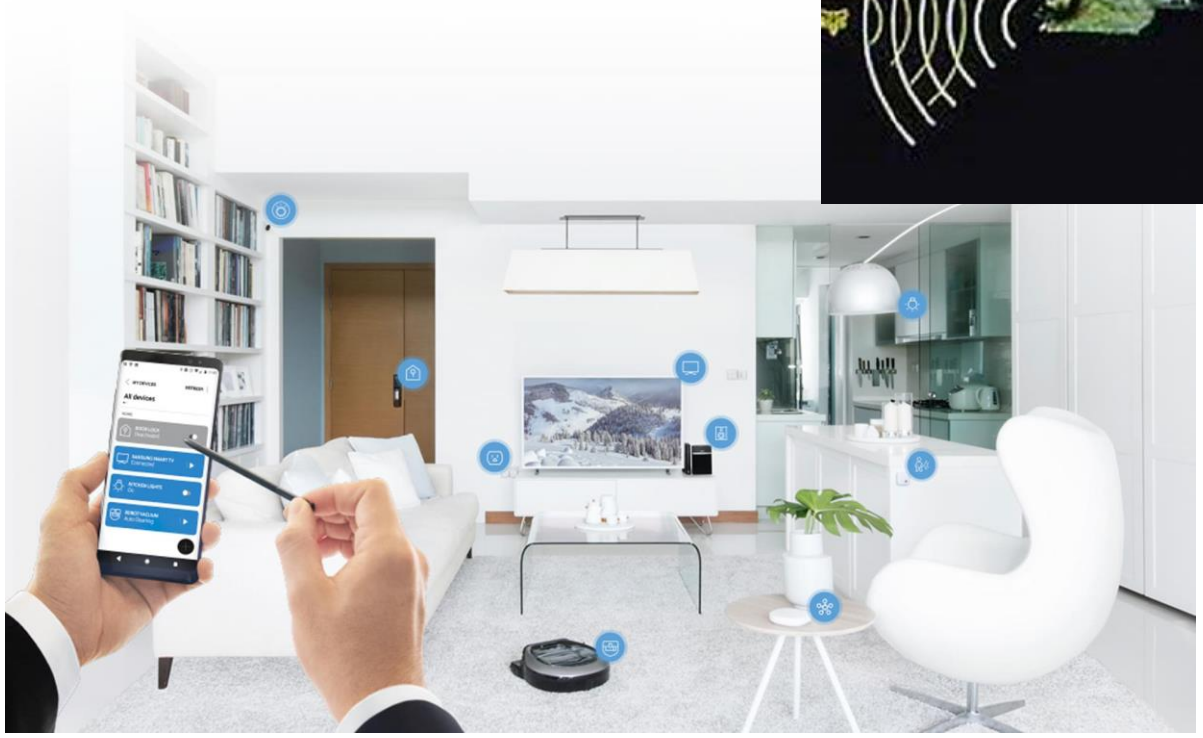
The Sensing Capability of Smartphone

Sensors								
Came-ra: Eye	Audio: Ear	Accele -rator: Speed	GPS: Loca-tion	Gyro: Move-ment	Com-pass: Direc-tion	Distan -ce	Light: Ear	Others

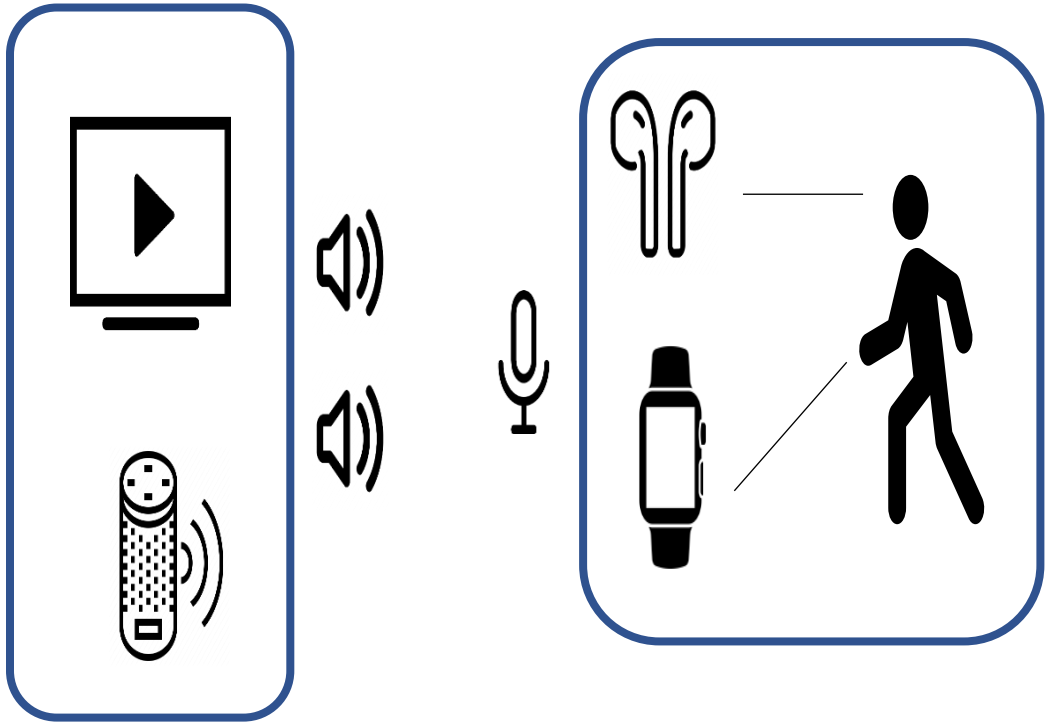
Smartphone becomes the remote control center of the IoT era

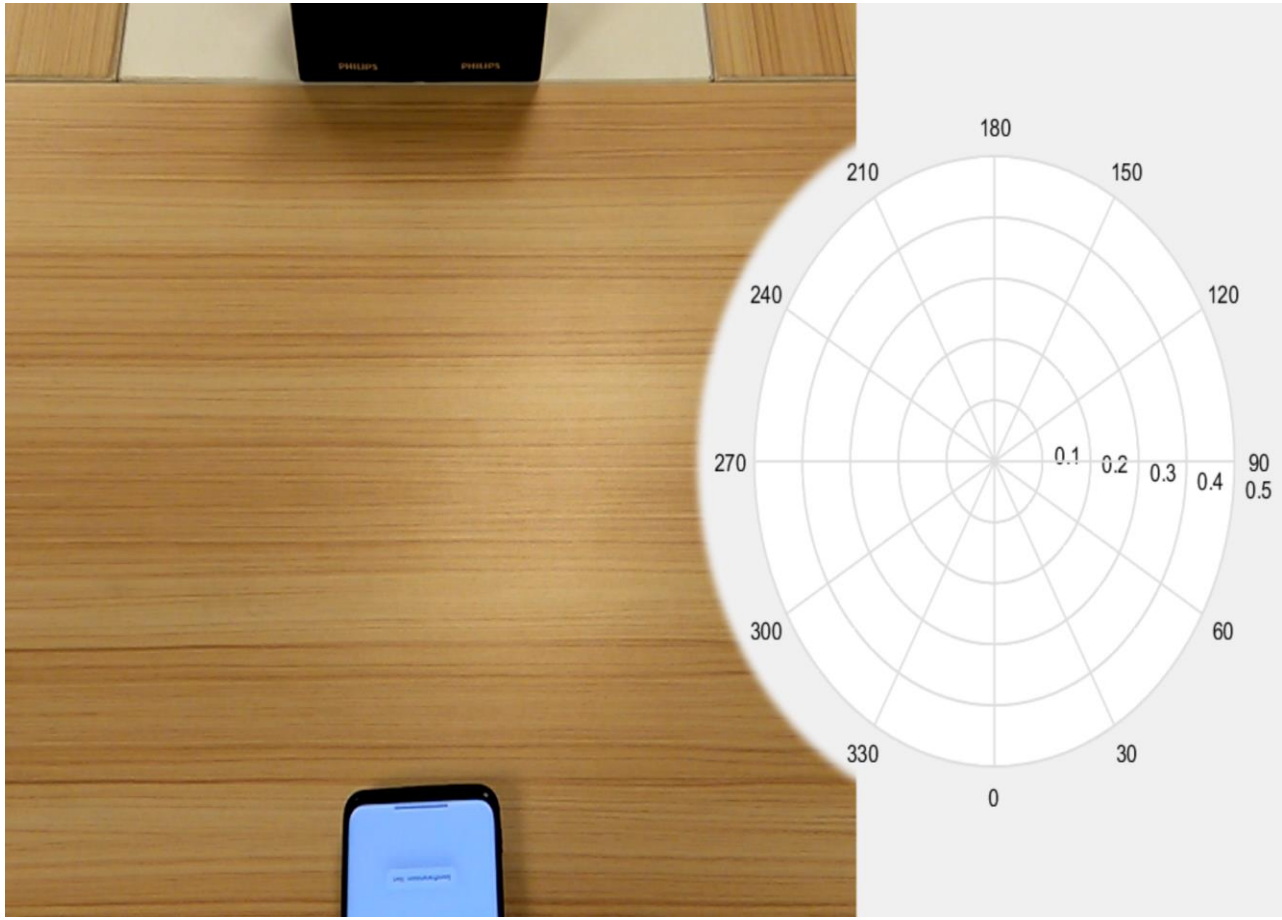
Acoustic Sensing

- Most of smart devices has speakers and microphones
- Applications of acoustic sensing:
  - ✓Localization
  - ✓Tracking
  - ✓Multi-screen interaction
  - ✓Respiration detection
  - ✓Heart rate detection
  - ✓Human-computer interaction

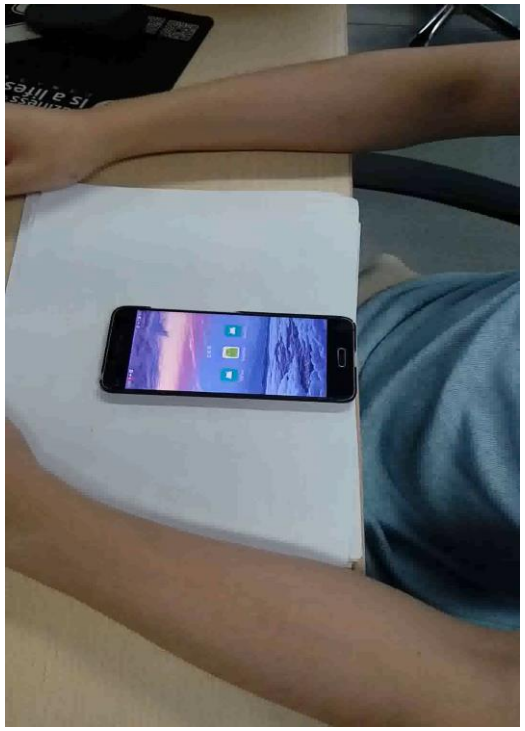


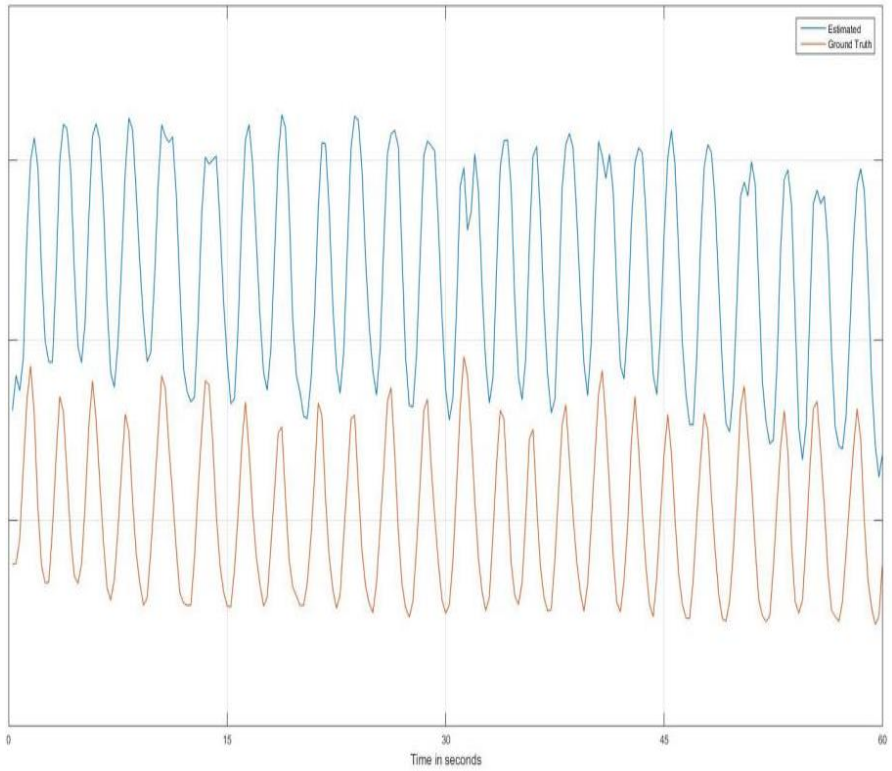
Object Tracking

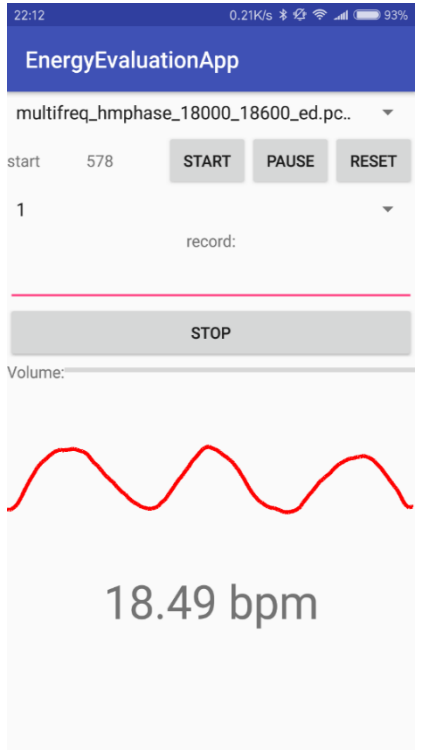




Respiration Detection

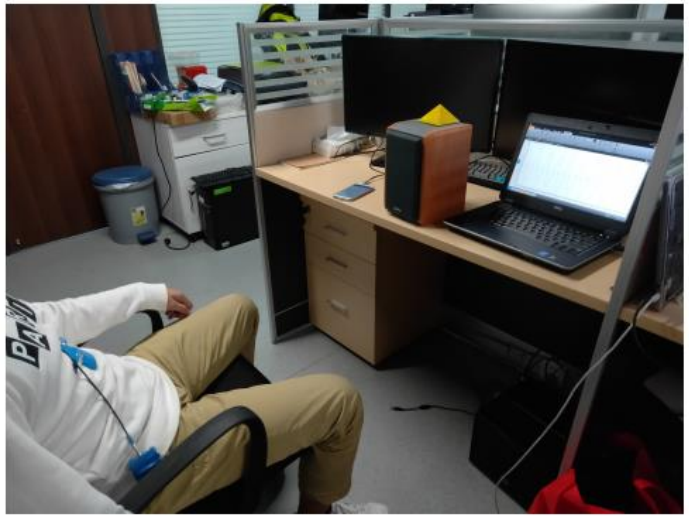


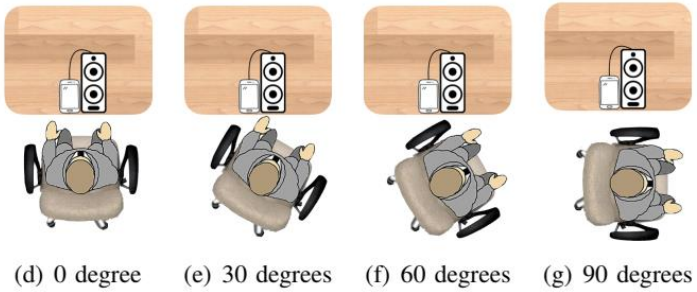


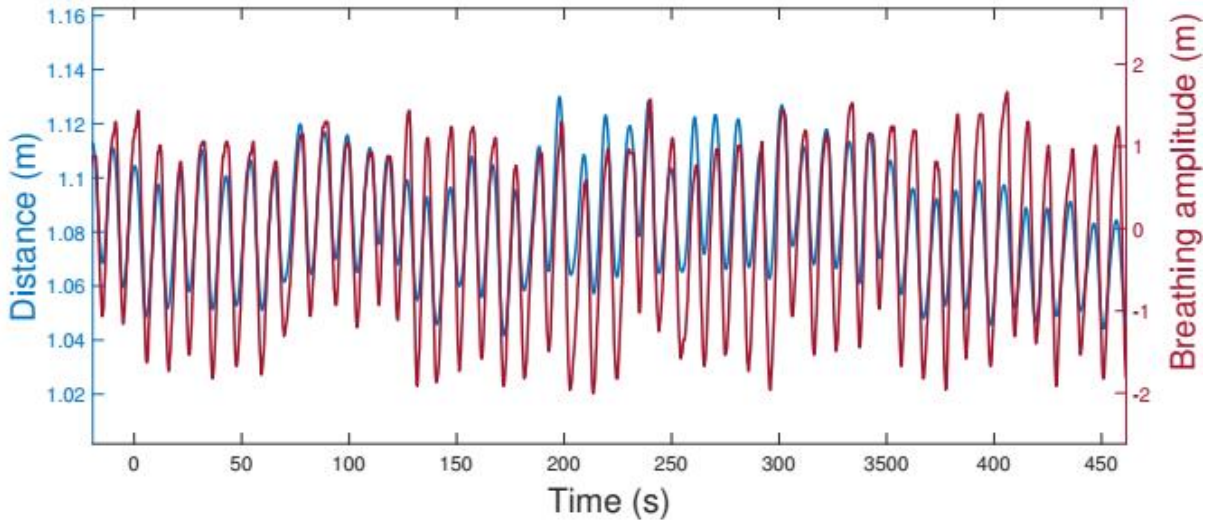


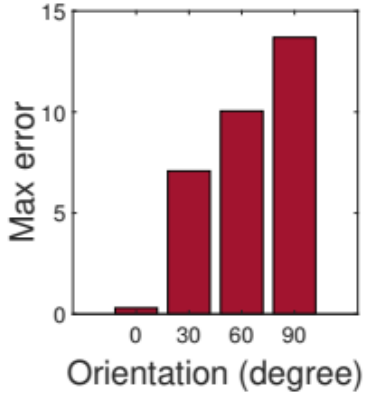
L Ge, **J Zhang**, Multi-Frequency Ultrasound-based Respiration Rate, Computational and Mathematical Methods in Medicine, 2018

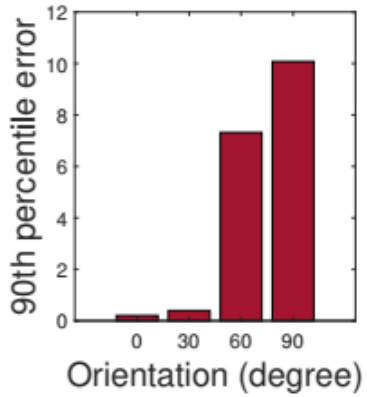
Music-based Respiration Detection

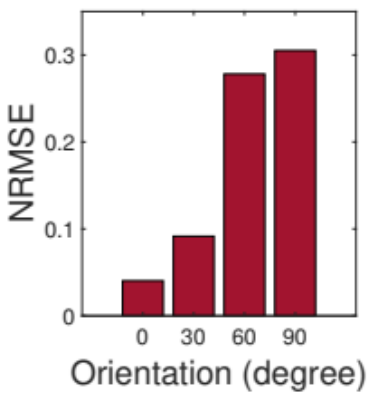












W Xie, **J Zhang**, Q Zhang, Non-contact Respiration Detection Leveraging Music and Broadcast Signals, IEEE Internet of Things Journal, Volume: 8, Issue: 4, pp 2931-2942, 2021

Smart Glass-based Upper Facial Activity Recognition

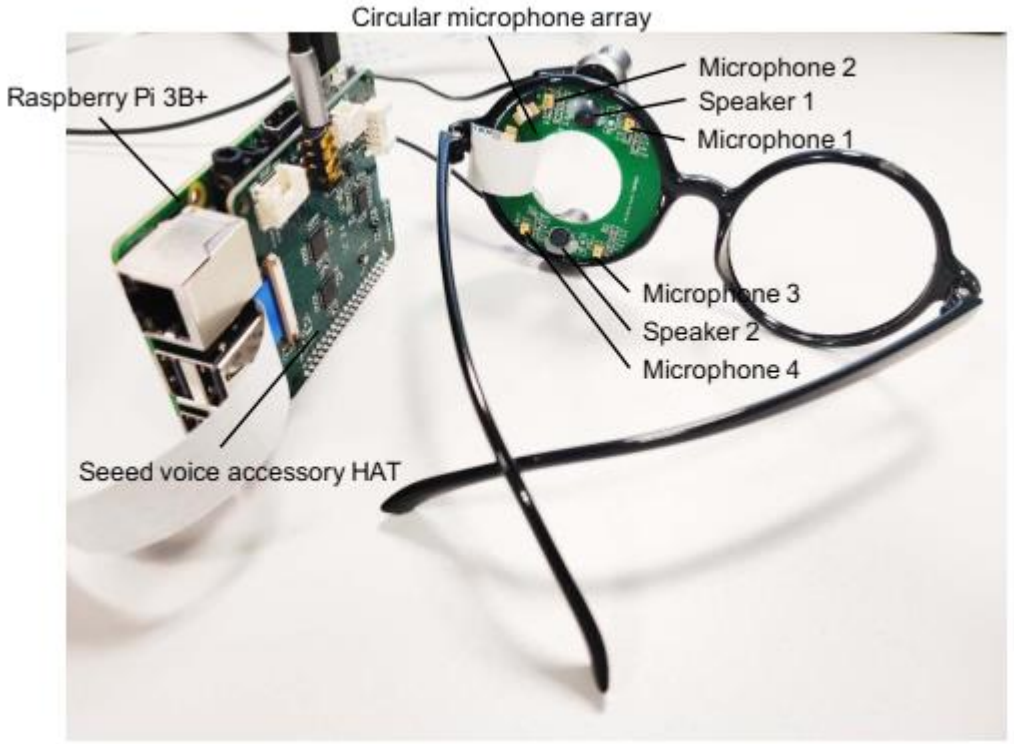
- Existing system:

EPSON Moverio BT-300

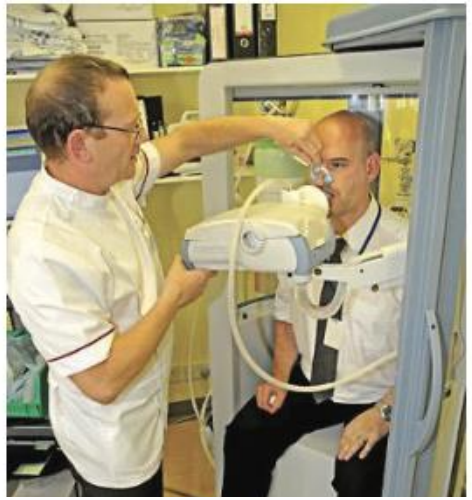
Everysight Raptor

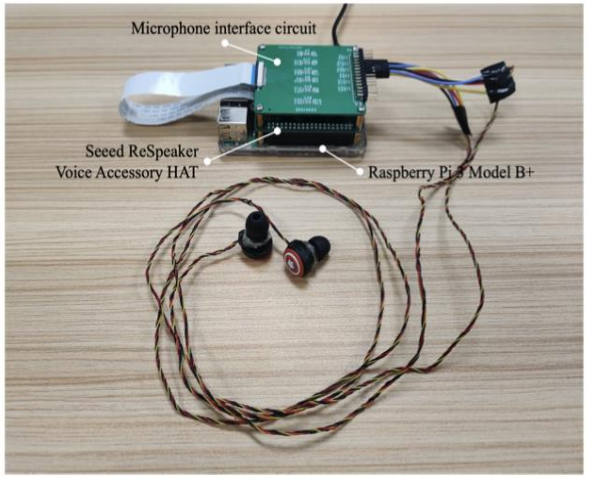
Touchpad

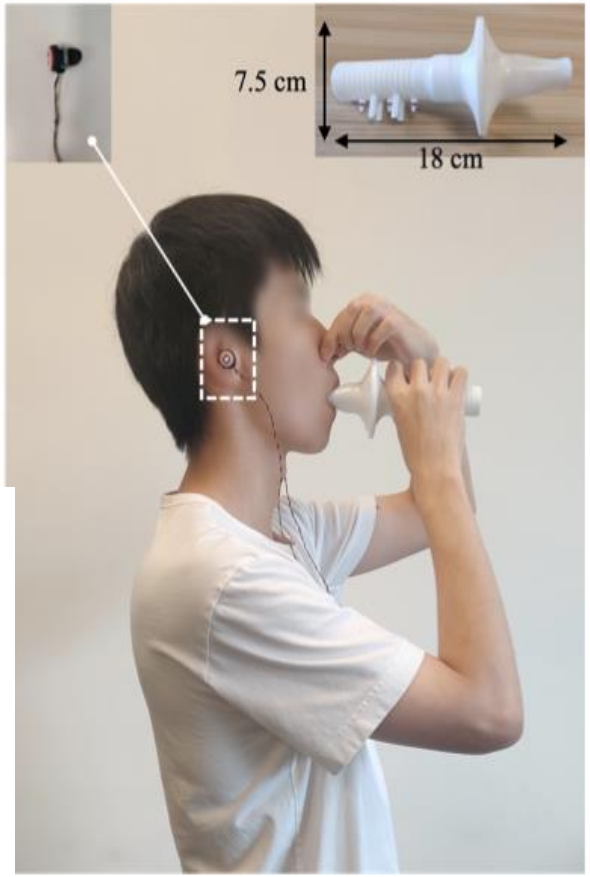
- Our solution:

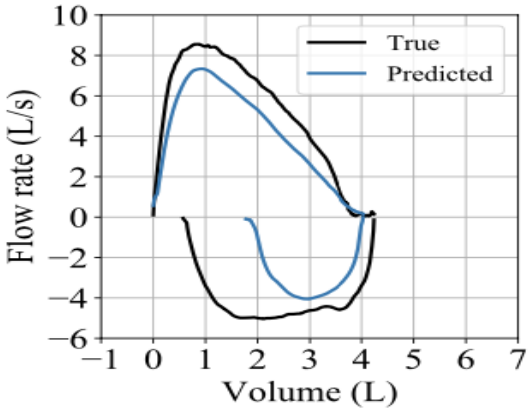


EarSpiro: Earphone-based Full Spirometry for Lung Function Assessment

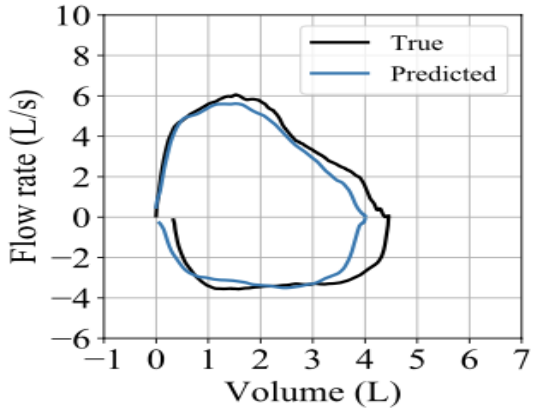




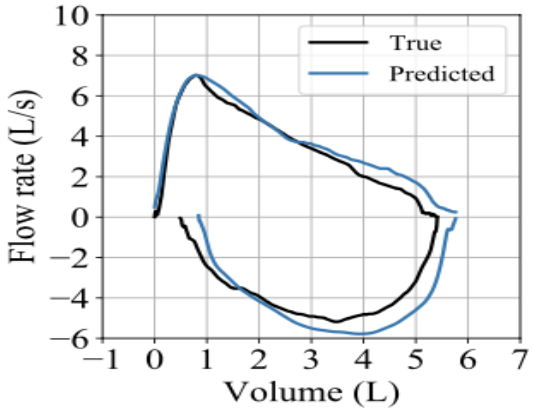




(b) Low 25%.

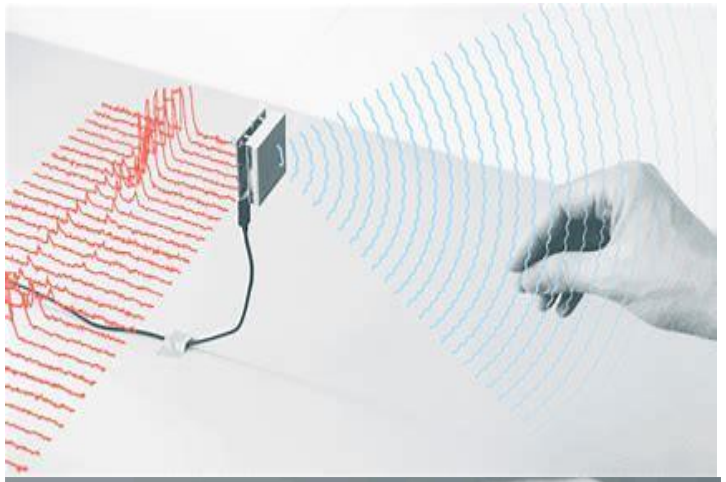


(c) Median.



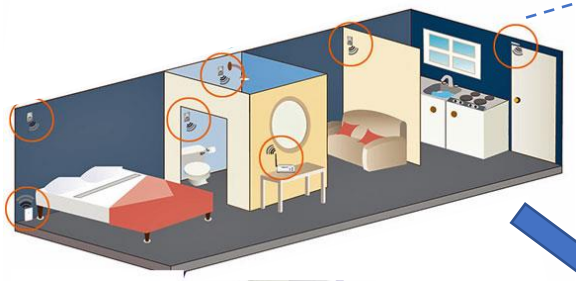
(d) Top 25%.

mmWave-Radar Sensing

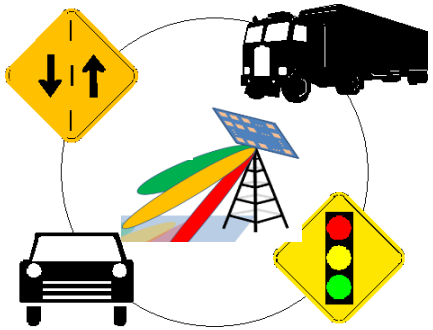


感知终端功能

存在感知
距离检测
动作识别
体征监测



智能家居



智能交通

无线感知平台

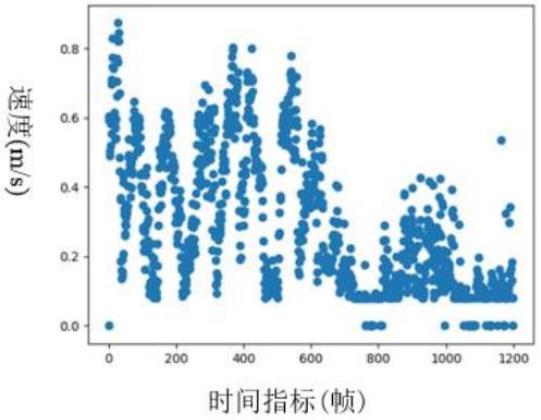
医疗健康

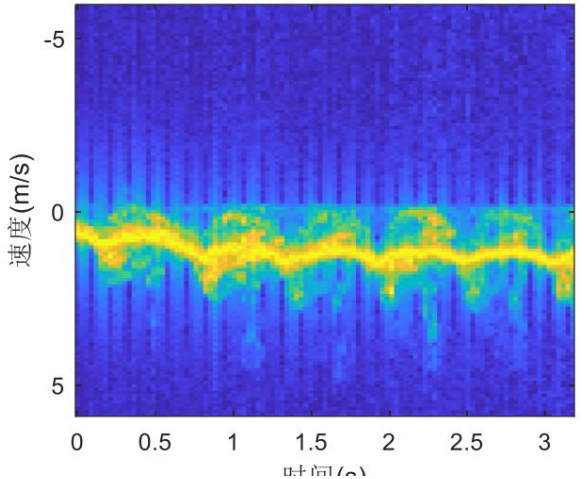
平台功能

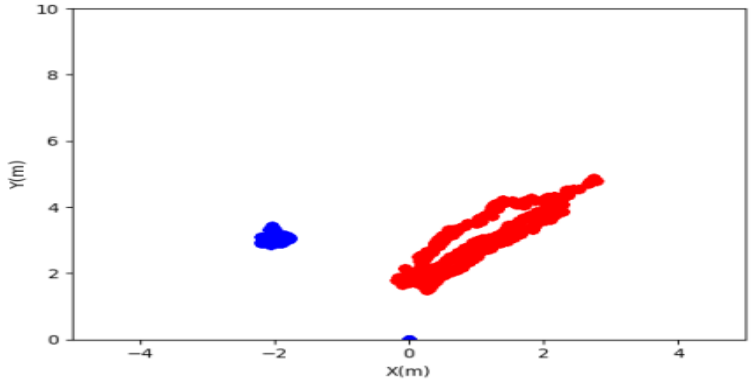
数据存储
大数据分析
模式识别
趋势分析
异常检测

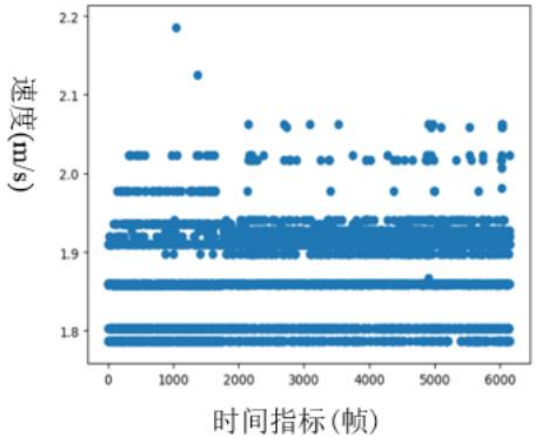
工业检测

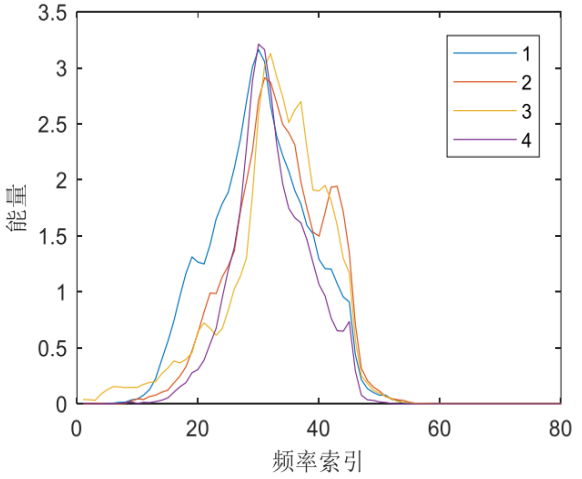
mmWave-Radar Human Tracking



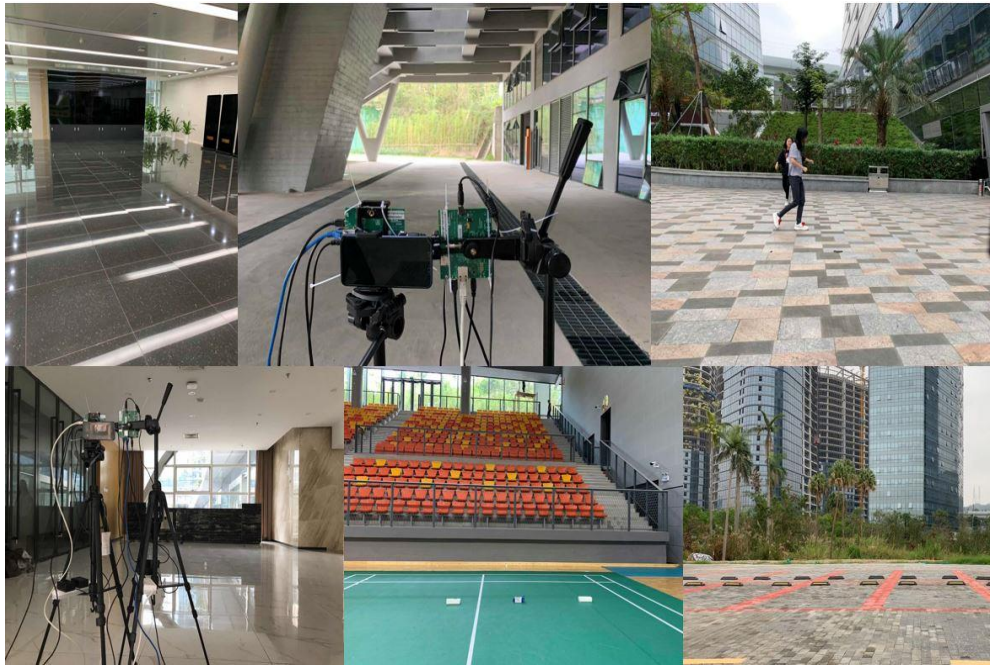


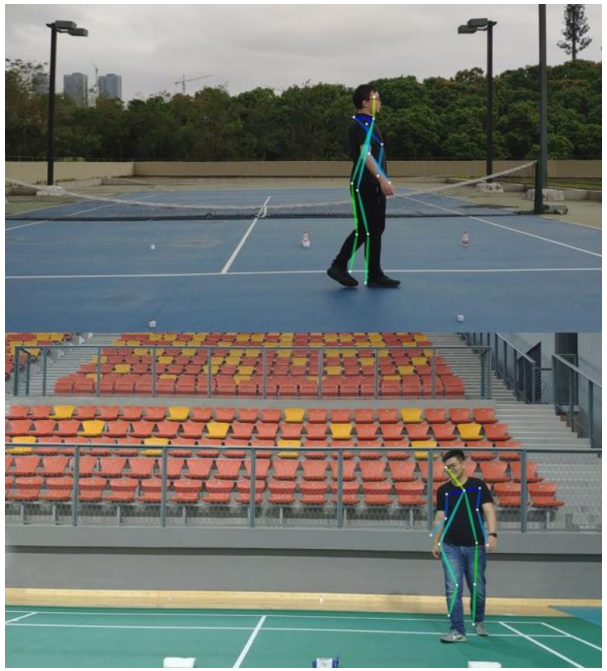






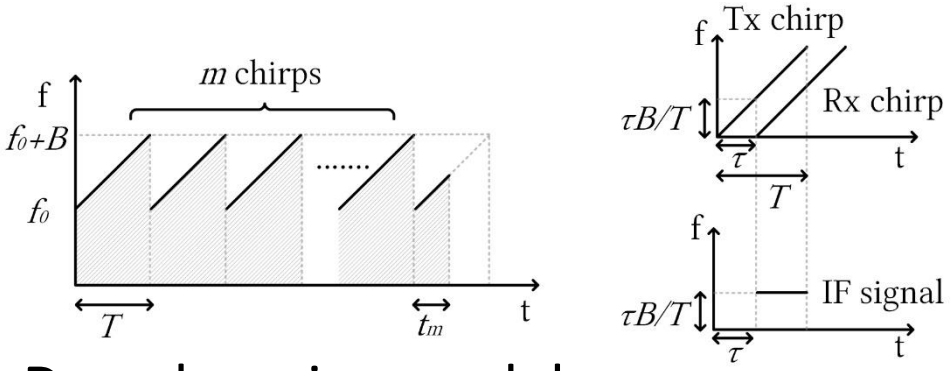
Skeleton Detection and Activity Analysis



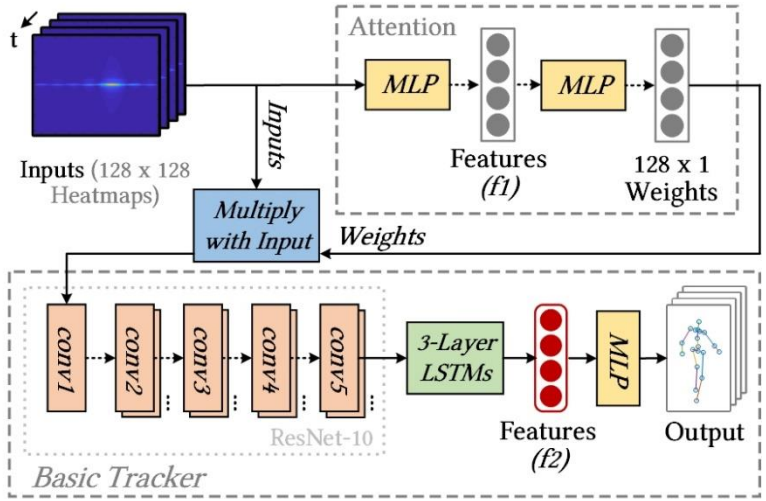


Synthesized Millimeter-Waves for Human Motion Sensing

FMCW signal synthesize

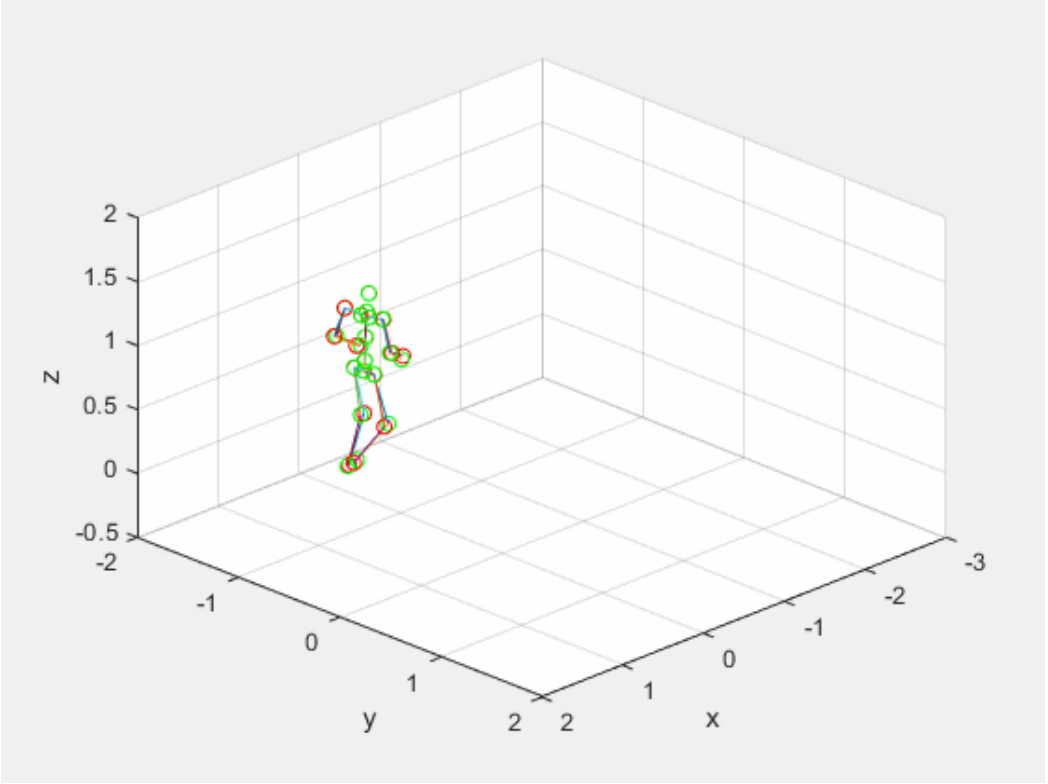


Deep learning model

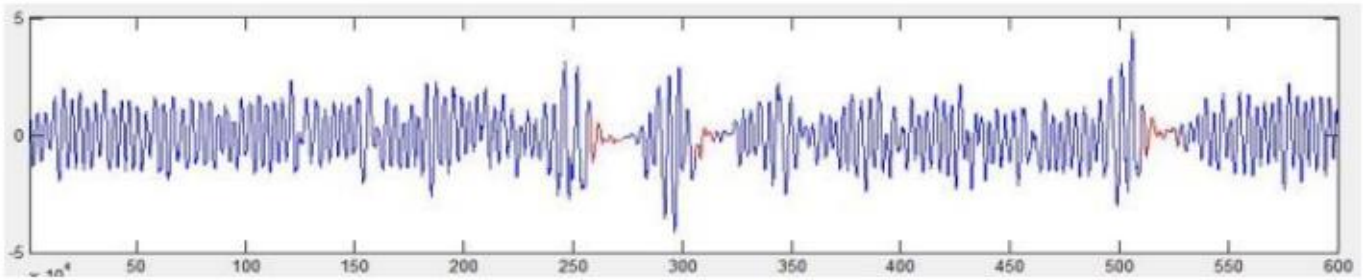


Zero-shot activity recognition

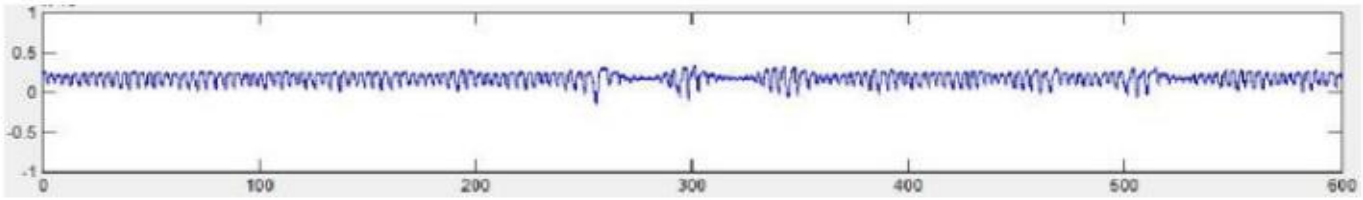
Few-shot skeleton tracking



mmWave-Radar Sleep Analysis



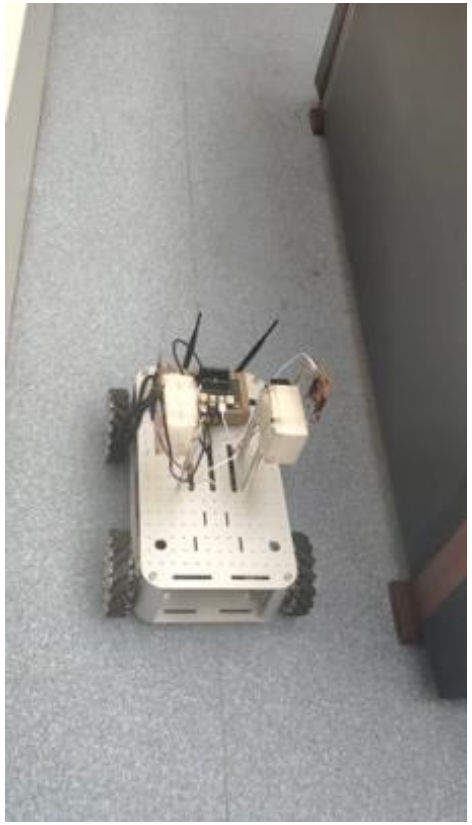
(a) radar recording

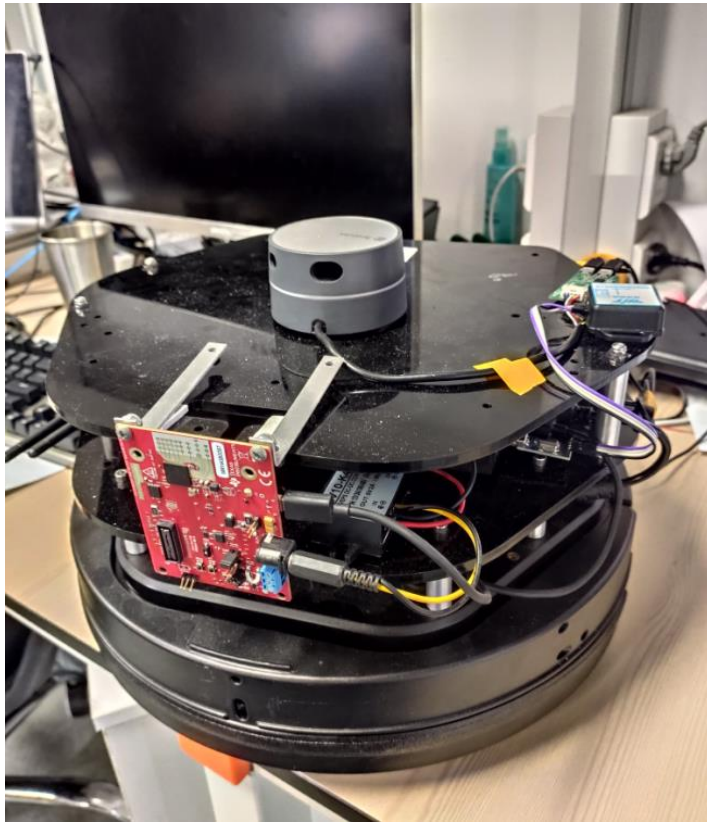


(b) respiration belt recording

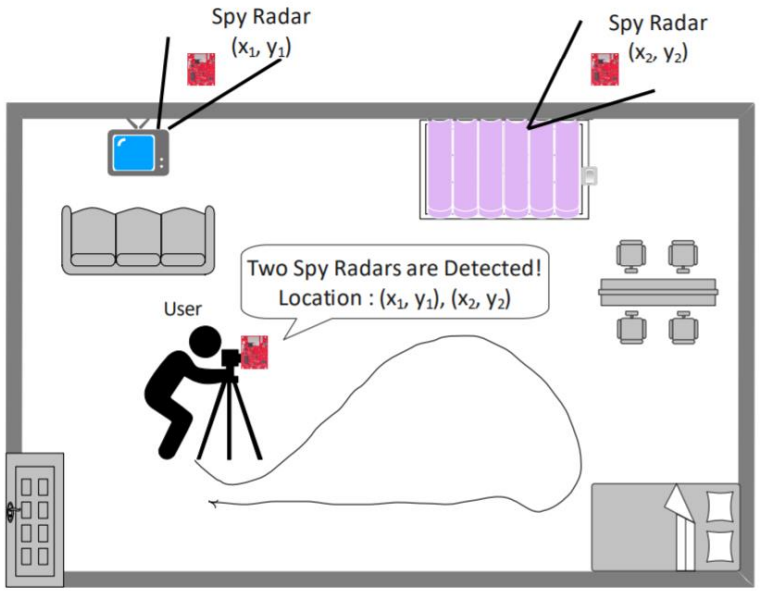
Agreement	Sensitivity
92.5%	94.12%
Specificity	**Effectiveness**
90.03%	91.56%

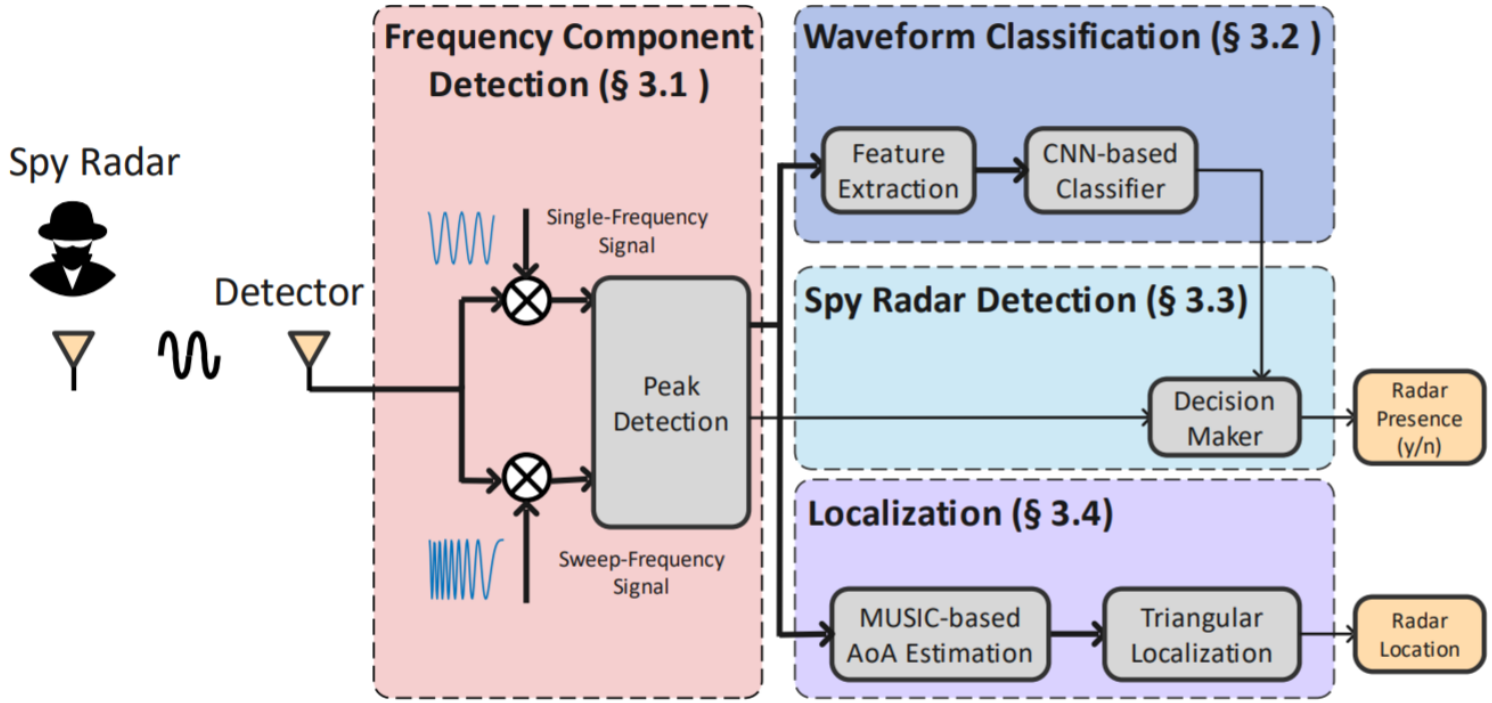
Environment Sensing and SLAM





Spy Radar Detection





Summary

- Mobile sensing
- Acoustic sensing
- mmWave sensing
- Smart healthcare
- Security in mobile sensing

几点建议

- 多探索 多尝试 做自己喜欢的事情
- 不要纠结 大胆做决定 越是纠结的两条路越没有明显的好坏之分
- 坚持终身学习 以开放的态度迎接新领域、新方向
- 要努力 无论哪条路都没有捷径
- 相信自己 保持好心态

评教

- 网页端：官网首页-常用系统-教学质量管理平台。（网址：eval.sustech.edu.cn，用CAS账号、密码登录）
- 微信端：通过微信进入“南方科技大学”微信企业号--教学质量管理平台。
- 在“我的任务”中填写并提交本学期所选课程的所有听课评教表。操作指南扫描右图二维码获取。

Final Exam

- June 10 (Friday) 2:00-4:00pm
- Content: all sections in Chapter 5 and 6 in slides.
- Online Q&A: June 9 (Thursday) 4:00-6:00pm
  - https://meeting.tencent.com/dm/cFAB5ZFdaH2c#
  - 腾讯会议：419-525-913

Thanks!