Experience: Cross-Technology Radio Respiratory Monitoring Performance Study

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Background

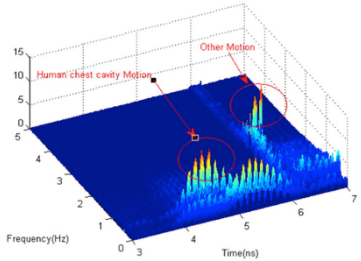
Need for non-contact respiration monitoring

- In-home Elder Care
- Opioid Monitoring

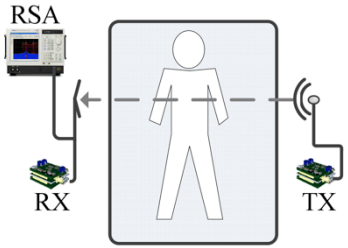
IoT devices in buildings allow for dual purpose data transfer and sensing

Radio frequency sensing

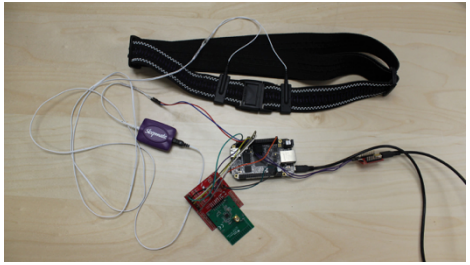
Ubicomp ‘16



EMBS ‘12



IPSN ‘14



HotWireless ‘16

Goal:

How do these technologies compare to one another?

Do they perform well over long periods of time while in uncontrolled environments?

Purpose of our research

Perform comparison of RF-based respiration monitoring in an extensive side-by-side experimental study

Test on patients in uncontrolled manner

patients: 20

hours: 160

Professional annotated events

Publish data so that other researchers can develop their own algorithms

Link to data

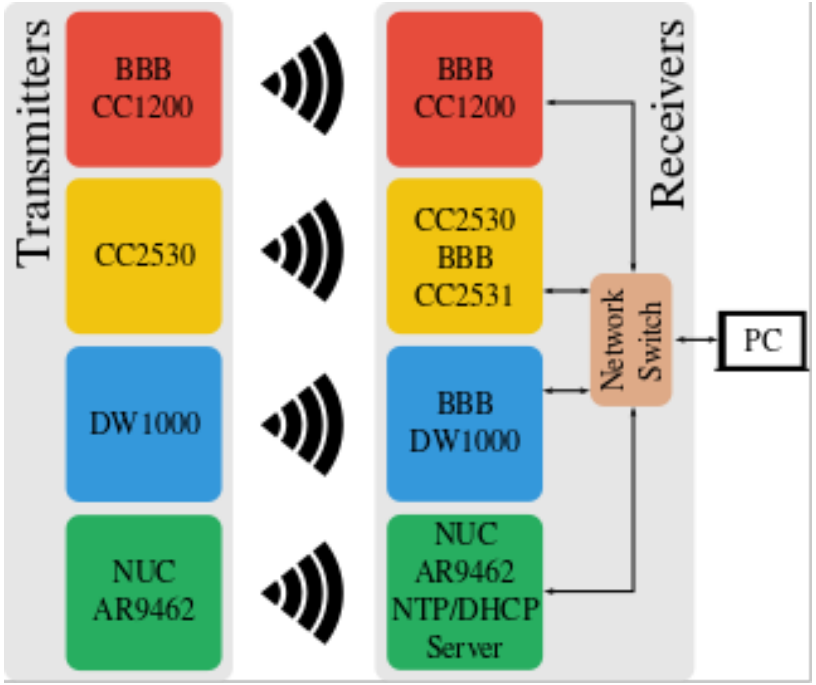
https://doi.org/10.7910/DVN/X7AYXQ

Downloaded 305 times as of 25 Oct!!!

Current radio sensing hardware

915MHz
Single Channel CW
0.013dB RSS

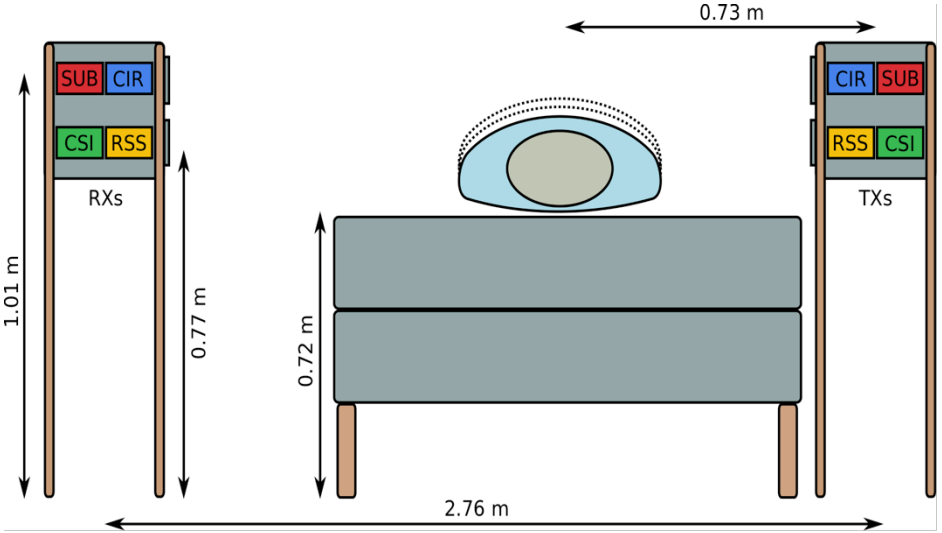
3.9936 GHz
(Channel 2)
500MHz



802.15.4
2.4GHz
16 channels
1dB RSSI

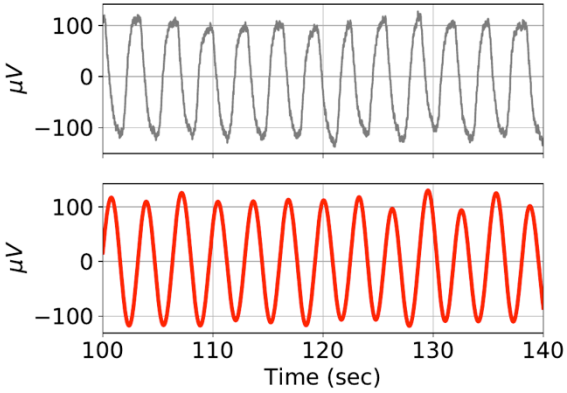
2x2 MIMO
2.4GHz & 5GHz
114 subcarriers

Experimental Setup

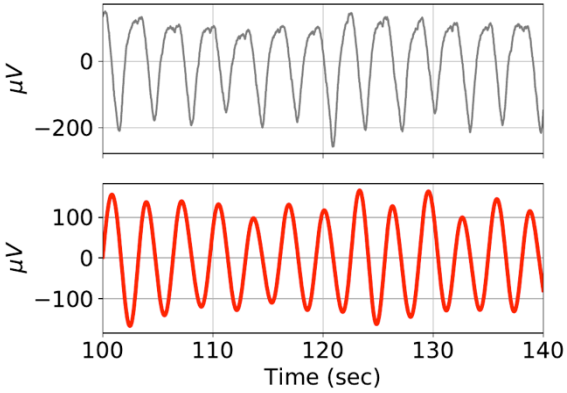


Polysomnography Respiratory Signals

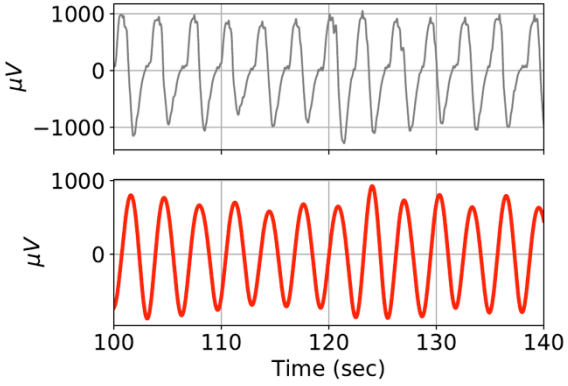
Chest



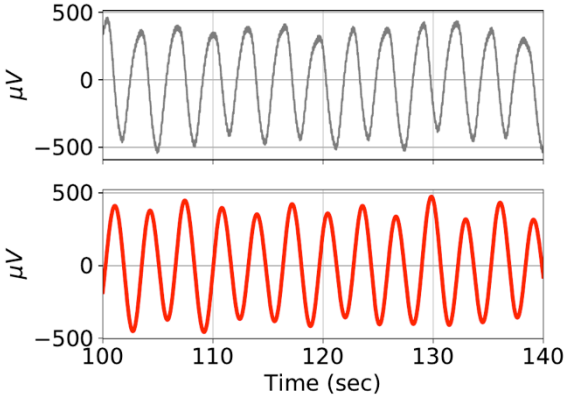
Abs



Nasal

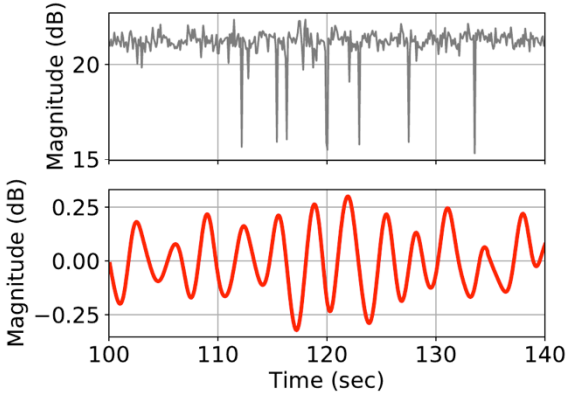


Thermo

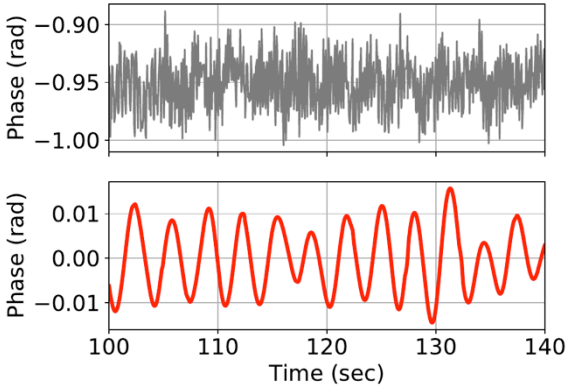


RF-based respiratory signals

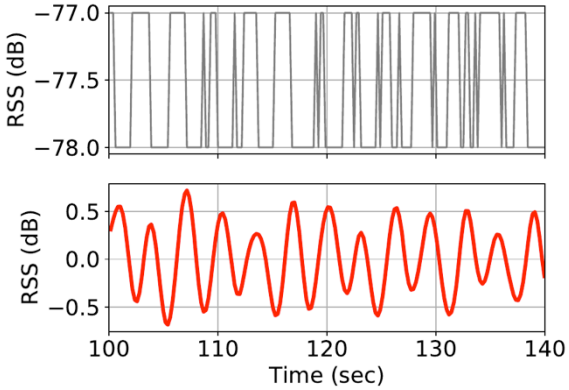
CSI



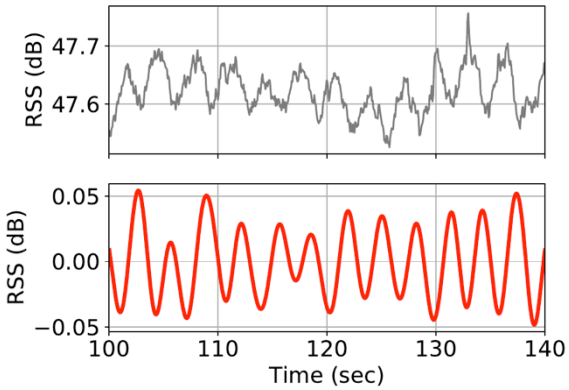
CIR



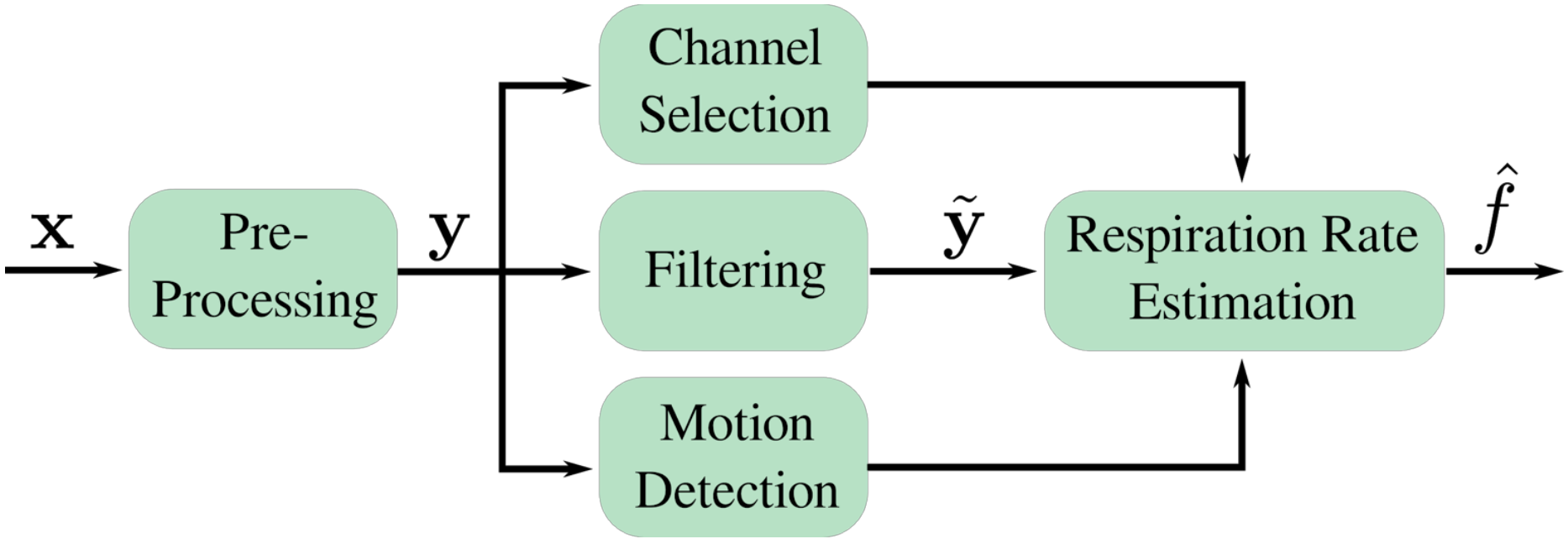
RSS



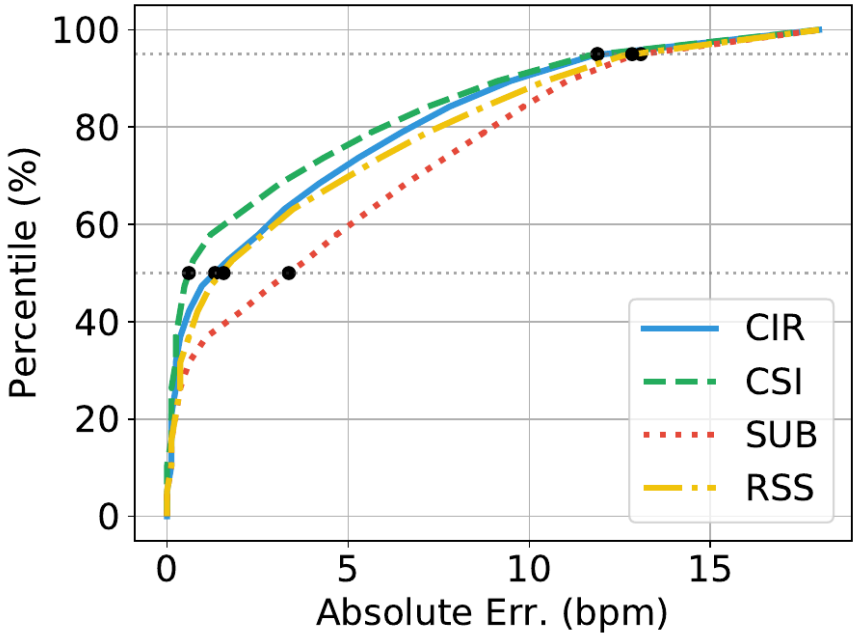
Sub-dB



Processing Flow Diagram

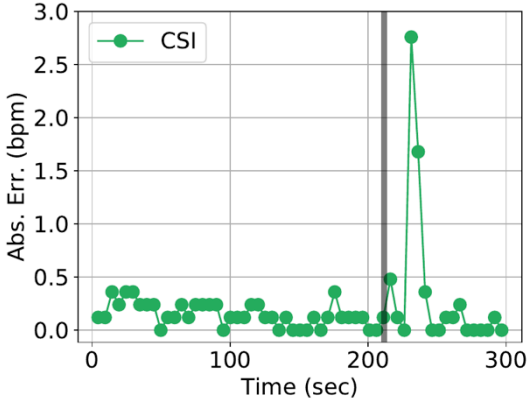


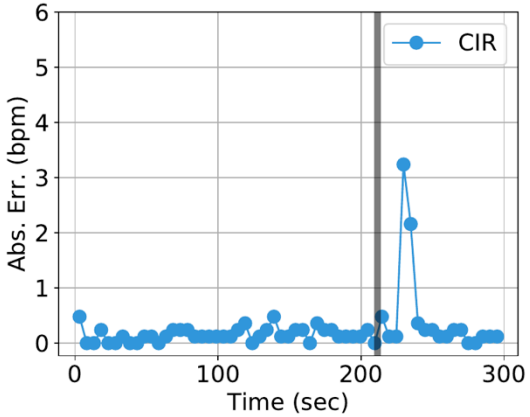
In the lab, things are great…

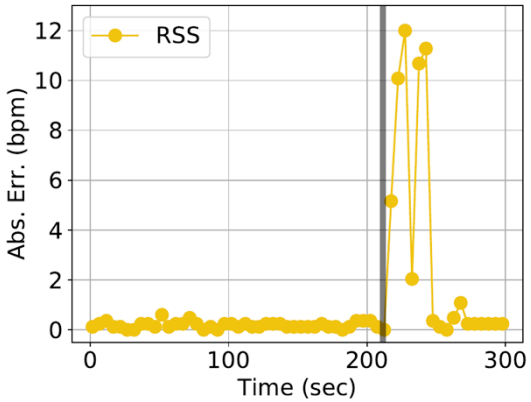


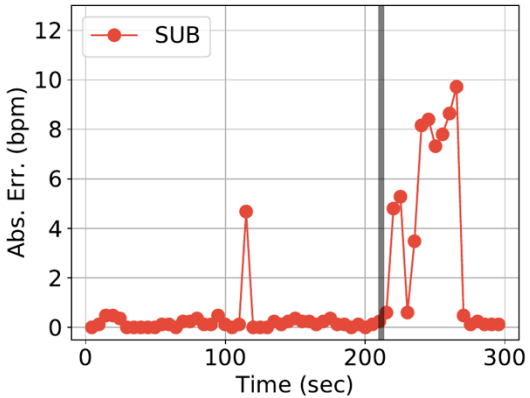
RF Tech	Median e	95th pctl. e
CIR	1.32	11.88
CSI	0.60	11.88
RSS	1.56	12.84
SUB	3.36	13.08

But only when patient isn't moving

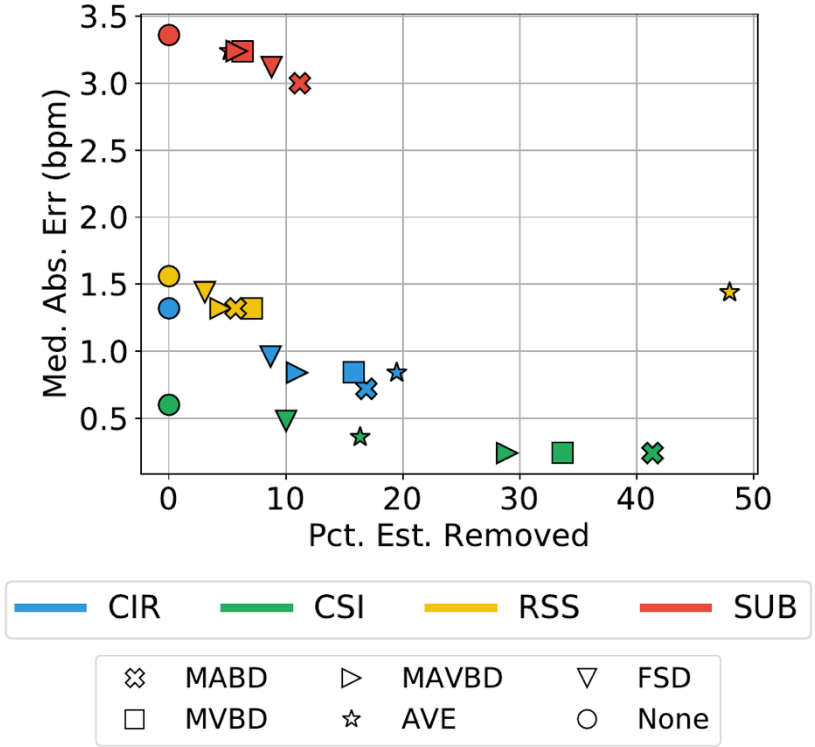




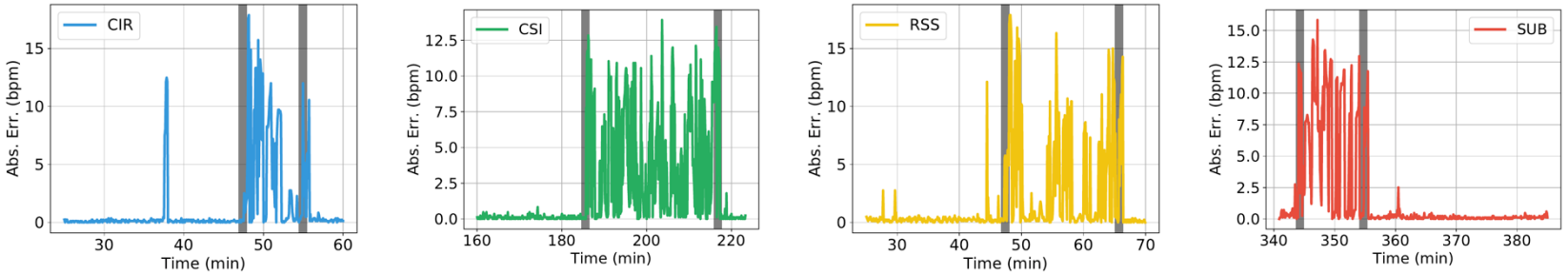




How do you remove motion?



Stop moving!



Motion Events	CIR	CSI	RSS	SUB
Before	0.12	0.12	0.24	0.24
Between	2.22	3.12	1.0	7.38
After	0.24	0.12	0.12	0.12

Questions?

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BACK UP SLIDES