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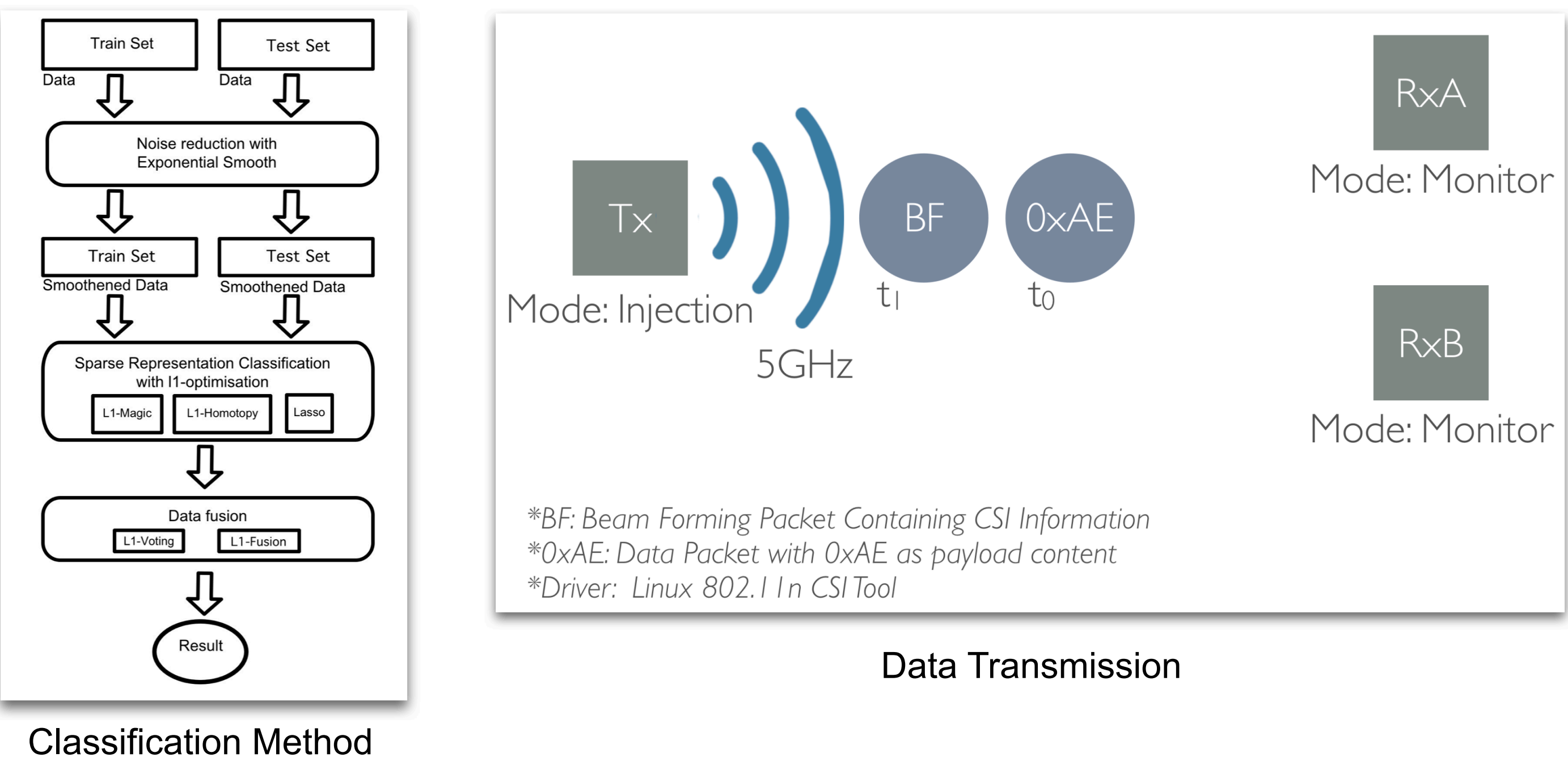
Background

Activity tracking is becoming more and more popular as the world evolves. It is being used in the vast variety of disciplines, including health, security, etc. As the demand for the technology grows, the need to expand the capability of this technology is followed just right behind. The current technology like CCTV can be use to track activity that is not sensitive to privacy concerns. Thus, the usage for CCTV is limited by the sensitivity to privacy the application is required. The previous study has shown that it is possible to use Wi-Fi signal signatures as the data source with high sample rate. However, the all previous pieces of literature are focused on proving that it is possible to do activity tracking using radio frequencies. In order to bring the technology forward, it is necessary to study more in depth of how well the system performs under different conditions.

Objectives

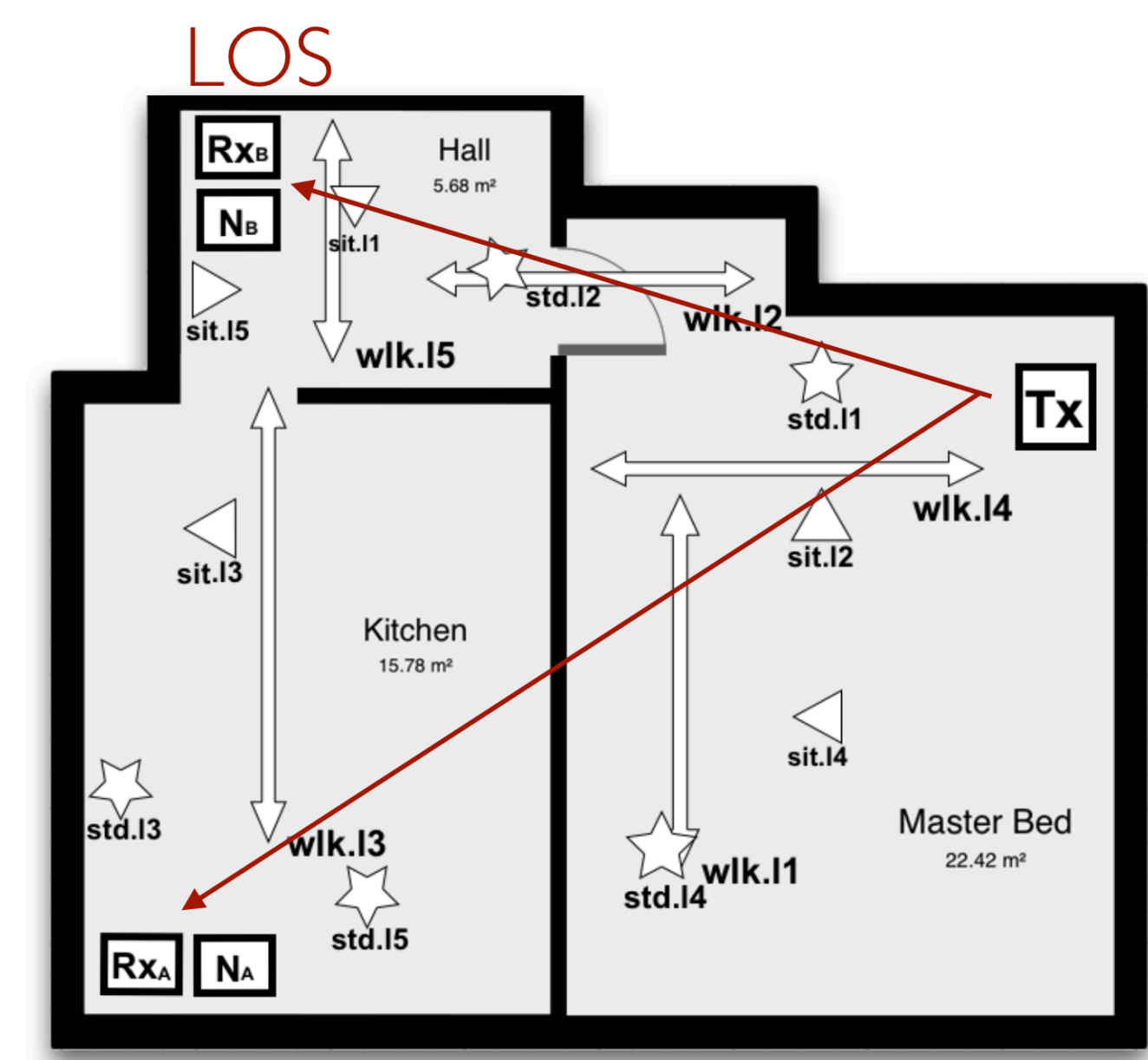
- To study and understand how the system perform under different scenarios that reflects real-world conditions.
- Development of Indoor Context Tracking System using Wi-Fi
- Development of Tools to facilitate the experiment process

System Overview



Results

Setup and Classes



LOS: Line-Of-Sight, NLOS: Non-Line-Of-Sight
 Receivers: Rx_A and Rx_B. Transmitter: Tx.
 Interference Sources: N_A, N_B

1Rx vs. 2Rx: Accuracy

Class	Accuracy		
	NLOS	LOS	2Rx
sit.11	98%	97%	100%
sit.12	87%	63%	91%
sit.13	89%	100%	99%
std.11	94%	100%	100%
std.12	90%	86%	96%
std.13	50%	100%	84%
wlk.11	100%	100%	100%
wlk.12	100%	100%	100%
wlk.13	100%	99%	100%
Average	90%	94%	97%

Data: 160407

1Rx vs. 2Rx: Runtime

Runtime (s)		
NLOS	LOS	2Rx
5.19	15.46	40.78

Data: 160407

Environment Change

The results varied on different environment. The test is performed on each dataset, 160407 and 160906 to see how the change in environment can affect the system. The differences between two datasets are the height of bed in bedroom. The former data has full-height beds while the latter one have beds with only half the height.

Environment Change: Accuracy

	Accuracy		
	NLOS	LOS	2Rx
sit.11	58%	88%	82%
sit.12	86%	43%	90%
sit.13	95%	100%	100%
std.11	91%	98%	100%
std.12	100%	100%	100%
std.13	33%	100%	96%
wlk.11	100%	95%	100%
wlk.12	100%	100%	100%
wlk.13	100%	100%	100%
Average	85%	92%	96%

Data: 160906

Environment Change: Runtime

Runtime (s)		
NLOS	LOS	2Rx
15.83	15.46	43.03

Data: 160906

Interference

Placing receivers next to interference source. The interference sources are transmitting at 32Mbps and 64Mbps with traffic frequency of 10KHz.

Interference: Accuracy

	Accuracy		
	No Noise	32Mbps	64Mbps
sit.11	82%	27%	7%
sit.12	90%	35%	24%
sit.13	100%	29%	41%
std.11	100%	44%	25%
std.12	100%	19%	11%
std.13	96%	30%	37%
wlk.11	100%	9%	22%
wlk.12	100%	11%	23%
wlk.13	100%	32%	25%
Average	96%	26%	24%

Data from 2Rx

Interference: Packet Loss Rate

Data (Noise)	Loss Rate
160407	15%
160906	1%
160923 (32Mbps)	70%
160923 (64Mbps)	58%

15-Class

With 15-class, the system with 2 receivers started to suffer from confusion. 2 out of 15 classes no longer achieve above 80% in accuracy.

15-Class: Accuracy

Class	Accuracy		
	NLOS	LOS	2Rx
sit.11	55%	86%	78%
sit.12	84%	48%	87%
sit.13	88%	99%	99%
sit.14	100%	64%	100%
sit.15	45%	40%	63%
std.11	92%	92%	99%
std.12	100%	100%	100%
std.13	37%	96%	93%
std.14	43%	54%	54%
std.15	100%	96%	100%
wlk.11	100%	91%	100%
wlk.12	100%	100%	100%
wlk.13	100%	97%	100%
wlk.14	98%	98%	99%
wlk.15	100%	100%	100%
Average	83%	84%	91%

Data: 160906

Conclusions

- 90% accuracy is achievable with sample rate of 10Hz and windows size of 1s
- Strategically add more receiver can greatly improve accuracy
- Classification results varied by environmental change
- Interference can greatly reduce performance

Future Works

- Real-time classification
- Improve accuracy under heavy interference