

Recitation Project 1

Measuring Wireless Channels

Jingxian Wang

Feb 12, 2021

Outline

- Setting up experiments
- Description of experiments and analyzing the results

Objective

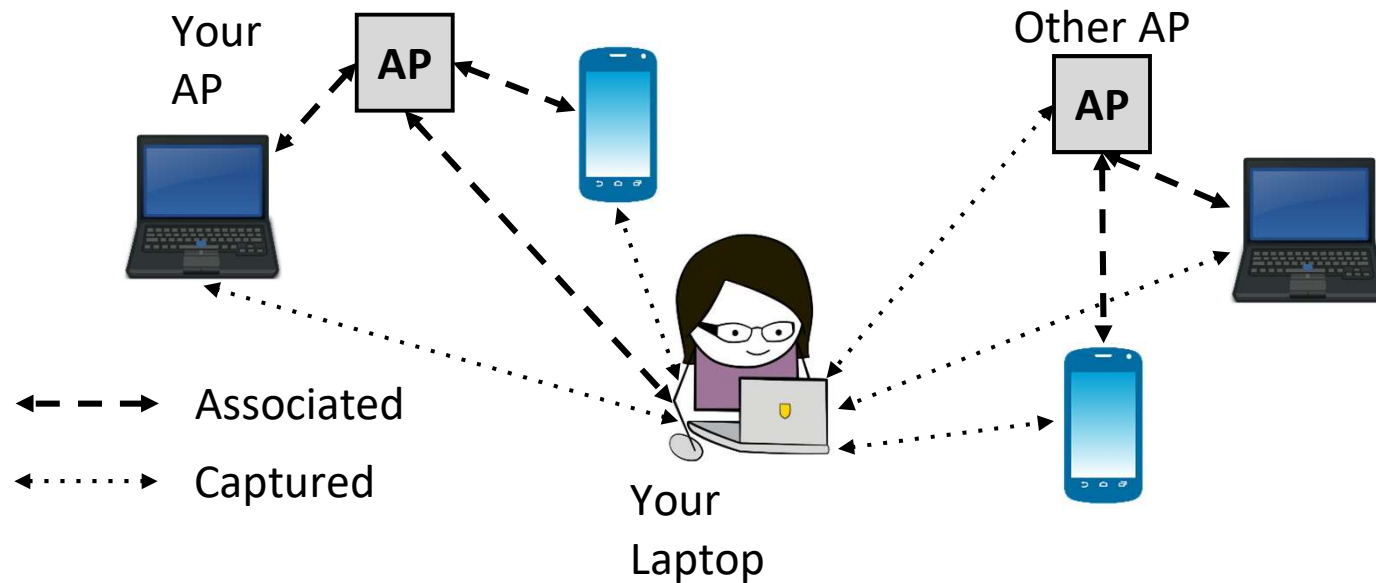
Experimentally measure a wireless channel



What is the Signal to Noise Ratio (SNR) across this channel?

Signal strength, Data rate, Frequency,...

Home Environment



Associated: WiFi communication between AP and associated device

Captured: Passive packet capture in monitor ("promiscuous") mode

Choosing Devices



- Receiver A: Mac/Linux laptop running Wireshark in Monitor Mode
- Transmitter B: any wifi-router/PC/laptop/mobile phone
- One of the two devices should be mobile
- Signal strength and consistency considerations:

Phone < Laptop <
Access point

Picking a Transmitter

The Transmitter B must send enough traffic!

- Wi-fi router sending traffic to associated client devices
- Laptop/PC as device B:
 - Use ping - for example, to send a specific number of ICMP packets)
`sudo ping -f 192.168.1.1 -c 10000`
- Mobile Phone as device B:
 - Ping is ping app from Apple Store or Android Store



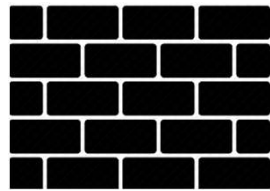
Outline

- Setting up experiments
- Description of experiments and analyzing the results

How does the wireless channel change?



Varies over time



Obstructions



Crowded space



Mobility



Experiments

1. Discrete data collection
 - emulates stationary user (sitting down using skype)
 - measure discrete points in the channel
1. Continuous data collection
 - emulates moving user (walking & using phone)
 - Measure continuously while moving one device at a constant rate

Discrete Data Collection

Setup:

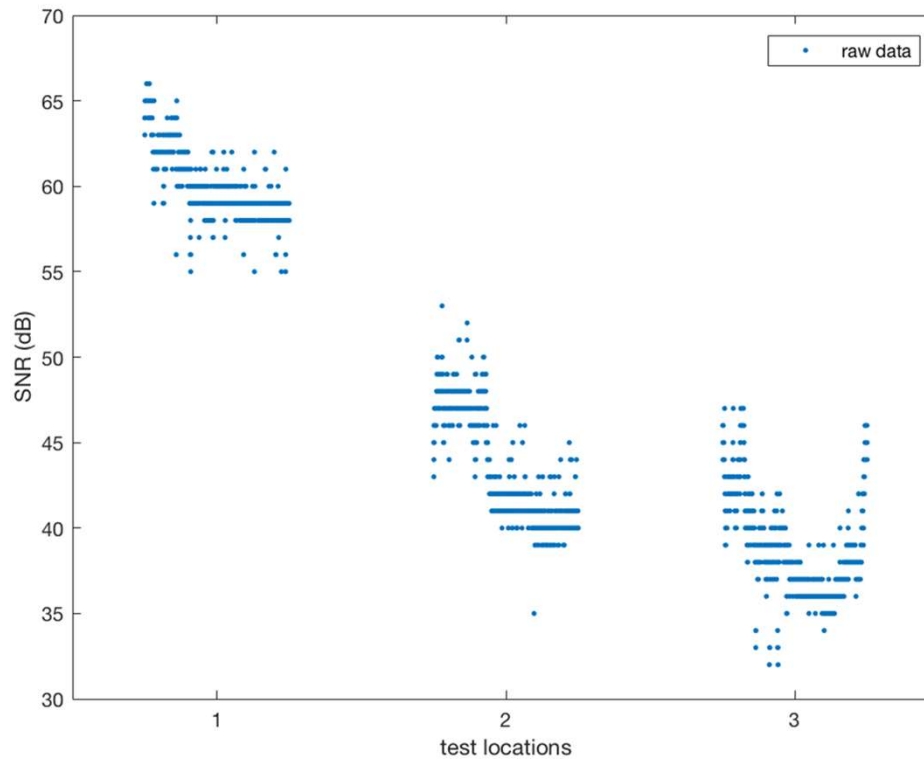
Planned measurement locations (distance between A and B from 1 meter to 5 meter)

Intuition:

SNR will decrease as distance increases, closing door will also decrease SNR

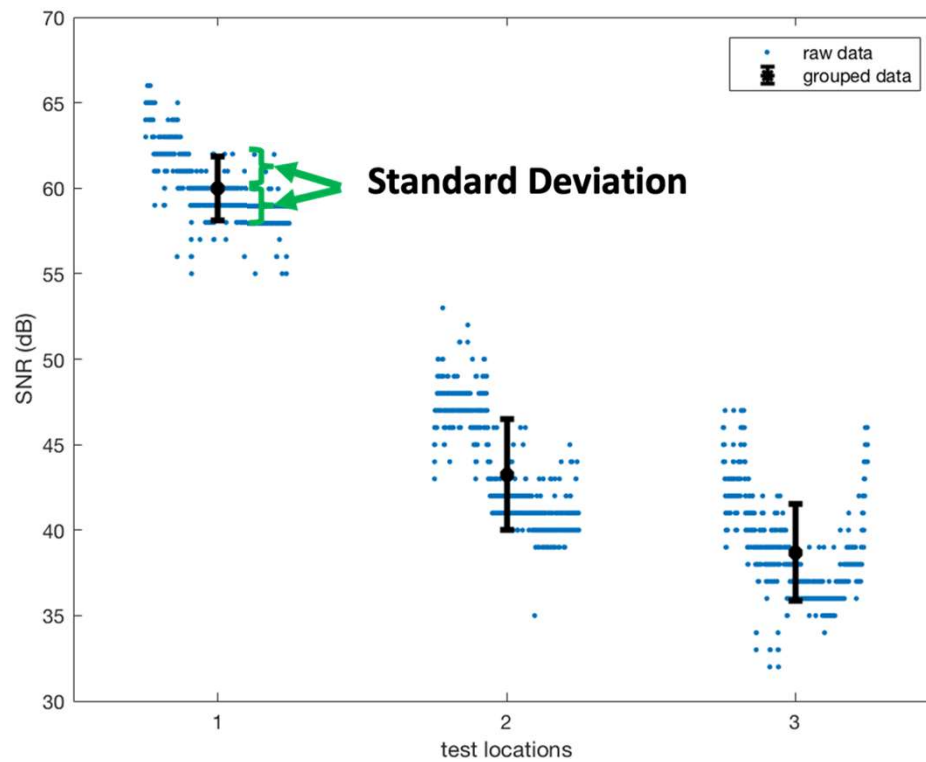
Scatter Plot - discrete collection

- 3 discrete distance test events
- Can be grouped into each event



Scatter Plot - discrete collection

- Plot mean with error bars of standard deviation



Continuous Data Collection

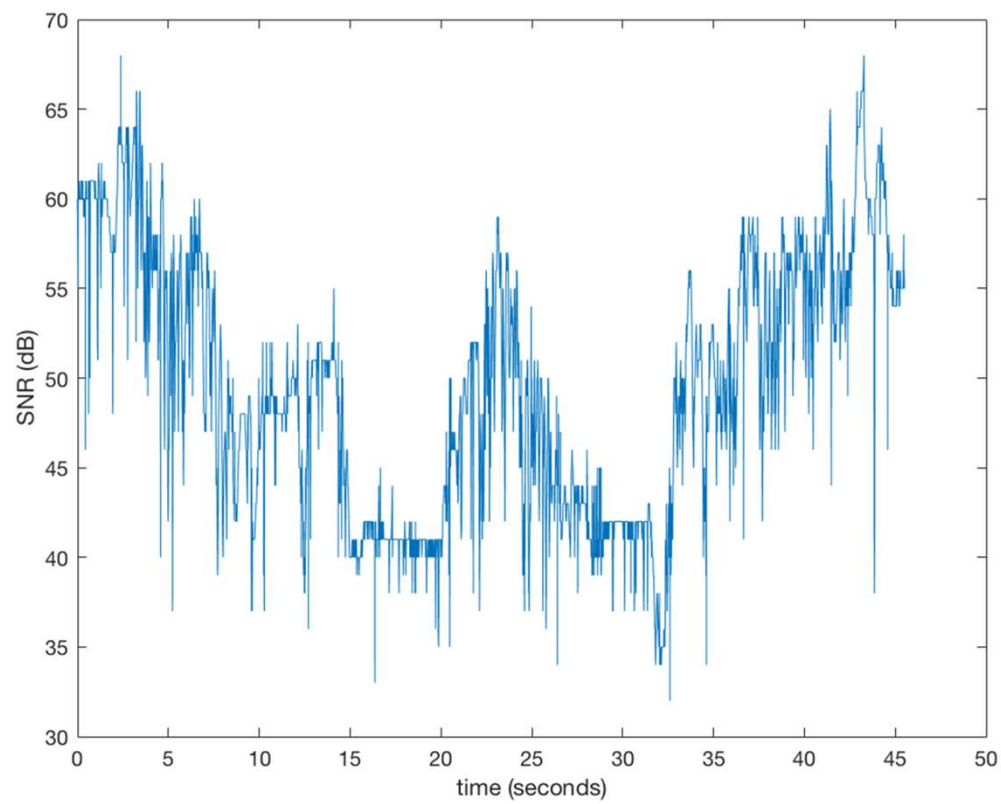
Setup:

Planned path, movement speed

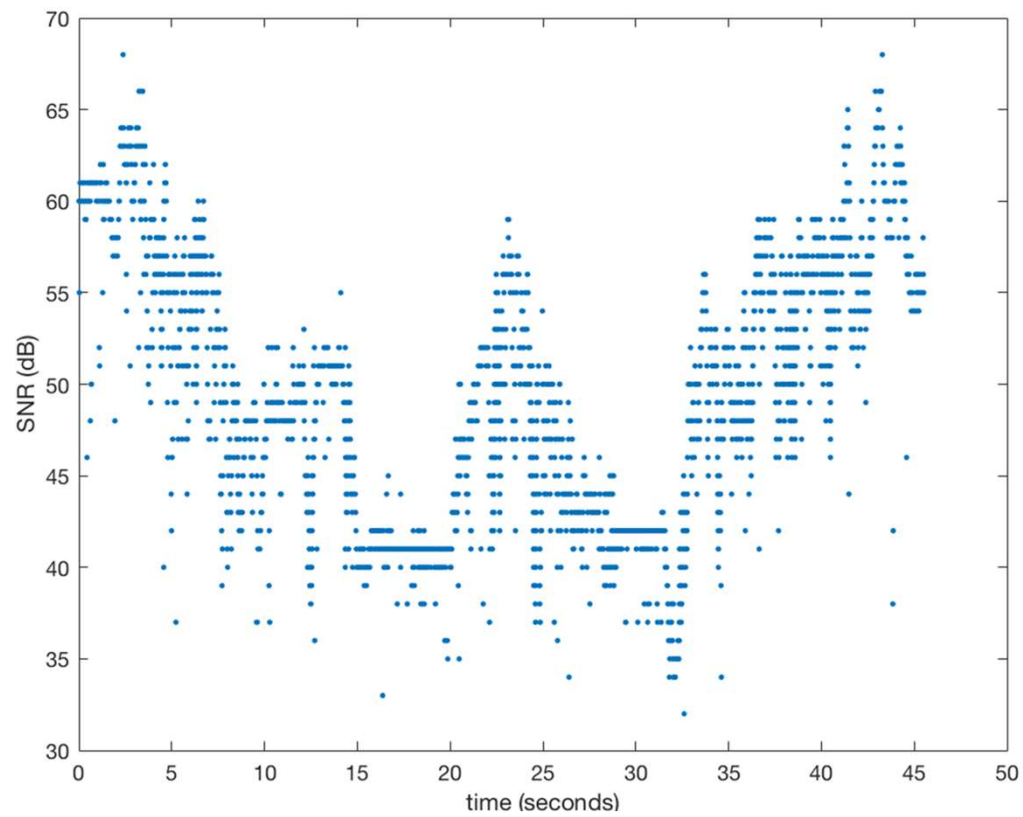
Intuition:

SNR will decrease as distance increases, closing door will also decrease SNR

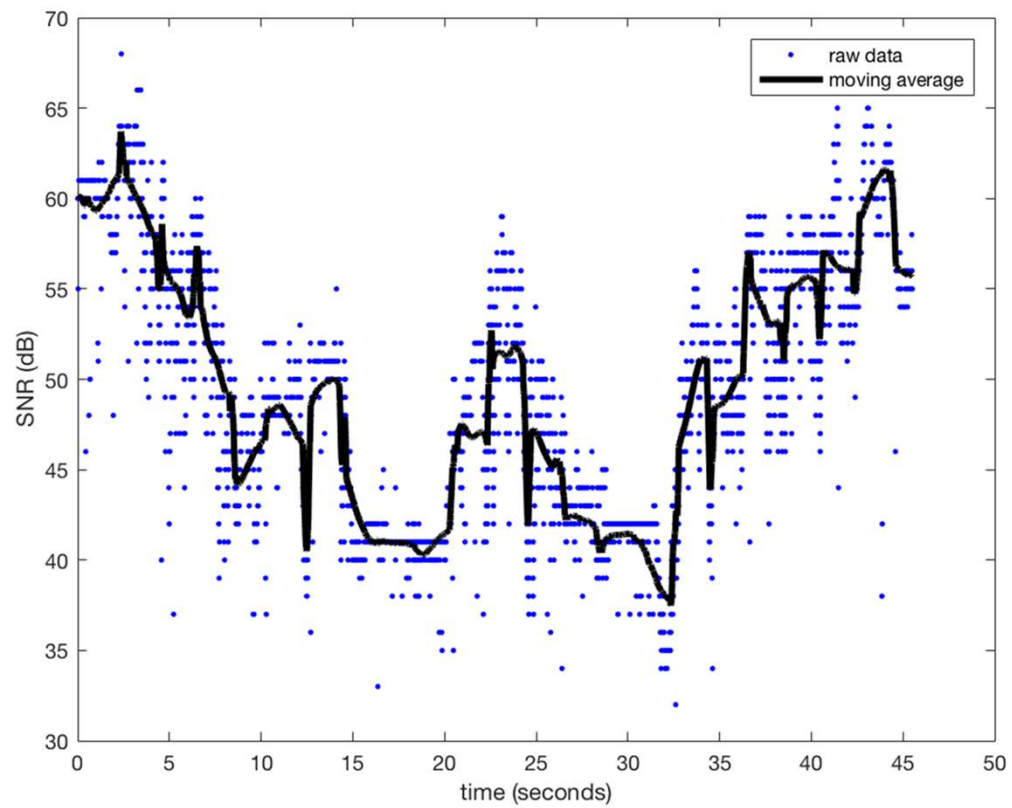
Example graph



Scatter plot



Filtered plot



Analysis thoughts

- Can be beneficial to compare data
 - compare to theoretical mode
 - other data points, different scenarios
- Can be beneficial to observe different characteristics of the data
 - Example: Observing SNR, could be beneficial to observe trends in signal strength and noise level

Questions