COMP9336 Mobile Data Networking

www.cse.unsw.edu.au/~cs9336 or ~cs4336

WiFi Fingerprinting

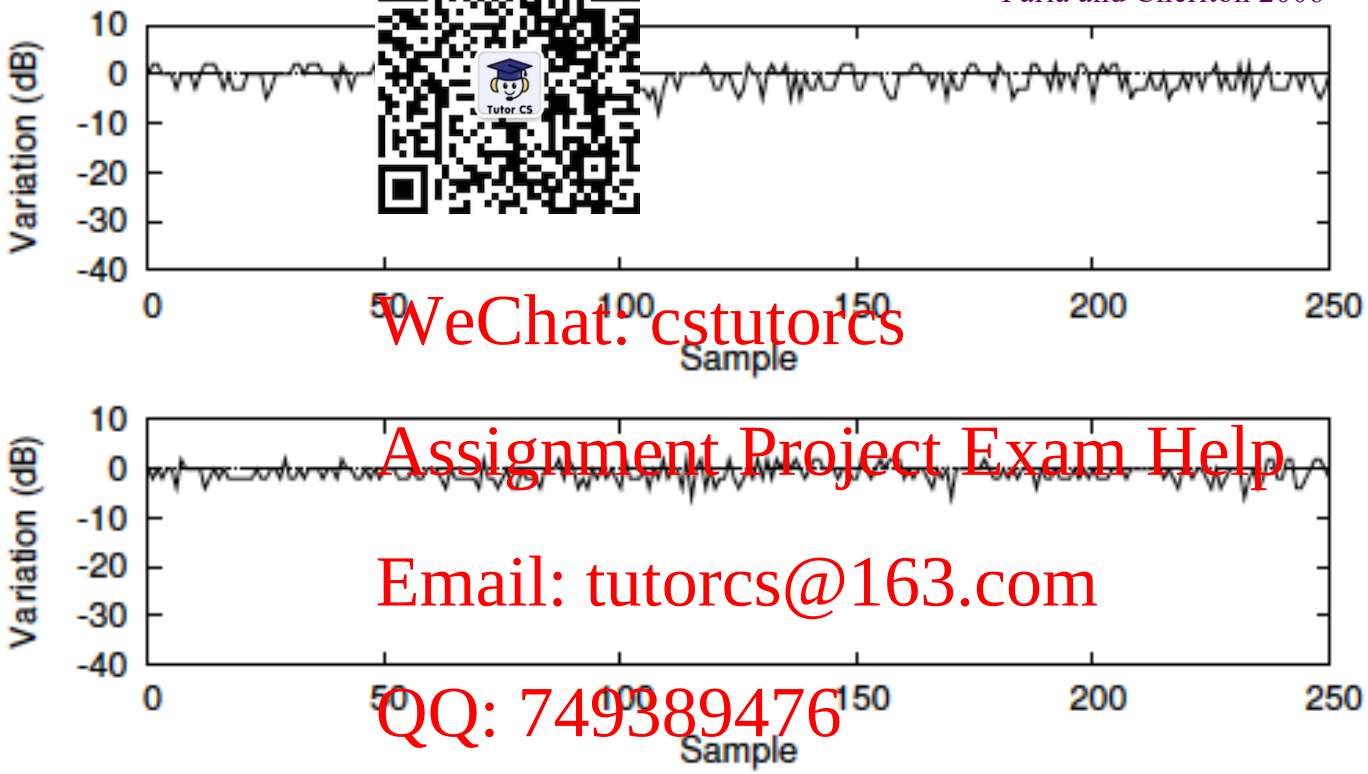
Adapted from **Faria and Cheriton 2006**

Signal fingerprint based positioning

- Received signal is extremely location-specific
  - dependence on terrains and obstacles
- Multipath structure is unique to every location
  - considered a fingerprint or signature of the location
- Create fingerprint database for locations of interest
- Received signal is matched against database
  - to identify location of the transmitted signal

RSSI Oscillation

Faria and Cheriton 2006



L1

L2

In most cases, for a given location, RSSI remains within a few dBm of the median value (median shown as '0')

L1 could be differentiated from L2 using a **single** WiFi AP if the **RSSI medians** were 10dB apart in this case

Why a single WiFi AP is inadequate?

- In the previous [illegible] 1 and L2 could not be always separated if the [illegible] SSIs were less than say 5dB
- A single WiFi AP therefore cannot provide high-resolution localization with good accuracy
- What if the mobile device can hear from multiple WiFi APs?

Basic WiFi Fingerprinting Example

Finger

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RSSI-AP_1 RSSI-AP_2 RSSI-AP_3

Fingerprint (L1) = {-50, -70, -65}

Fingerprint (L2) = {-70, -50, -62}

Fingerprint (L2) = {-70, -60, -60}

AP_1 AP_2 AP_3

Location 1 Location 2 Location 3

- **Vector** of RSSIs
- One RSSI for each AP
- Vector length could be variable

Median RSSI for AP3 is within 5dB for all three locations, yet the vector of three APs provide unique WiFi fingerprint for these locations!

A basic algorithm for identifying locations with WiFi fingerprint

1. Mobile obtains real-time fingerprint
2. Compare the real-time fingerprint with each signature in the database (RSSI differences in vector elements)
3. Attach a score to each comparison (number of elements differed less than Δ dBm)
4. Maximum match = signature with max score

Example

- 2 signatures in database for two different locations
  - S1 = {-50,-70,-45} and s2 = {-40,-70,-35}
- Real-time fingerprint of a mobile = {-44,-66,-34}
- Assuming a Δ=5dBM (needs to be finetuned for real environments)
  - Score for S1 = 1, and
  - Score for S2 = 3
- Maximum match is with location 2 (s2)
- The client positioning is predicted as 'location 2'