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CS724 - Assignment 2

Step 1: Finding the Path Loss Exponent

a) Downloaded the Wifi Analyzer app to get the signal strengths and distance from the wifi access points.

b) Collected the samples by varying the distance in between these transceivers and at every positions recorded 5 RSSI samples with different orientation.

```
distances = [7, 23, 52, 93, 129]
rssi = [
    -64, -65, -67, -62, -66,
    -74, -75, -76, -76, -75,
    -82, -84, -81, -80, -80,
    -87, -88, -84, -85, -84,
    -89, -91, -89, -92, -90
]
```

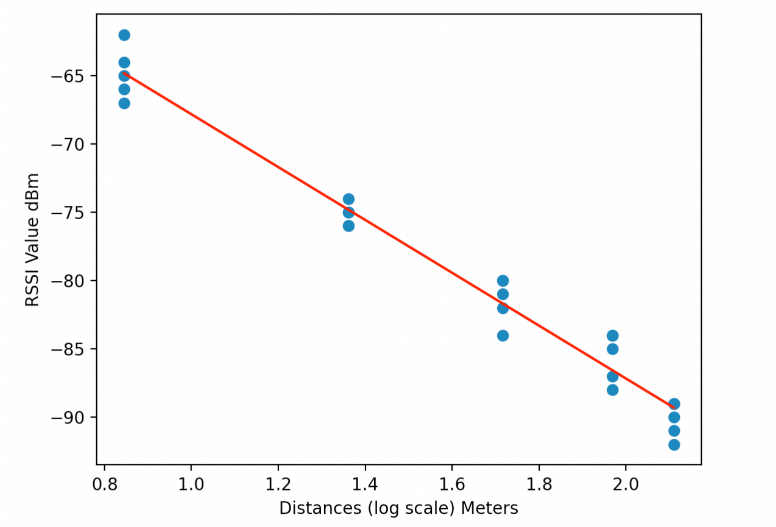
c) Plot a graph with the RSSI values in y-axis (dBm) and the distance in x-axis but in the log scale

d) Draw a best fit line for this plot. Find out the slope of this line, divide it by 10 and take absolute value to get the path loss exponent.

```
bestFit = np.polyfit(distances, rssi, 1)
plt.plot(distances, bestFit[0]*distances + bestFit[1], 'r')
plt.show()

slopeBestFit = bestFit[0]
pathLossExponent = abs(slopeBestFit/10)
```

The **slope** of the best fit straight line is **-19.34539273298087**
The **path loss exponent** is **1.9345392732980868**



e) Variance of these RSSI w.r.t the best fit line. Calculated the RSSI values for the log distance scale by using the equation of the best fit line. Then squared the difference of the estimated and actual for each sample and took the sum to calculate the variance.

Variance = $\sum (RSSI_c - RSSI_i)^2$ / Number_of_Values

$RSSI_C$ -> RSSI calculated from the best fit line equation
$RSSI_i$ -> RSSI sample

Variance of these RSSI samples w.r.t the best fit line **2.338972929743423**

Step 2: Range Estimation

a) Assume $d_0 = 1$ and using the equation of the best fit line we can get the value of power received value. In $y = mx + c$, we have m and c from the previous step, as x is the log scale of the distance so for distance of 1 the x = 0 and we'll get y = c.

$P_r(d) = P_r(d_0) - 10nlog_{10}(d/d_0)$ solving this equation we can rewrite the equation as

$d = 10^{(P_r(d_0) - P_r(d))/10n} * d_0$ by using this we can estimate the distance d for given sample.

rssi = -89, estimated_d = 124.32397490790149

b) Due to noise there might be some errors in the range/distance estimation. To calculate the average error, we have estimated distances for ~5-6 samples.

rssiSamples = [-51, -71, -82, -87, -89]
actualDistance = [1, 16, 52, 93, 117]

estimatedDistances = [1.3497797129062497, 14.591528448972607, 54.039537768779404, 97.9875948943888, 124.32397490790149]

Average error in distances for the above values came out to be **2.6584831465897105**