Goals

- Estimate path loss exponent in a room in order to create a sufficient model for power prediction at any given point within the room.
- Apply probability formulas to verify the above model.

Motivations

- Motivations
  - Create a way to estimate power effectively within an environment.
  - Gain a better understanding of physical layer wireless communication systems.

Research Challenges

- Recording for a large amount of time does not capture all the variation possible for received power.
- Keeping the transmitter and receiver as uniform as possible, by turning off all other apps, to justify the assumption of each measurement to be independent and identically distributed.
- Developing a test for verifying the path model used.

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Methodology

- Homedale – a free-ware program capable of collecting wireless power data was used.
- Power measurements were conducted in EE 209 using Homedale to at 30 points of interest.
- Samples of power along with corresponding positions are taken at these 30 points, each test lasting several minutes.

\[ P(d) = P(1m) - 10n\log_{10}(d) + \chi(0, \sigma^2) \]
- An initial power (dBm) at one meter is found.
- Assuming an independent identical distribution at every measurement allows one to assume the noisy effects of shadowing to be normal.
- Least squares fitting is done for all points and power pairing to find the path loss 'n.'
- This path loss, along with shadowing noise distinct to every point of interest, is verified through probability analysis.

Results

- Over 1800+ data points collected.
- A suitable path loss of 3.73.
- A meshgrid of the path loss model.
- Measured points corresponded closely with this graph.

\[ D_B(p, q) = \frac{1}{4} \ln \left( \frac{1}{4} \left( \frac{\sigma^2}{\sigma^2} + \frac{\sigma^2}{\sigma^2} + 2 \right) \right) + \frac{1}{4} \left( \frac{\mu_p - \mu_q}{\sigma^2} \right)^2 \]
- The Bhattacharyya distance indicates how similar two normal distributions are, lower values indicate more similarity.
- Test measurements were taken at known points for sufficient time to become normally distributed.
- The parameters of each test were compared with the parameters of the ‘known’ points of interest.
- The minimum Bhattacharyya distance of five test point-distance pairs were found and then recorded.
- Better at distance estimation than on location

References