Using Statistical Learning to Classify Six In-Building Propagation Environments

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Often, researchers want to compare radiowave propagation characteristics among multiple environments or locations. Metrics such as the rate of path loss, path loss dispersion, or path loss central tendency can be analyzed and categorized to classify environments. This classification provides us with new understanding of how radiowaves propagate in different signal environments.

To study different propagation environments, we collected field data at the University of Colorado. For these measurements, we transmitted a Band 14 signal at 736 MHz from an LTE Small Cell located in a room at the University's Discovery Learning Center. Then, we measured path loss at six locations in and around the building.

From these measurements, we developed linear regression models of the distance versus path loss relationships for each location. We explain how we used statistical methods, developed in the field of Criminology (Paternoster et al., *Criminology*, 1998, Vol 36, No 4, 859–866), to determine the statistical equivalency of regression coefficients of six in-building propagation models. Surprisingly, we learned that the rates of path loss were equivalent among all six environments. We also show how we used Analysis of Variance (ANOVA) to group environments in terms of path loss dispersion and path loss central tendency.

We present our in-building path loss models, discuss model development and generalization, and demonstrate how statistical learning methods were used to classify the environments.