Master Thesis

„Mathematics of Point Clouds in indoor radio propagation“

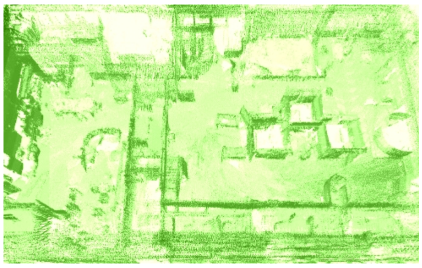
In wireless communications, the indoor radio environment is a special one. In communication sense, indoor environments are important because of high bandwidth requirements from many users, resulting in problems with interference and optimal usage of the radio channel. In propagation sense, the indoor radio channel is reverberant with many potential scatterers directly surrounding communication partners. For instance, Line-of-Sight connections indoors typically show fading after some meters. Like in the acoustic case, only rules-of-thumb exist for some generic reverberation parameters. Recently, closed-form descriptions for indoor propagation channels were derived using Point Clouds as recorded by Laserscanners. These are formulated as summations of geometric series expressing the infinite number of interactions between all the points of the scan. In a high-definition scan, the number of points is huge and the number of mutual interactions even larger.

The task at hand is to reduce the computational complexity of these expressions, either by truncating the number of interactions or by finding a workable inversion method for the summation of the geometric series. An alternative formulation of this task is possible too. Using graph theory and considering the ensemble of point-point interactions as a complete bivariate graph, can complexity be reduced by merging vertices and/or pruning edges?

Typically, complexity reduction goes at the expense of the accuracy, so, the desired output of this project is a description of the possible compromises between accuracy and complexity reduction.

Expected skills:

- Fit in mathematics, either in Linear Algebra, solving systems of linear equations or interested in Graph Theory
- Basics of electromagnetic wave propagation



Example of Point Cloud
Source: Remote Sens. 2017,9,796

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