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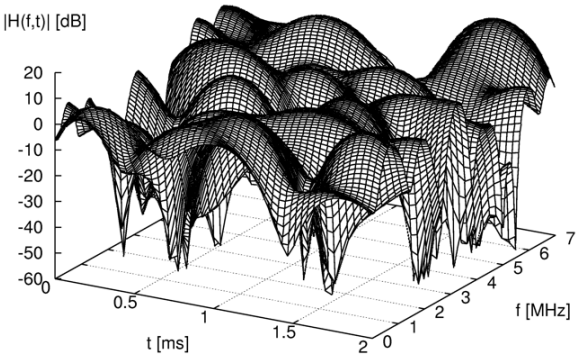
CCS

Bachelor / Master's Thesis

Wireless Channel Models: A Machine-Learning Approach



Often, we want to predict whether a given wireless transmission will (or, indeed, might) reach its destination; similarly, we often want to predict how long a given destination might remain unreachable. The reasons for such transmission failures are numerous: Too much power might have been lost due to obstacles, due to destructive interference of the signal with itself, due to dust in-between sender and receiver, or any of an endless number of effects. What we need is an abstract *model* of what happens to a wireless signal on the way from sender to receiver, that is, on the *wireless channel*. Sometimes, the model can be as simple as rolling dice. A more precise model would, of course, respect many variables like position (and distance between) sender and receiver or obstacles, time, or even capture semi-random effects. Many models have been proposed in the literature, all with varying degree of precision and with varying degrees of complexity.

Goals of the thesis

In the present thesis, we want to investigate whether tools from *machine learning* are a suitable means to derive a channel model. For this, we propose to train a machine learning model using trace data, that is, a record of how transmissions were impacted by various factors in real measurement campaigns. Specifically, we want to understand whether machine-learning-based channel models can predict the behavior of a wireless channel *better* than existing techniques. *Better* here can mean more accurately over given time horizons, over longer time horizons, with less computational overhead, etc.

Suggested steps: survey existing wireless channel models; in particular, empiric models; survey machine learning approaches for function approximation; select at least one ML approach to be investigated in detail; select at least one conventional, empiric wireless channel model to be used as comparison case; select a collection of wireless trace data to be used as inputs; select quality metrics for wireless channel models (mostly, from literature); in particular, prediction accuracy; compute channel models on such trace data, using the selected approaches, dividing traces into training and test sets; compare approaches using selected metrics. If master's thesis: repeat evaluation with own traces, collected from laptop or RaspberryPi installations.

In-cooperation

This bachelor/master's thesis is being offered (and will be conducted) in cooperation with the computer networks group (Prof. Karl).

Keywords

Stochastics, statistics, machine learning, computer networking, programming, Linux networking

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