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Bachelor/Master's Thesis

Channel Prediction in Vehicular Networks

Abstract

Modern Intelligent Transportation System (ITS) exploit Vehicle-to-everything (V2X) communication to improve road safety and traffic efficiency, through applications operating currently in sub-6 GHZ. Recently, moving the communication to the millimeter wave (mmWave) frequency band has emerged as a possible solution to the increased number of connected devices in the network and the newly applications, requiring higher communication speed and capacity. However, despite the large bandwidth available in mmWave frequencies such as 60 GHz and 77 GHz, the communication experience several challenges, such as high path loss, limited communication distances and requirement for beam alignment. In these circumstances having a radio fallback system that switches to the microwave frequency band in the cases when the communication at mmWave frequencies is not available is a possible solution approach. To determine the suitable technology for communication, the transmitter needs accurate Channel State Information (CSI), which most of the time is estimated at the receiver and fed back to the transmitter. In scenarios such as vehicular communications, this information becomes quickly outdated due to the rapid channel variations. As a result, predicting future channel state is needed.

Content

The goal of this thesis is to develop a channel prediction scheme for predicting the CSI in vehicular communication scenarios. The predicted CSI in the transmitter will be used to choose the appropriate communication technology, which can be communication in microwave frequencies or mmWave. Possible milestones are as follows:

- Literature research on existing prediction schemes.
- Develop one or multiple solutions for channel prediction. Possible approaches are available: regression model, statistical analysis, or develop a prediction model based on experimental data.
- Use the predicted CSI to decide on the communication technology.
- Evaluate the proposed solution for one or multiple vehicle communication scenarios.

Requirements

It will be helpful to have a basic understanding of *Vehicular Networking*, *Signal processing or Machine Learning*, and *C++*. In case you are not familiar with these requirements, you will need to familiarize yourself during the thesis.

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