Master Thesis
2021

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Joint Sensing and Communications for Future Autonomous Applications

Keywords : Joint sensing and communication, capacity-distortion-cost tradeoff

Description: The key-enabler of mobility-driven networks such as vehicle-to-everything (V2X) communications is the ability to continuously track and react to the dynamically changing environment (hereafter called the network "state") while exchanging information with each other. Motivated by such applications, the joint sensing and communication, where a transmitter equipped with on-board sensors wishes to communicate data to its receivers and simultaneously estimate/track the states, has been extensively studied in the literature. Although common waveforms to perform both communication and sensing tasks have been proposed for specific scenarios, the fundamental limit of such a system is not well understood yet.

In this master thesis, we aim to study the fundamental tradeoff between state sensing and communications in simple point-to-point channels. Our preliminary results were restricted to the memoryless channels with identically and identically distributed (i.i.d.) states, which is unrealistic in practical wireless channels. Therefore, the focus is to extend the preliminary results to temporally correlated channels such that the transmitter can predict the upcoming channels from the previous observations in order to enhance further both sensing and communication performance. If time allows, we will consider other types of channels such as block-fading channels, multiple-input-multiple-output (MIMO) channels.

Prerequisites:

- Solid background in signal processing, optimization or information theory.
- Matlab programming skills.

References:

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