Chair of Communications Engineering
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Master's Thesis

Joint Beam Alignment and Multi-target Tracking

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.

Joint radar and vehicular communication based on IEEE 802.11 has been proposed in the literature, where the same mmWave frequency bands (e.g. 60GHz) are considered for both radar and communication.

At such a high frequency bands, beamforming both at the transmitter and the receiver is considered essential to compensate the high propagation loss over mmWave frequencies.

In this master thesis, we study beam alignment for a joint radar and communication system. In particular, we are interested in the multi-target detection (or estimation) problem such that the transmitter wishes to detect targets reliably (or estimate the multi-target parameters accurately) in a given angular area. A natural question arises as whether it is better to choose a wide beam to perform multi-target detection or scan sub-areas successively with narrow beam to perform hypothesis testing in each sub-area such that the detection/estimation performance is maximized.

Possible research directions include:

- Understand the basic of radar detection and hypothesis testing for a single-target case.
- Study the multi-target detection/estimation using various waveforms.
- If time allows, extend to the mobility scenario.

Reference:

M. A. Richards, ``Fundamentals of radar signal processing'', Tata McGraw-Hill Education, 2005.

Prerequisites

Solid background in wireless communications, signal processing, and optimization.

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