IEEE CTW 2019 – Positioning Algorithm Competition

Background

Indoor positioning is a key enabler for a wide range of applications, including navigation, smart factories and cities, surveillance, security, IoT, and sensor networks. Additionally, indoor positioning can be leveraged for improved beamforming and channel estimation in wireless communications.

The Competition and Evaluation Criteria

The object of the competition is to design and train an algorithm that can determine the position of a user, based on estimated channel frequency responses between the user and an antenna array. Possible solutions may build on classic algorithms (fingerprinting, interpolation) or machine-learning approaches.

Channel vectors from a dataset created with the channel sounder in described [1] will be used. The dataset comprises channel responses and associated position ground truth information (see below for more detail), and may be partitioned into training and probe sets as found appropriate for the algorithm development and training.

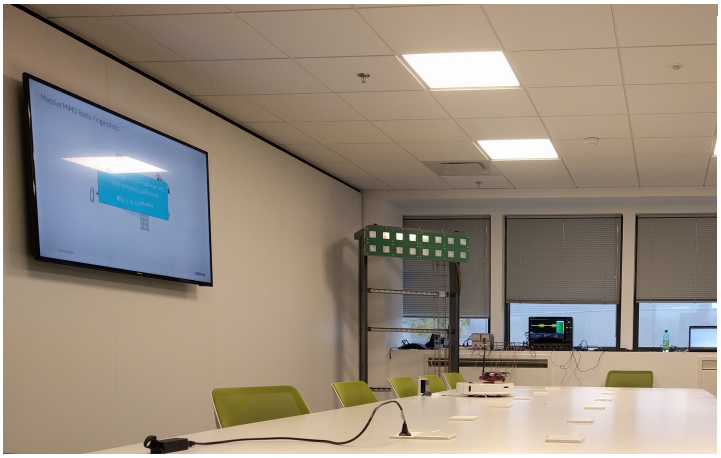
To compete, teams should download the dataset and develop algorithms. In the morning of May 28, 2019, at IEEE CTW, a set of test data comprising only channel responses (but no ground truth) will be distributed. During the day, the participating teams should run their algorithms on this test data set, and submit their estimated position coordinates to `data-competition@inue.uni-stuttgart.de` no later than 20.00 (Iceland local time). The winners will be determined by the organizers, by evaluating and comparing the root-mean-square position error, averaged over all positions in the test dataset, of the submitted solutions.

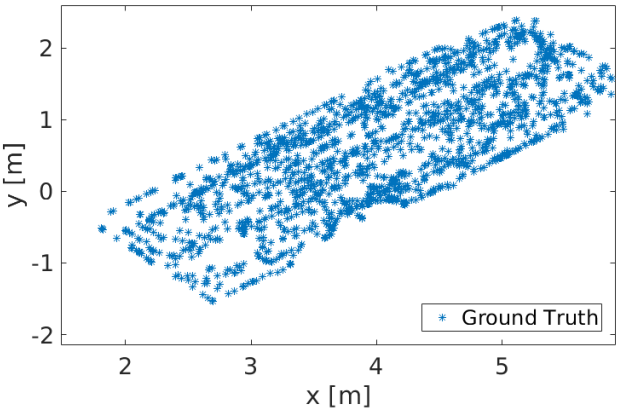
Awards

A 500$ prize will be awarded to the winning team.

About the Dataset

The dataset was acquired by the massive MIMO channel sounder described in [1]. Specifically, channel responses were measured between a moving transmitter and an 8×2 antenna array. As transmitter, an SDR-equipped vacuum-cleaner robot was used, and it drove in a random path on a $\sim 4 \times 2$ m table and transmitted uplink OFDM pilots with a bandwidth of 20 MHz and 1024 subcarriers at a carrier frequency of 1.25GHz. 10 % of the subcarriers were used as guard bands.





The left figure shows a picture of the measurement setup. The right figure shows an example of ground truth coordinates, measured by a tachymeter with an accuracy below 1cm.

The data are provided in three different formats (.mat, h5, and pickle), and available via the following links:
MAT: `https://drive.google.com/open?id=1Ldk7Kz178Q7r6J7PwhIvVj_GIQUEoTls`
HDF; `https://drive.google.com/open?id=1abRC-QsSBmWiyc6fFlL9x5mNO-9npSyc`
PICKLE: `https://drive.google.com/open?id=1hHahhemCgbTKaUiwQEDps989PAzbHH41`

Each link contains three files: i) channel responses, ii) ground truth positions, and iii) SNR information. The channel variable is called `h_Estimated` with the dimension of [Number of measured Points × Number of antennas (16) × Number of used subcarriers (924)]. The position is given in the `r_Position` variable with dimensions of the number of points and the coordinates $[x, y, z]$ (in this order). The last variable contains the SNR of each antenna at each point resulting in the dimensions of [Number of measured Points × Number of antennas].

Further details are available in the README file and Jupyter Notebook provided at the following GitHub page:
`https://github.com/MaximilianArnold/CTW2019-PositioningCompetition`
This GitHub page also contains an FAQ that will be continuously updated.

Reference

[1] Maximilian Arnold, Jakob Hoydis, and Stephan ten Brink, "Novel Massive MIMO Channel Sounding Data applied to Deep Learning-based Indoor Positioning", submitted to SCC2019, arXiv:1810.04126.

Contact

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- General questions about the CTW competition:
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