IEEE CTW 2019 – Positioning Competition

Background

Due to the huge success of mobile communications in almost any area of modern life, indoor positioning systems receive large attention from both industry and academia. Indoor positioning is a key enabler for a wide range of applications such as indoor navigation, smart factories, surveillance, security, smart cities, 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 task is to estimate a user position based on frequency responses of a channel between a user at an unknown location and an array of antennas. Possible solutions may include classic approaches (fingerprinting, interpolation) as well as deep-learning based approaches. Channel vectors from the dataset created with the channel sounder in [1] will be used.

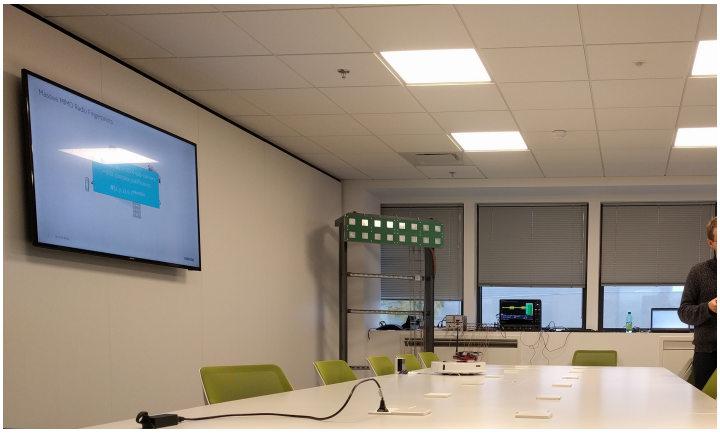
To compete, teams may download the dataset and develop algorithms. The dataset contains i) channel responses, ii) ground truth positions, and iii) SNR information. (See below for more detail.) The dataset may be partitioned into training and test sets as found appropriate for the algorithm training and development.

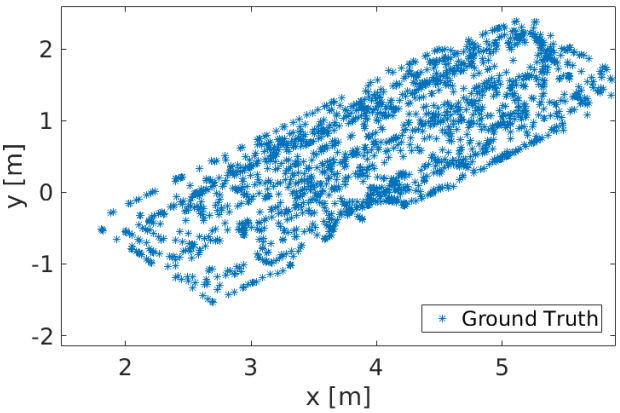
In the morning of May 26.5.2019, at IEEE CTW, a set of test data will be distributed. Participating teams may run their algorithms on this test data set, and submit their estimated position coordinates to `data-competition@inue.uni-stuttgart.de` no later than 20:00. Winners will be determined by the organizers by evaluating and comparing the root-mean-square position error. (Ground truth will not be available to the participants, and the test dataset will not be available before the conference. It will be averaged over all test positions)

A prize will be given to the best three competing teams.

About the Dataset

A massive MIMO channel sounder was used to acquire channel responses between a transmitter and an 8×2 antenna array [1]. An SDR-equipped vacuum-cleaner robot drove in a random path on a 4×2m 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 Fig. shows a picture of the measurement scenario. On the right hand the “Ground Truth” Points created by a Tachymeter with an accuracy below 1cm is shown.

The dataset is provided in three different formats (.mat, h5, and pickle), and available via the following links:
MAT: `https://drive.google.com/open?id=11IGqnn9k8vjkgfMG4GO-AYTgIA5CoDMW`
HDF; `https://drive.google.com/open?id=11qtImrA8Y12L_2RncRC12GXKo0pdrYhT`
PICKLE: `https://drive.google.com/open?id=1HNXjmyMZe6D828oYuhEQqmW5jwf4wy_I`

The dataset contains three main files: the channels, the positions, and the SNRs. The channel variable is called "h_Estimated" with the dimension of [Number of measured Points x Number of antennas (16) x Number of used subcarriers (924)]. The position is given in the "r_Position" variable with dimensions of the number of points and there 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 x Number of antennas].

To get started with the competition, find further details in the README and the basic Jupyter Notebook provided in the following link:
`https://github.com/MaximilianArnold/CTW2019-PositioningCompetition`

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.
[Online]. Available: arXiv:https://arxiv.org/abs/1810.04126

Contact

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- General questions about the CTW competition:
  - Prof. Erik G. Larsson, `erik.g.larsson@liu.se` (2019 IEEE CTW technical co-chair)
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