Efficient Coordinated Recovery of Sparse Channels in Massive MIMO - MATLAB code

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I. Introduction

This article provides a quick introduction to the MATLAB code for our scientific paper

> M. Masood, L. H. Afify, and T. Y. Al-Naffouri, "Efficient coordinated recovery of sparse channels in massive MIMO." *Signal Processing, IEEE Transactions on* 63.1 (2015): 104-118.

The code package containing all required functions and programs that could be used to reproduce the results of the above-mentioned paper could be downloaded from the website of one of the authors, Prof. Tareq Al-Naffouri. Please follow the link http://faculty.kfupm.edu.sa/ee/naffouri/publications/demo_massiveMIMO.zip. The code is also available at MATLAB file exchange and could be downloaded by following this short url http://goo.gl/P19F1Y.

II. Abstract of the Research Paper

This paper addresses the problem of estimating sparse channels in massive MIMO-OFDM systems. Most wireless channels are sparse in nature with large delay spread. In addition, these channels as observed by multiple antennas in a neighborhood have approximately common support. The sparsity and common support properties are attractive when it comes to the efficient estimation of large number of channels in massive MIMO systems. Moreover, to avoid pilot contamination and to achieve better spectral efficiency, it is important to use a small number of pilots. We present a novel channel estimation approach which utilizes the sparsity and common support properties to estimate sparse channels and requires a small number of pilots. Two algorithms based on this approach have been developed which perform Bayesian estimates of sparse channels even when the prior is non-Gaussian or unknown. Neighboring antennas share among each other their beliefs about the locations of active channel taps to perform estimation. The coordinated approach improves channel estimates and also reduces the required number of pilots. Further improvement is achieved by the data-aided version of the algorithm. Extensive simulation results are provided to demonstrate the performance of the proposed algorithms.

III. Content of the Package

The package contains 1) Readme.txt file, 2) one `.m` file, and 3) several p-code files. The file named `demo_massiveMIMO.m` contains the following functions:

1) `demo_massiveMIMO` - this function calls functions to generate required data, channels etc. followed by the required functions to perform sparse channel estimation and finally to display the results.
2) `InitializationsMIMO` - this function allows the user to control several system parameters, such as antenna grid size, constellation size, number of pilot tones, ability to generate space-invariant or space-varying channels etc. to name a few.
3) `GenerateSimulationData` - based on the parameters set in the above function, this function generates the required data and channels and assign these to proper MATLAB structures.

Detailed comments are provided to describe the working of all functions along with the input and output arguments. The comments should be sufficient to be able to use the functions. However, if you have problems running the code, please contact any of the authors through email addresses listed above. Please also refer to the Readme file.

IV. Attribution

If you use the code, please cite our paper

```
@article{masood2015efficient,
  title={Efficient coordinated recovery of
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