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AN OVERVIEW OF BASIC WIRELESS COMMUNICATION SYSTEM

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Abstract

For equalizing channel demodulating and distortion received signals, channel state information (CSI) is given by Channel estimation. Consequently, in recent wireless communications systems, channel estimation takes associate important task. Various channel estimation techniques are discussed in this thesis. Channel estimation technique of Compressive sensing can expand the sparse belongings of the wireless channel of communication and come via higher estimation performance victimization a lot of fewer pilots; hence it is highly spectrum economical. But, most estimators of compressive sensing are possible solely in multipath channels for real valued system, however, now not legitimate in usually systems of complex valued.

Keyword

Wireless communication, CSI, Sparsity, SNR, SL0 algorithm

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Introduction

Information is one of the main characteristics of our modern and rapid developing world. There is no doubt that the information revolution accelerates the pace of life of ordinary people and scientific research in various fields. Each day, we use vast amount of information, including sound, images, and text data etc. Among all these data, a considerable amount is transmitted by various kinds of wireless communication systems. It is generally accepted that a basic wireless communication system shown in Fig. Includes five main parts: data acquisition, data compression, data transmission, differential detection or CSI and coherent detection, data decompression[1].

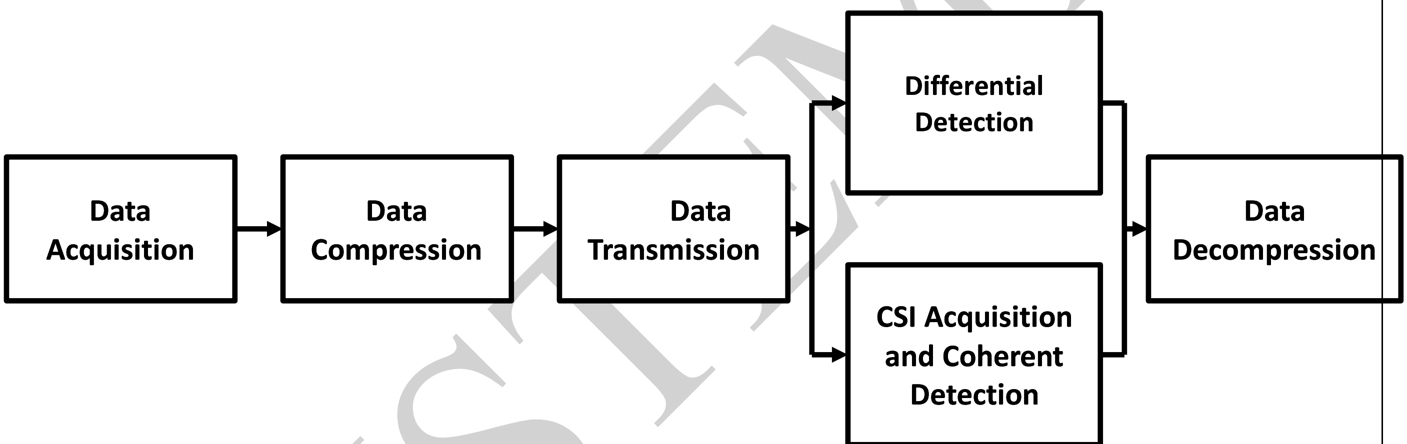

Figure: Basic wireless communication system

At the transmitter, data is firstly acquired for transmission. Following that, data compression is required for efficient transmission. After transmission, at the receiver, differential detection or coherent detection is employed to obtain the transmitted data. Finally, the useful data is obtained by decompression. The differential detection doesn't require the channel state information (CSI), however, it requires high SNR for the received signal. Comparatively, coherence detection requires the CSI, which can be used to reduce the impact brought by the physical channel during the transmission. Generally, coherence detection uses about 3dB less SNR than differential detection for the same BER performance. In order to pursue better estimation performance, majority of communication systems adopt the coherent detection. For coherent detection, as an effective tool to obtain CSI, channel estimation is essential at the receiver. In terms of the

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classification of whether to use the frequency bands or not to estimate the channel, training based channel estimation and blind channel estimation are the two major types of channel estimation methods. Among them, training based channel estimation is the more widely used type. Unlike the blind channel estimation, which can realize the channel estimation depending only on some specific statistics properties, training based channel estimation can fully utilize its training sequence and pilots to obtain effective CSI. Most training based channel estimation methods are realized by undergoing two steps, which are channel sensing and channel reconstruction. Channel sensing process mainly focuses on how to effectively make use of limited frequency bands to fully make sense of the CSI. To realize this, optimal or suboptimal training sequence or pilot pattern arrangement should be developed in terms of different channel models. Different from the channel sensing process, channel reconstruction process concentrates on efficiently extracting CSI obtained by the channel sensing process. In this process, it is important to effectively balance the estimation performance, spectrum efficiency and the computational complexity which is the guarantee for the realization of high data rate, high frequency efficiency and green communication in modern communications. Both of those two steps mentioned above can be and can only be effectively realized based on having good knowledge of wireless communication environment, its corresponding physical channel and the characteristics of the channel. Traditional training based channel estimation methods are effective to estimate the rich multipath channels, however, if the channels are sparse, which are demonstrated to be existed in many wireless communication environments, the traditional methods can hardly be effective. The primary reason is that the sparsity of the sparse channel can hardly be explored by the current channel estimation methods. If the characteristics of sparsity of the physical channels can be fully utilized, it can actually benefit spectral efficiency, channel estimation performance and the computational complexity. As one of the major discoveries in the 21th century, compressed sensing (CS) theory provides an effective way to extract the CSI of the sparse channel with limited frequency bands and acceptable computational costs. The following sections in this thesis mainly focus on the review of modern wireless communication systems, sparse channel estimation in OFDM system and analysis of its performance using proposed sparse channel estimation [1].

Objective and Scope of present work

1. To analyze various modern wireless communication channels.
2. To develop the mathematical model of modern wireless communication.
3. To study the different channel estimation methods.
4. To explore the sparsity of the channel by channel estimation methods and utilize the characteristics of sparsity of the physical channels.
5. To extract the CSI of the sparse channel and to reconstruct efficiently sparse signals from a very limited number of measurements (samples).
6. To develop and modify the compressive sensing based complex sparse channel estimation method using modified SL0 algorithm.
7. To analyze the performance of our developed sparse channel estimation algorithm.
8. To analyze the performance of our proposed work with modern wireless communication channel model.
9. To simulate the various results for our proposed work.

Significance

Modified SL0 algorithm, discussed in this thesis, provide sparse channel estimation based on compressive sensing technique. The algorithm has comparable performance and therefore offers flexibility. Motivated by conclusion of SL0 algorithm by author H. Mohimani et al. in their article [2], we have carried out an extensive empirical analysis with the objective of finding the optimal parameter values. We suggest a modification to the existing SL0 algorithm which may greatly improve the overall performance. The modified SL0 algorithm used in this thesis have many attractive features such as sparse, for complex valued system, fast, bandwidth efficient, and reliable. Therefore the algorithm present an attractive solution for several size restricted wireless portable devices, such as 3G, 4G-LTE, Wi-Fi, Wi-MAX and WLAN.

In this thesis, we have proposed a new compressive sensing reconstruction algorithm named modified SL0 based on the existing concept of smoothed l0 norm. This proposed modified SL0 algorithm to exploit the sparse structure of the channel by improved parameter selection.

Experiments show that modified SL0 is with better tracking behavior, more steady state and stronger robust, when in comparison to algorithm SL0. Then we provided a mathematical analysis and simulation results for showing its performance improvement over standard.

The modified SL0 algorithm has comparable performance. Good performance of MIMO system can be achieved by this sparse channel estimation method. Achieving best results for proposed algorithm is one of the toughest challenges that exist in the complex valued sparse channel estimation method. These concepts have been utilized in modern communication systems like mobile and broadband wireless systems, including the Wi-Fi (IEEE 802.11) systems and the LTE system, to greatly improve both bandwidth and power efficiency.

Conclusion

Now a days, wireless communication is widely used for data transmission. Speed and accuracy are the major factors in the transmission. SNR, MSE and BER these are the massive parameters to bring the accuracy 100%. Due to multipath fading, accuracy may lack. Various techniques like MIMO-OFDM and various algorithms are used to tackle the signal strength. Channel State Information is giving the status of channel and modified SL0 algorithm using CS technique gives better performance at the output end.

References

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Bio

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