Master Thesis

Low-Complexity Channel Estimation for Wireless Sensor Networks

Introduction:

Recently, there has been a growing research interest in wireless sensor networks (WSNs) as their unique features allow a wide range of applications in the areas of military, environment, health and home. They are usually composed of a large number of densely deployed sensing devices which can transmit their data to the desired user through multihop relays. As sensing devices carry limited, in general irreplaceable power sources, low complexity and high energy efficiency are the most important design characteristics of communication protocols and physical layer techniques employed for WSNs.

Aim:

This project will focus on low complexity channel estimation methods for WSNs. The student will investigate the set-membership filtering (SMF) framework and incorporate it into the conventional channel estimation algorithms such as the normalized least mean squares (NLMS), recursive least squares (RLS), conjugate gradient (CG) algorithm, affine projection (AP) algorithm and data reusing algorithm, etc. These set-membership channel estimation algorithms can reduce the computational complexity significantly and extend the lifetime of the WSN by reducing its power.

This project will involve the use of mathematical and engineering models to solve relevant problems encountered in the field of WSNs. These models are tested with computer simulations (Matlab) and verified with analytical expressions.

Skill requirements:

Knowledge in wireless communications and signal processing

Maths at advanced level (linear algebra, probability and statistics, optimization)

Basic Matlab knowledge

Supervisors:

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Key references:

[1] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "A Survey on Sensor Networks," *IEEE Communications Magazine*, vol. 40, pp. 102-114, August 2002.
[2] J. N. Laneman and G. W. Wornell, "Cooperative diversity in wireless networks: Efficient protocols and outage behavior," *IEEE Transactions on Information Theory*, vol. 50, no. 12, pp. 3062-3080, December 2004.
[3] S. Haykin, *Adaptive Filter Theory*, 4th ed. Englewood Cliffs, NJ: Prentice-Hall, 2002.
[4] T. Wang, R. C. de Lamare, and P. D. Mitchell, "Low-Complexity Set-Membership Channel Estimation for Cooperative Wireless Sensor Networks," *IEEE Transactions on Vehicular Technology*, vol. 60, no. 6, May, 2011.