Final Year Project  MM1-09
SIGNAL PROCESSING FOR INTERFERENCE MITIGATION IN MIMO NETWORKS
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**ABSTRACT**

Multiple-input multiple-output (MIMO) has become a key technology in the future wireless communication systems because of its potential for dramatically increasing the channel capacity without requiring extra bandwidth. In this project, we investigate the signal processing strategies for mitigating the interference in practical MIMO networks and propose a modified single user strategy that gives better throughput. We also look at multi-user MIMO with feedback delay, and compare it with single user, thus propose an adaptive scheme.

**INTRODUCTION**

Much of the early work on MIMO was focused on single-user systems, whose significant gains were predictable and it was proportional to the number of receivers. However, the practical systems are inherently multi-user, and the interference from other users can degrade the overall system performance significantly. Multi-user MIMO system can perfectly remove the interference without noise enlargement. This unique feature, however, requires a full channel state information at transmitter end (CSI), and it is largely depends on the stability of the channel.

**SYSTEM MODEL**

The channel is modeled by Jake’s autocorrelation model, where the channel $H$ of current frame is correlated with the previous frame, with an extra error vector $A$.


and he received signal is

$$y = Hx + n$$

We assume the channel estimation is perfect in both single-user and multi-user systems. The error occurs when the CSI is fed back to the transmitter. The feedback delay in multi-user systems is modeled respectively for two feedback schemes, FDD and TDD.

**TRANSMISSION TECHNIQUES**

Equalization techniques are employed for single-user case. Zero forcing (ZF) and minimum mean-squared error (MMSE) strategies are considered. ZF equalization perfectly removes the interference between channels. However, MMSE is preferable over ZF because the noise enlargement effect is much smaller compared with ZF system.

Zero-forcing beamforming (ZFBF) is used in multi-user transmission. The filter matrix is applied at transmitter, and the received signal is simply the information corrupted with Gaussian noise.

**KEY RESULTS**

A modified MMSE strategy strategy. Figure on the right side illustrates that the modified strategy has the lowest bit error rate.

**CONCLUSIONS**

Mathematical derivation and Simulation results show that modified MMSE equalization strategy performs optimally among single user strategies.

We conclude from simulation results that our adaptive scheme gives an average gain around 20% in terms of throughput over each single transmission scheme, and the system is operating with tolerated reliability while other schemes may have exceed the error tolerant.