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Gaussian Intersymbol Interference Channels With Mismatch

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Abstract

This paper considers the problem of channel coding over Gaussian intersymbol interference (ISI) channels with a given metric decoding rule. Specifically, it is assumed that the mismatched decoder has an incorrect assumption on the impulse response function. The mismatch capacity is the highest achievable rate for a given decoding rule. Existing lower bounds to the mismatch capacity for channels and decoding metrics with memory (as in our model) are presented only in the form of multi-letter expressions that have not been calculated in practice. Consequently, they provide little insight on the mismatch problem. In this paper, we derive computable single-letter lower bounds to the mismatch capacity, and discuss some implications of our results. Our achievable rates are based on two ensembles; the ensemble of codewords generated by an autoregressive process, and the ensemble of codewords drawn uniformly over a "type class" of real-valued sequences. Computation of our achievable rates demonstrates non-trivial behavior of the achievable rates as a function of the mismatched parameters. As a simple application of our technique, we derive also the random coding exponent associated with a mismatched decoder which assumes that there is no ISI at all. Finally, we compare our results with universal decoders which are designed *outside* the true class of channels that we consider in this paper.

I. Introduction

The mismatch capacity is the highest achievable rate for a given, possibly suboptimal, decoding rule. This scenario arises naturally when, due to imprecise channel measurement, the receiver performs maximum-likelihood decoding with respect to the wrong channel law, or when the receiver is intentionally designed to perform a suboptimal decoding rule due to implementation constraints. This problem has

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