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On the Error Exponent of Trellis Source Coding

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Abstract- In this paper, we develop a single-letter lower bound on the error exponent for the problem of trellis source coding. We demonstrate that for the case of a binary source with the Hamming distortion measure, and for rates close to the rate-distortion curve, this bound is superior to Marton's block coding exponent, for the same computational complexity.

Index Terms - Block source coding, block source coding error exponent, computational complexity, rate-distortion function, relative entropy, trellis source coding, trellis source coding error exponent, Viterbi algorithm.

1 Introduction

Historically, trellis source codes were developed in analogy to trellis channel codes (specifically, convolutional codes), whose performance/complexity tradeoff was shown to be better than that of block channel codes [22]. Trellis channel codes also serve as building blocks for nowadays state-of-the-art channel codes, like Turbo codes. Thus, it should not be surprising that trellis source codes are superior to block source codes in terms of having better performance/complexity tradeoff, as demonstrated empirically, e.g., [5], [6], [9], [14], [15], [24], [25], [26], and analytically [21], [29].

Jelinek [13] was the first to conjecture that trellis source codes are asymptotically opti-