Methoden der Signalverarbeitung (Prof. Utschick)

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Abstract: We study the problem of compression of a Gaussian vector for the purpose of similarity identification, where similarity is defined by the mean square Euclidean distance between vectors. While the asymptotical fundamental limits of the problem - the minimal compression rate and the error exponent - were found in a previous work, in this paper we focus on the nonasymptotic domain. We first present a finite blocklength achievability bound based on shape-gain quantization: The gain (amplitude) of the vector is compressed via scalar quantization, and the shape (the projection on the unit sphere) is quantized using a spherical code. The results are numerically evaluated, and they converge to the asymptotic values as predicted by the error exponent. For a practical implementation of such a scheme, we use wrapped spherical codes, studied by Hamkins and Zeger, and use the Leech lattice as an example for an underlying lattice. As a side result, we obtain a bound on the covering angle of any wrapped spherical code, as a function of the covering radius of the underlying lattice.

Stichworte: asymptotical fundamental limits, compression rate, finite blocklength achievability bound, Gaussian processes, Gaussian vector, information theory, Lattices, Leech lattice, mean square Euclidean distance, nonasymptotic domain, quadratic similarity queries, quantisation (signal), Quantization (signal), query processing, scalar quantization, Shape, shape-gain