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Design of single and dual-mode companding scalar quantizers based on piecewise linear approximation of the Gaussian PDF. (English) Zbl 1457.94048 J. Franklin Inst. 357, No. 9, 5663-5679 (2020).

Summary: This paper proposes a novel companding quantizer design for Gaussian source by using piecewise linear approximation of the probability density function. As the optimal companding technique represents very effective tool for quantizing signals with nonlinear distribution, such as speech, the lack of optimal closed-form solution for Gaussian source represents an issue that motivated us to provide an approximation model, supported with closed-form designing expressions, suitable for applications requiring low processing delays. We provide the derivation of closed-form expressions for approximate compressor and inverse compressor functions, which are used to define representation levels and boundary segments, as the optimal compandor design requires integral equations solving. Also, we analyze how the probability density function within a dual-mode framework behaves and we propose a novel model of probability density function. System performances are analyzed for various values of configuration parameters and estimated theoretical performances are compared with appropriate simulations. Moreover, the results are compared with performance of the optimal compandor to justify the usefulness of dual-mode technique and it is demonstrated that the model we propose outperforms it, making the model competitive for speech applications where the system complexity is significant or critical aspect alongside achieved performances.

MSC:

94A12 Signal theory (characterization, reconstruction, filtering, etc.)
62E17 Approximations to statistical distributions (nonasymptotic)

Keywords:

companding quantizer design for Gaussian source; optimal compandor design

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References:

Liu, S.; Wei, G.; Song, Y.; Ding, D., Set-membership state estimation subject to uniform quantization effects and communication constraints, Journal of the Franklin Institute, 354, 7012-7027 (2017) - Zbl 1373.93324


Nikolic, J.; Peric, Z.; Velimirovic, L., Simple Solution for Designing the Piecewise Linear Scalar Companding Quantizer for Gaussian Source, Radioengineering, 22, 194-199 (2013), 1


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