Joint Source-Channel Coding with Unequal Error Protection using Asymmetric Turbo Codes

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Abstract⸺ **In this paper, we devise an efficient joint source-channel coding scheme for robust image transmission over noisy channels. We firstly present a novel interleaver, named unequal row column cyclic cross interleaver, which could improve the error correction capability of turbo codes effectively. Secondly, we devise two types of asymmetric turbo codes which consist of the parallel concatenated turbo codes using two non-identical component encoders with the different constraint lengths and mixed types of generator polynomials. The presented asymmetric turbo codes can optimize the bit error rate of both water-fall region at low signal to noise ratio and error-floor region at high signal to noise ratio, they outperform the conventional symmetric turbo codes but with reduced decoding complexity. Finally, we propose a joint source-channel coding scheme based on unequal error protection using asymmetric turbo codes. This scheme can adaptively adopt different coding strategies, different interleavers of turbo codes, various decoding algorithms and appropriate decoding iterative numbers according to the different significant levels of image data streams and the varying conditions of estimated channel state information. The proposed scheme can also dynamically adjust the source compression ratios and channel code rates by optimizing the rate allocation according to the calculated peak signal to noise ratio of reconstructed images and the estimated channel states information. The experimental results show that the proposed joint source-channel coding scheme can evidently increase the peak signal to noise ratio of the reconstructed images and improve the visual effect of the images but with no additional bandwidth, the scheme is more adaptive and feasible.**

Keyword⸺ **Joint source-channel coding; Unequal error protection; Asymmetric turbo codes; Interleaver; Bit error rate; Water-fall, Error-floor; Peak signal to noise ratio**

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