Zero-Delay and Causal Secure Source Coding*

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Abstract

We investigate the combination between causal/zero-delay source coding and information-theoretic secrecy. Two source coding models with secrecy constraints are considered. We start by considering zero-delay perfectly secret lossless transmission of a memoryless source. We derive bounds on the key rate and coding rate needed for perfect zero-delay secrecy. In this setting, we consider two models which differ by the ability of the eavesdropper to parse the bit-stream passing from the encoder to the legitimate decoder into separate messages. We also consider causal source coding with a fidelity criterion and side information at the decoder and the eavesdropper. Unlike the zero-delay setting where variable-length coding is traditionally used but might leak information on the source through the length of the codewords, in this setting, since delay is allowed, block coding is possible. We show that in this setting, separation of encryption and causal source coding is optimal.

Index Terms: Source coding, Zero-delay, Secrecy, Causal source coding, Rate-Distortion, Side Information

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