Convolutional codes for network coding

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Coding theory has emerged out of the need for better communication and has rapidly developed as a mathematical theory in strong relationship with algebra and combinatorics. Error correction codes are used in everyday practical applications and have been the foundation of the revolutionary growth in digital communications.

Network coding theory is concerned with the encoding and transmission of information over networks where there may be many information sources and possibly many receivers. The mathematical foundations of random network coding emerged through an award-winning paper by R. Koetter and F. Kschischang in 2008 and it has since then opened a major research area in communication technology with widespread applications for communication networks like the internet, wireless communication systems, and cloud computing. Restriction to the so-called Grassmannian codes has proven to be advantageous and leads to the theory of designs over Galois fields. Network coding allows transmitting information through a network by disregarding any of its topological features. In network coding, algebraic algorithms are applied to the data to achieve better network throughput, reduce delays and make the network more robust.

In this paper we present a novel coding approach to deal with the transmission of information over a network. In particular, we propose to use a rank metric code obtained by concatenation of a Hamming metric outer convolutional code and a rank metric inner block code which encodes each symbol of the outer code separately. We show that the proposed novel scheme improves significantly the transmission of a streaming of information over a network improving the error correction capabilities of the codes, and therefore making the transmission over the network more robust.

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