

Application of the Concatenation of RS and LT Codes in Deep Communications

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Abstract: Fluctuating deep communication channel quality invalidates the RS codes sometimes. RS codes and LT codes are concatenated in the space communications. An improved decoding algorithm is presented by introducing some low computational cost operations on additional information of received symbols when the traditional one gets into the idle wait status.

Index Terms: FEC; erasure correction codes; RS codes; fountain codes; decoding

I. OBJECTIVES

The concatenation of LT codes with the improved decoding algorithm and RS codes makes the information transmission rate approach the deep communication channel capacity as possible. RS encoded deep communication channel can be considered as an erasure channel. LT codes can approach the capacity of any erasure channel. The improved decoding algorithm of LT codes spends the idle wait time, which exists in the traditional decoding method, performing some low computational cost operations on the additional information of the received symbols to recover as many input symbols as possible from the received symbols.

II. DESCRIPTION OF THE RESEARCH APPROACH

It is concluded by analyzing of the principle of the traditional decoding algorithm that idle wait usually occurs in the traditional decoding algorithm for LT codes and does frequently when the channel quality is poor. The idle wait leads to longer decoding delay and possible more receiving buffer consumption and even to a lower successful decoding probability when the number of the output symbols is finite since the receiver can not obtain enough known received symbols. The computational cost of the extra operations is also analyzed briefly in the full version of the paper.

Simulations are made in Matlab to compare the decoding overhead and the successful decoding

probabilities of the traditional decoding algorithm and the improved one with a finite number of output symbols over six erasure channels.

III. RESULTS

Fig.1 and Fig.2 show the successful decoding probabilities and decoding overhead of the two decoding algorithms over six erasure channels, respectively.

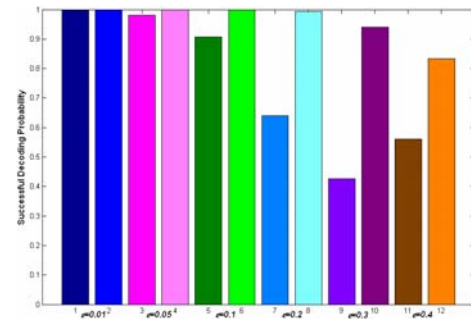


Fig.1 Successful decoding probabilities vs. erasure channels

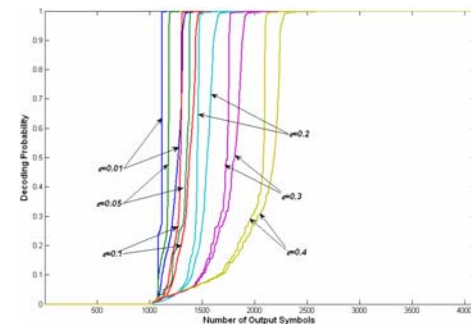


Fig.2 Decoding overhead vs. erasure channels

It can be seen from Fig.1 and Fig.2 that the improved decoding algorithm can increase the successful decoding probability, reduce the decoding overhead, and shorten the decoding delay and have more real-time properties.

IV. THE IMPACT FOR SPACE SYSTEMS

When LT codes are concatenated with RS codes in deep communications, the problem of the channel quality fluctuation can be solved. The improved LT codes decoding algorithm can increase the code rate and the channel efficiency.