TURBO-PRODUCT CODES DECODING FOR REMOTE MEDICAL MONITORING

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Medical diagnostic equipment often interfaces with computers or networks for data storage, analysis and transmission. With the rise of remote patient monitoring devices, ensuring the secure and error-free transmission of patient data is essential. Implementing error correction techniques such as turbo-product codes (TPCs) can help maintain data integrity during these processes, reducing the risk of diagnostic errors. The *aim* of this work is to analyze the decoding procedure for TPCs.

The iterative procedure is two-stage – horizontal and vertical decoding. A decoding method based on a list of code words is effective, which uses a set of vectors from the communication channel r_j, changing the least reliable symbols and decoding each word with a hard decoder. After that, the similarity metrics M_i of competing words c_{ij} are calculated and the best of them M_b is determined. Next, the reliability of each symbol in the bit sequence is calculated, using the received c_b sequence, list of code words and external information from the decoder is found:

$$E_j = \begin{cases} \frac{1}{4} \cdot (\min\{M_i, c_{ij} \neq c_{b,j}\} - M_b) \cdot (2c_{b,j} - 1) - r_j, c_{ij} = c_{b,j}; \\ \beta \cdot (2c_{b,j} - 1) - r_j, \qquad\qquad c_{ij} \neq c_{b,j}, \end{cases} \tag{1}$$

where $\beta = [0.2;\ 0.4;\ 0.6;\ 0.8;\ 1.0;\ 1.0;\ 1.0;\ 1.0;...]$.

Now it is necessary to update the information entered into the decoder at iteration *q* according to the expression:

$$w_j^q = r_j + \alpha \cdot E_j^q, \tag{2}$$

where $\alpha = [0.0;\ 0.2.;\ 0.3;\ 0.5;\ 0.7;\ 0.9;\ 1.0;\ 1.0;...]$.

This procedure repeats for all rows. Then the algorithm performs column decoding using the w value obtained after row decoding.

The TPCs could be utilized to improve the reliability of data transmission from different medical devices, including wearable sensors or implantable devices.

References:

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