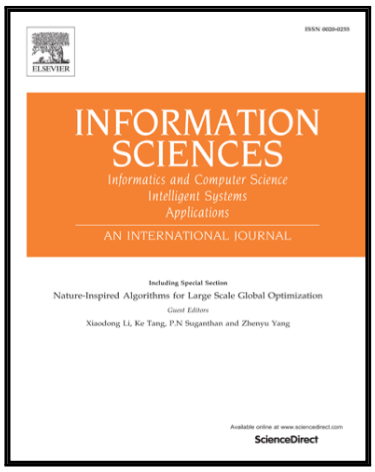

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Reversible data hiding with contrast enhancement and tamper localization for medical images

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Abstract: Digital transmission of medical images often involves hiding crucial information in some parts of the images which should be later extracted to authenticate ownership and identity. In this paper, a new reversible data hiding (RDH) algorithm for medical images is proposed. The primary objective of the algorithm is to achieve contrast enhancement of the region of interest (ROI) without introducing distortion, and achieve tamper localization against attacks on the ROI. First, the background and ROI of the medical image are segmented using Otsu's automatic optimal thresholding method. To reduce the visual distortion, an improved scheme for preprocessing is applied to reduce the number of disordered pixels. By expanding the peak-pairs of the ROI histogram, data embedding along with distortion-less contrast enhancement of the ROI is achieved. The feature-bit matrix generated from the ROI is embedded into the least significant bits (LSBs) of the background pixels. At the receiving end, the tampered contents from the ROI of the detected image can be located using a difference matrix between the feature-bit matrix generated from the ROI and that extracted from the background. In the absence of tampering, the original ROI can be completely restored after the embedded data is extracted. Experimental results demonstrate that in comparison with some state-of-the-art RDH algorithms, the proposed algorithm achieves better performance in terms of contrast enhancement of ROI, preserving visual quality of the background and tamper localization.

Keywords: Reversible data hiding; Contrast enhancement; Tamper localization; Medical images; Region of interest

1. Introduction

Over the past few decades, the transmission of secret data and authentication of digital media have been accomplished by widespread use of information-hiding technologies [2, 7, 19, 31, 34, 35, 36]. Aimed particularly at losslessness in applications such as medical imaging, the technique of reversible data hiding (RDH) [9, 13, 23] was developed to embed authentication-related information into the cover images. After extraction of the information embedded by RDH, the marked object can be restored to its original state. Moreover, the data hidden in a medical image is not limited to authentication information, and may also include electronic patient records (EPR) consisting of diagnostic reports, vital signs, and other information such as IDs [8].

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