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Robust blind image watermarking scheme using a modified embedding process based on differential method in DTCWT-DCT

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Abstract
This research paper presents a modified blind and robust image watermarking scheme that combines dual-tree complex wavelet transform (DTCWT) and discrete cosine transform (DCT) domains. A key challenge for researchers is to determine the optimal locations for embedding watermarks in the low-frequency coefficients of the hybrid domains, ensuring both imperceptibility and security. To identify the most effective sequence for the watermark embedding process, a differential approach is implemented on two correlated DCT-transformed vectors derived from DTCWT wavelet low-frequency coefficients. The watermark data does not need to be extracted from the original image. The proposed scheme aims to assess the efficiency improvement against various image processing attacks. We utilized fifteen grayscale images from the UCI-sipi image database, each with a size of 512×512 pixels, to evaluate the proposed scheme. The experimental results demonstrate that our scheme outperforms existing schemes in common image attacks such as geometric attacks, compression, filtering, and noise addition.

Keywords Watermarking · DTCWT · DCT · Differential Method

1 Introduction

In recent years, it has become crucial for image watermarking technology to be robust against various types of attacks in order to protect copyrights [1–3]. Image watermarking techniques can be classified into spatial and frequency domains based on the domain of transform [4, 5]. The spatial domain uses the direct image pixels' values to embed the watermark, making it less complicated to implement [6–8]. However, it is susceptible to

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