

图形、图像、模式识别

## 小波变换和硬C均值聚类的数字水印算法

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**摘要** 提出一种基于硬C均值聚类的小波域数字图像水印算法。该算法利用人类视觉特性对小波域的低频子图进行硬C均值聚类, 确定可嵌信息区域, 在可嵌信息区域内通过交换相邻小波域系数值嵌入二值水印图像; 双混沌序列的使用增强了水印系统的安全性。实验结果表明: 该算法不仅具有良好的透明性, 而且对叠加噪声、JPEG压缩、几何剪切, 改变图像核心部分等恶意攻击具有高鲁棒性。

**关键词** [小波变换](#) [硬C均值聚类](#) [双混沌系统](#)

**分类号** [TP391](#)

## Digital watermarking algorithm based on DWT domain and HCM

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### Abstract

This paper presents a new algorithm based on Discrete Wavelet Transform (DWT) domain and Hard C-means Cluster (HCM). Firstly, the DWT is performed on host image. Then, the watermark embedding location is identified adaptively by applying HCM in low frequency sub-image. Finally, the binary watermark is embedded by exchanging the adjacent wavelet coefficients in the watermark embedding location. The using of double chaotic sequences intensifies the security of watermark system. The experimental results demonstrate that this method is invisible and robust against various image processing such as noise adding, compression, cropping, changing the core of the image, and so on.

**Key words** [Discrete Wavelet Transform \(DWT\)](#) [hard C-means cluster](#) [double chaotic system](#)

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