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Discrimination of Natural Images and Computer Generated Graphics Based on Multi-Fractal and Regression Analysis

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Abstract: The aim of the work presented in this paper is to discriminate natural images (NI) and computer generated graphics (CG). The texture differences are analyzed to the residual images of NI and CG. The residual images are first extracted by using multiple linear regressions, and then the fitting degree of the regression model is investigated. Through the analysis of the difference of their residual images, 9 dimensions of histogram features and 9 dimensions of multi-fractal spectrum features are extracted to represent their texture differences. Combined with 6 dimensions of regression model fitness features, natural images and computer generated graphics are discriminated by using a support vector machine (SVM) classifier. Experimental results and analysis show that it can achieve an average identification accuracy of 98.69%, and it is robust against JPEG compression, rotation, additive noise and image resizing. Compared with some existed methods, the selection of features is effective and fewer features are required for representing the differences between NI and CG. Meanwhile, the classification time is significantly reduced and the robustness is maintained. It has great potential to be used in image source pipeline identification.

Key words: Digital image forensics; Image source identification; Multifractal; Regression analysis; Natural images; Computer generated graphics

1. Introduction

With the development of digital image processing technologies, CG is more and more photorealistic. As it provides conveniences to our daily life, it also brings serious consequence to