Chapter 16
Contrast Modification Forensics Algorithm Based on Merged Weight Histogram of Run Length

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ABSTRACT

A novel image forensic algorithm against contrast modification based on merged weight histogram of run length is proposed. In the proposed algorithm, the run length histogram features were firstly extracted, and then those of different orientation were subsequently merged; after normalization of the prior features, the authors calculated leaps in the histogram numerically; lastly, the generated features of authentic and tampered images were trained by a SVM classifier. Large amounts of experiments show that, the proposed algorithm has low cost of computation complexity, compared with some existing scheme, and it has better performance with many test databases, furthermore, the proposed algorithm can effectively detect local contrast modification of image.

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INTRODUCTION

Due to the rapidly development of image processing tools, it becomes easy for people to edit or forge an image, so it has aroused the attention for the authenticity of an suspicious images. In order to determine if an image has undergone any form of alteration, people have exploited a wide variety of image forensics algorithms, such as algorithms to deal with the detection of resampling, image compression, image copy-paste and image filter.

Contrast enhancement is a very ordinary means to modify image, it can be used for the whole or local image. In general, image contrast enhancement is frequently applied in order to ease the visual pleasantness of a digital image and favor its interpretation by providing a better understanding of its details. At present, people have proposed several forensic schemes to identify whether a digital image undergone a contrast enhancement processing. For example, Stamm and Liu (2010) proposed an image forensic method for detecting general forms globally and locally applied contrast enhancement by searching for the identifying features of each operation's intrinsic fingerprint; Lin et al. (2013) raised a novel forensic method of exposing cut-and-paste image forgery through detecting contrast enhancement by revealing the inter-channel correlation introduced by color image interpolation. Recently, Cao et al. (2014) presented two methods to detect the contrast enhancement in digital image via histogram peak/gap artifacts analysis, the method can detect the global contrast enhancement in both uncompressed and previously JPEG-compressed images, and the zero-height gap bins in gray level histograms were exploited as identifying features. Different from the forensic methods which are based on first-order statistics, i.e. a statistical analysis of the image histogram, such that contrast enhancement forensic scheme of Stamm et al. (2008, 2010), Cao et al. (2010) and P. Ferrara et al. (2013), Alessia et al. (2015) proposed a simple image forensic algorithm based on second-order statistics derived from the co-occurrence matrix, the algorithm can resist the counter-forensic methods devised to fool first-order statistics detectors.

This paper proposed a novel method for detecting image forgery through contrast enhancement processing, the proposed algorithm can detect global and local modification of image contrast enhancement via merged weight histogram of run length, its advantage lies in that, the statistic feature has only one dimension, the computation complexity is low, the other one is that the algorithm is especially effective for detecting contrast enhancement forgery with small size of image than some existing scheme .

The rest of this paper is organized as follows. In Section 2, some preliminaries are introduced. In Section 3, the proposed detector is given and the experiment results are reported. Finally, the conclusion is drawn in Section 4.

PRELIMINARIES

Contrast Enhancement Detection Based on Histogram

Stamm et al. (2010) have proposed an algorithm of contrast enhancement detection based on histogram peak/gap artifacts left by attacked image; the main steps are described in the following:

1. Calculate the image's pixel value histogram $h(x)$ and the modified histogram $g(x)$ such that:

$$g(x) = p(x)h(x) \tag{1}$$