A Review on Boundary Detection Techniques in Authentic Region

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Abstract

Image authentication is a tedious process researchers have been established for new technical solutions for image authentication, in recent times started expansion of new methods aiming at blind passive detection of image splicing. Conversely, many other research societies dealing with data processing need to collect an open data set with various content and realistic splicing conditions in order to expedite the progresses and facilitate collaborative studies. A skilled image editor can be done an image splicing process by verification of image authentication has become important. In this paper, we suggest a detection method for splicing boundaries that uses consistency on camera response function (CRF) in an image. The uniformity of CRF is detected as differential features. In some images, the non-uniformity of CRF typically appears on the edges of a splicing region. The physical appearance of CRF taken out from edges in an image differsamong a transformed region and an authentic region. The QR map is used to analyze the topographies that represent the relation between this features and image intensity. In common the CRF has an authentic boundary within an image, but a splicing boundary is not available.

Index Terms— *Image authentication, CRF, image splicing boundary, QR map.*

I. INTRODUCTION

The high functionality image editing software is used to edit images which smoothly edit an image boundary and splicing of images to produce images unintended by the professional photographer, and being unsure of whether the digital image is real or not makes it difficult to certify it as authentic. In response, digital watermarking is used as means of verifying an image's authenticity. This is a method of detecting change by inserting information in the interior ofimage; it needs toembed of the information in advance. Therefore, a detection method of altered region which do not need embedded information has become important.

In this paper, the estimation of camera response function (CRF) has been done and investigates the constancy of the response function within the image in order to detect whether the image has been spliced. The CRF has reliability within an original image and detect some different CRF within an altered image. The characteristics can be used for detecting altered regions. The CRF is not typically known function in order to analyze and estimate CRF, many methods has been projected [1]-[5]. Author K. Ikeuchi etal. follow this method he used to collect several images of the similar static scene occupied from the same view point to estimate it exactly in the occurrence of noise [1]. S. Lin et al. follow RGB distribution at edges to found image radiometric calibration, and S. F. Chang et al. used to distinguish CRF by the geometrical invariant method (GI), which is a camera-specific invariant found from the gradient information around the edges [6]-[8]. The technique can estimate it from a piece of image. In this article we use splicing boundaries between altered area and authentic area. And we analyze the features of splicing boundaries differing from those of a normal edge area and discuss a method for detecting altered regions from a single image.

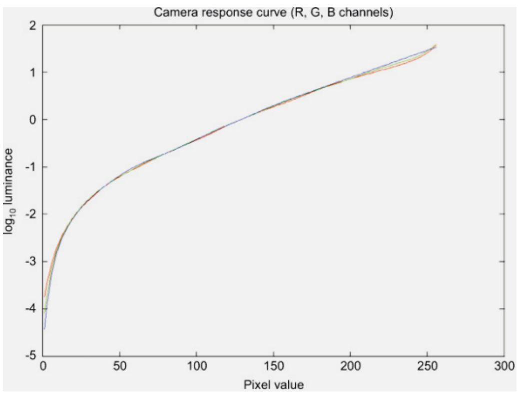

Fig. 1. Camera Response Function

II. CAMERA RESPONSE FUNCTION ESTIMATION

The estimation of CRF can be done by splicing image as three regions, region 1 is taken by camera 1, the region 2 by camera 2, and the region 3 on the boundary of these first two regions. F. Hsu *et al.* intensive on whether there was uniformity within an image by means of CRF for alteration detection [8]. This boundary region 3 is theoretically occurring when image is spliced. Each CRF is respectively estimated in regions 1 and region 2 by the method of *Tian T. Ng*. In altered image, there is a substantial variance in CRFs between region one and region two. This difference is used to evaluate whether an image has been spliced. However this approach has a problem when textures have low intensity around target boundaries. If there are very small changes in CRFs, is very challenging job to detect CRF in altered regions. And also need to examine a method of detecting the alteration in the case that some textures in an image partly have low intensity.

CRF is a function for adapting the irradiance, as light energy occurrence on the image sensor, into image concentration. So, CRF is normally denoted as $R=f(r)$, where R is the image intensity and r is the light energy incident on the image sensor. CRF is generally unknown because it varies by device and photography setting, and it is known to be a non-linear function as shown in Fig. 1. CRF is displayed as a gamma curve$f(r) = r^{\gamma}$, in practical the actual CRF cannot be mentioned as gamma curve model this can be denoted by a polynomial expression.

The Geometrical Invariance of CRF can be expressed in the coordinates of image as R(x, y) = f(r(x, y)). Then, GI is distinct as equation (2).

$$\frac{R_{xx}}{R_x} = \frac{R_{yy}}{R_y} = \frac{R_{xy}}{R_x R_y}\frac{f''(f^{-1}(R))}{(f'(f^{-1}(R))^2} = GI(R) \text{-2}$$

Where, R_x, is the first-order derivatives in the x-direction $R_y$is the first-order derivatives in the y-direction. And R_{xx}, R_{yy}, R_{xy} are expressed as the equivalent second-order derivatives. In equation (2), GI should beexpressed in terms of the derivatives of CRF, but it can be expressed in terms of the derivatives of R. Furthermore the GI can be determined from the majority of edges in an image. It can be found from the concentration in an image without irradiance. Therefore it is probably to estimate CRF by analyzing GI. CRF is demonstrated as equation (1), but it can be merely conveyedas$f(r) = r^{\gamma}$. The relation amongst the gamma curve and GI can be denoted as following equation,

$$\gamma = \frac{1}{1-G(R)\,R} = Q(R)$$
-3

III. FEATURES OF SPLICING BOUNDARY

The feature of GI changes are depends on the shapes of boundaries. GI changes based on difference between the characteristics of a splicing boundary and that of an authentic boundary. The differences of characteristics between the authentic and splicing boundaries are shown in Fig. 2. While the authentic boundary illustrations as sequential and smooth changes in intensity, splicing boundary in an altered image offerings drastic and sharp changes in intensity. Moreover, the areas distrusted of being spliced are divided into three regions. As region 1 and region 2 are images captured by different cameras, their CRF differs from each other. And region 3, which is the boundary, is considered to have a CRF that is not natural characteristics in the case of altered image. Therefore, GI of the splicing region 3 has a behavior different from an authentic image.

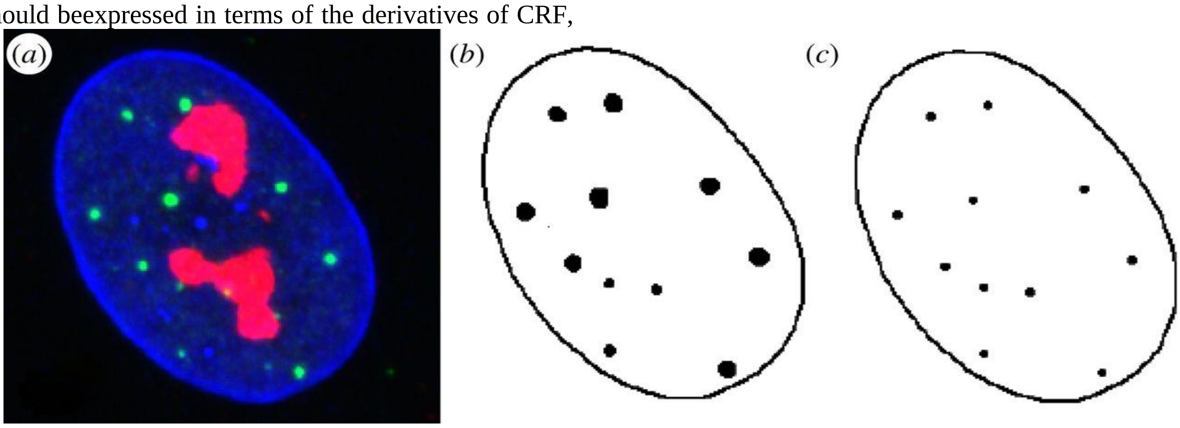

Fig. 2 Intensity Distribution (a) original image, (b) Authentic boundary, and (c) Splicing boundary

IV. QR Map

The QR map is expressed as$Q(R)$ in equation (3), can be plotted as a scatter diagram. The X- axis expresses the intensity R and the Y- axis expresses $Q(R)$. In fig. 3shows *that* $Q(R)$ map in which white pointsexpress GI, and the solid line express as a curve of a parameter γcan be valued from equation (3). $Q(R)$ principally has a uniform distribution function for a given intensity.

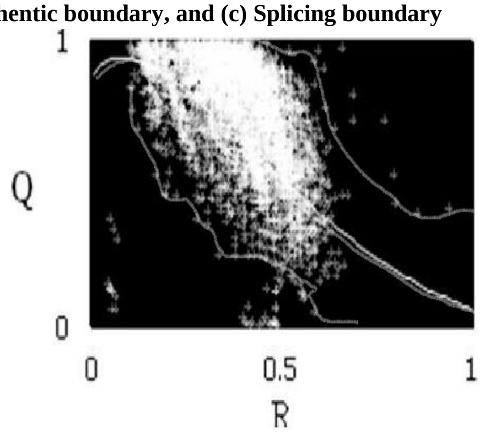

Fig. 3 QR Map

CRF should be estimated reliable within an image. However, Q(R) can be estimated from anyone part of the image, the distribution of *Q(R)* often departs from original appearances and it is often not to be a exceptional CRF. Therefore, a simple comparison of the estimated CRF in each region is not a particularly good method for judging whether a region includes a splice.

There are some transformations in the distribution profile of *Q*(*R*) authentic boundary is disseminated adjacent to the estimated curve. The Root Mean Square Error can be calculated between the estimated curve and *Q*(*R*) has a tendency to be exaggerated more by the texture of background than whether it is an authentic or splicing boundary. In texture boundary region distributed in the QR map spreads regardless of whether it is authentic or spliced. Consequently, it is difficult to distinguish it based uniquely on the RMSE between the distribution and estimated curve. However, it can be distinguished by finding the similarity of the estimated curve and *Q(R)* distribution profiles.

V. CONCLUSION

Authentic images can be confirmed by evidence photographs such that splicing boundary detection and authentic boundary detection by analyzing GI while estimating CRF. The characterization of CRF has consistency within an original image. For an authentic image, the distribution in the QR map always follows the shape of the CRF estimated curve in splicing boundary the distribution would be concentrated in a local area. The correlation amongst the actual distribution profile and the distribution expected from the CRF estimated curve in the QR map, it is possible to differentiate between a splicing boundary and an authentic boundary.

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