Illumination Color Classification Method to Detect Digital Image Forgeries

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Abstract - *Over the year, photographs have been used as document of events as well as proof in legal proceedings. Although some of the photographers are able to manipulate the images and make composites of original images. This process requires expert knowledge and demands lot of time. In today's world, a lot of skillfully developed image editing software's are available which makes image manipulation and modifications an easy task. This reduces trust in photographs and presents an open question on authenticity of images and photographs. This paper, aims at focusing on the most common form of image manipulation and that is copy move method. Here we propose a forgery detection method which uses inconsistencies in illumination of images. This illuminant estimates are used extract features which are then given to machine learning technique which support us in decision making.*

Key Words: **Authenticity, Manipulation, Illuminant Color, Illuminant map, Feature extraction, Classifier.**

1. INTRODUCTION

A large number of digital and analog images are captured and produced by a wider range of electronics devices and gadgets such as cameras handled multimedia devices, computers. Image and photographs are distributed across the globe via various means of communication. Nowadays, it is very easy to use image processing technique to manipulate images. Image editing software makes the modification and manipulation an easier job. However before considering an image inappropriate or taking actions on any image, one must confirm whether the image has been altered or is composite image[1]. So images are taken for scrutiny test to verify authenticity in forensic lab. Splicing and copy-move are common form of image composition in forgery. Hence to create composite image of people some part of image is copied and pasted from two or more images.

The example of image composition or splicing is the common image manipulation shown below in figure 1. The most famous photographer Mathew Brady of that time manipulated this image. General Sherman is seen posing with his Generals. General Francis P. Blair (far right) was added to the original photograph.

Fig -1: The Example of manipulated image

Based on the fact that illumination inconsistancies are potentially effective for splicing detection. It is very hard to make proper adjustment in illuminant condition in making composite image. Ilumination based forgery detection method classify into two categories: Geometry based method and color based method.

- Geometry-based: Inconsistancies in light source position between specific object in the scene.
- Color-based: Inconsistancies in interaction between object color and light color.

Thus Illuminat estimator are used to analyse the region and then illuminant map is obtained in result. But in practice, this is challenging task to detect forgery from illuminant map, as human visual system is quite unable to take decision on illumination environment in pictures. Our aim is to minimize human interaction in making tampering decision, the system should be automated [1][2].

2. OVERVIEW AND ALGORITHMIC DETAILS

We classify the illumination in the images as either consistent or inconsistent. The proposed method consists of five main components:

2.1 Dense Local Illuminant Estimation (IE)

The input image is segmented into homogeneous regions. Per illuminant estimator, a new image is created where each region is colored with the extracted illuminant color. This resulting intermediate representation is called illuminant map (IM).

2.2 Face Extraction

This is the only step that may require human interaction. An operator sets a bounding box around each face (e.g., by clicking on two corners of the bounding box). Alternatively, an automated face detector can be employed. We then crop every bounding box out of each illuminant map, so that only the illuminant estimates of the face regions remain.

2.3 Computation of Illuminant Features

For all face regions, texture-based and gradient-based features are computed on the IM values. Each one of them encodes complementary information for classification.

2.4 Paired Face Features

Our goal is to assess whether a pair of faces in an image is consistently illuminated. For an image with faces, we construct joint feature vectors, consisting of all possible pairs of faces.

2.5 Classification

We use a machine learning approach to automatically classify the feature vectors. We consider an image as a forgery if at least one pair of faces in the image is classified as inconsistently illuminated.

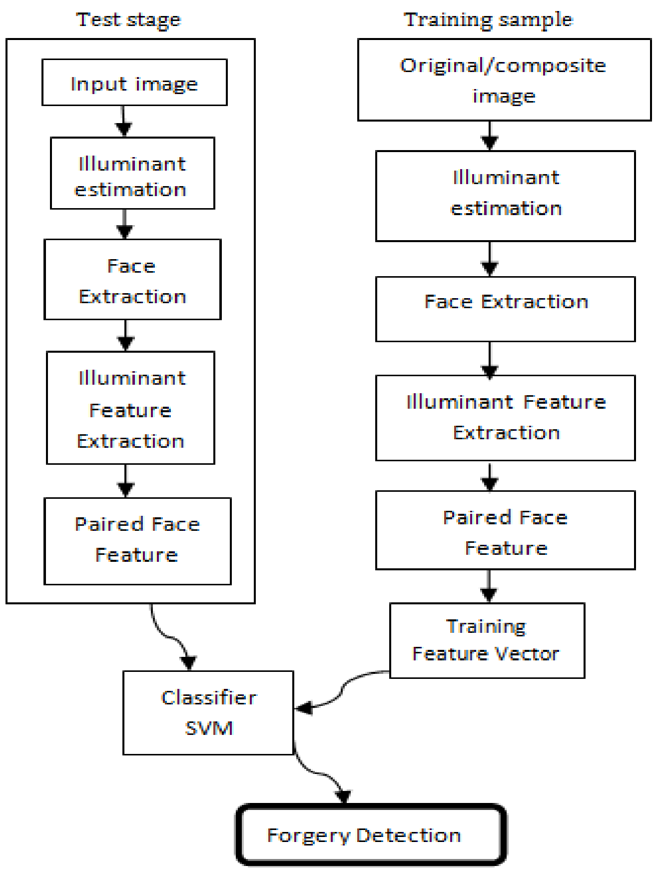

Fig -2: Architecture design of the proposed system

3. METHODOLOGY

3.1 Dense Local Illuminant Estimator

There are two separate Illuminant Estimatore(IE) are used to compute the illuminant color estimation: gray wold estimator and physics based illuminant estimator i.e. IIC (inverse intensity - chromaticity).

3.1.1 Gray-World Estimation

In gray world, consideration state that the average color of image seen is gray. Any deviation from average value is due to illuminant. Then maximum RGB can be estimated by the relation:[5]

3.1.2. Inverse Intensity-Chromaticity Estimates [5]

In this approach, the image intensities which obtained are assumed to show a combination of diffuse and specular reflectance. Diffuse reflection is the reflection of light from a surface such that an incident ray is reflected at many angles .Specular reflection is the mirror-like reflection of light , in which light ray coming from solitary direction is reflected into solitary outgoing direction. Crisp specularities are presumed to be composed of only the color of the illuminant. Riess and Angelopoulou [3] suggested a technique to compute these estimates in an image in small regions.

3.2 Face Extraction

It is needed that all the faces in an image or photograph should be enclosed with the bounding boxes .The bounding boxes can be procured by using an automated algorithm by Schwartz et. al.[7] or a human operator is chosen for bounding boxes. The advantages using a human operator for bounding boxes are that a human is better at judging the area of face to be enclosed in bouding boxes, reduces missed faces as well as false detection of faces.

3.3 Computation of Illuminant Features

3.3.1 Interpretation of Illuminant Edges

The Canny edge detector[8] is used for obtaining edge points from the illuminant map of the face region which gives edge points that are close in distance to each other. Then compute Histogram of oriented Gradients which gives description of distribution of chosen edge. HOG is used as the feature vector that can be sent to the next stage.

3.3.2 Texture Description

Statistical Analysis of Structural information (SASI) descriptor suggested by carkacioglu and Yarmn-Vural [4] is used for abtaining information from an image. This descriptor estimates structural attributes of texture by using the information from autocorrelation of horizontal, vertical and diagonal pixel lines are calculated.

3.4 Paired Faces

The same descriptors for each of the two faces are merged for analyzing and comparing the two faces. The SASI-descriptors obtained on gray world can be coupled together for similarity. The scheme behind this is a feature concatenation from two faces is distinct when one of the faces is an original and another is doctored one. The average value and standard deviation for each feature dimension is calculated. The feature dimensions with the max difference in the average values for are considered.

3.5 Classification

The illumination for every pair of faces in an photograph or image can be categorized as consistent or inconsistent. By supposing that all chosen faces are illuminated by the same lighting conditions, the image labeled as doctored if a pair is categorized as inconsistent, the discrete feature vectors are categorized by utilizing support vector machine classifier which makes use of radial basis function kernel. [9]Every combination of illuminant map and feature type are separately classified by making use of 2- class SVM classifier to for getting the distance between the image's feature vectors and the classifier decision boundary.

4. EXPERIMENT

The experiment is done on the images taken from internet. From the taken images and captured, we made dataset. Dataset contains downloaded original and spliced image. another dataset contains captured original and spliced images created by using Photoshop software. Then illuminant estimation are determined using gray worl and IIC space. The Illuminant map of all images provided a clue for forgeries detection by human expert. Then faces are cropped. In experiment, The illuminanat map of spliced images taken from dataset shows huge difference because manipulator perform many operation to match the original image.

5. CONCLUSION AND FUTURE WORK

In this paper, a brand new method is proposed for detecting forged images using illuminant map. Gray- world estimator and physics based illuminant estimator are proposed to estimate the illuminant of images. The illuminant map is considered as texture map and edge feature is also extracted. HOG edge descriptor and SASI descriptor are proposed to explain the texture-cum-edge patter. These complementary cues gives to machine learning that makes decision. To make decision requires minimum number of human interaction. Future work should be on skin detection method.

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