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Corso di Laurea Magistrale in Ingegneria Informatica

Review of illuminant inconsistencies-based methods for image splicing detection

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ANNO ACCADEMICO 2015/2016

Introduction

Digital images are easy to manipulate thanks to the availability of the **powerful editing software** and **sophisticated digital cameras**.

The development of methods for verifying **image authenticity** is a real need in forensics.

Purpose: to detect image splicing aimed at *deceiving* the viewer.

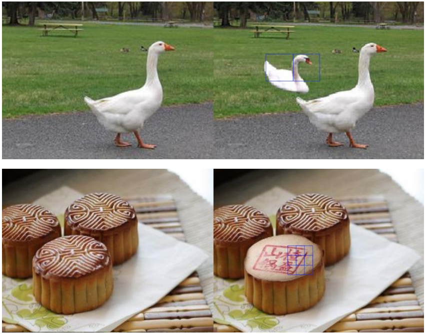
Forgery detection

Image splicing detection techniques are based on *inconsistencies*:

1. **Image resampling, copy-paste**: deduced from image metadata.
2. **Compression-based inconsistencies**: JPEG compression introduces blocking artifacts. Manufacturers of digital cameras and image processing software typically use different JPEG quantization tables.
3. **Neighboring pixels relationship inconsistencies**: when an image is spliced some artifacts can be created.
4. **Intrinsic image properties inconsistencies**: e.g. scene lights, shadows or perspective.

Lighting-based inconsistencies

Methods based on **Lighting inconsistencies** are particularly *robus*: a perfect illumination adjustment in a image composition is very hard to achieve.



Lighting-based inconsistencies

These methods can be divided into two types of approaches:

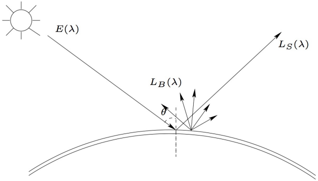
1. **Object light source inconsistencies**: detected using *shadows*, *face geometry*, *generic object surfaces*.
2. **Illuminant colors inconsistencies**: assuming that a scene is lit by the same light source, all objects must have the same illuminant colors.
   2.1 *Specular dichromatic reflectance models*
   2.2 *Illuminant Maps (IMs)*

Spectral dichromatic reflectance models

[Gholap and Bora 08]

Reflection of any materials can be modelled as additive mixture of two components: **diffused reflection**. $L_B(\lambda)$, and **surface reflection**, $L_S(\lambda)$. So, the *reflected light* can be written as:

$$L(\Theta, \lambda) = m_S(\Theta) * L_S(\lambda) + m_B(\Theta) * L_B(\lambda)$$

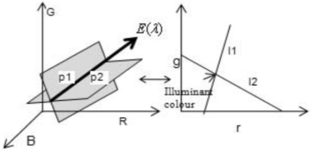


The two vectors $L_B(\lambda)$ and $L_S(\lambda)$ span the two dimensional plane called **dichromatic plane**.

Spectral dichromatic reflectance models

[Gholap and Bora 08]

From the two *dichromatic plane*, the **dichromatic line** is estimated: given two dichromatic lines of different objects, they intersects at a point giving the chromaticity values of the illuminant color.



Detection: if a object is spliced into the image, ad error is introduced in the estimation.

Riferimenti bibliografici

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