Localization of Tampering Created with Facebook Images by Analyzing Block Factor Histogram Voting

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ABSTRACT

Facebook images get distributed within a fraction of a second, which hackers may tamper and redistribute on cyberspace. JPEG fingerprint based tampering detection techniques have major scope in tampering localization within standard JPEG images. The majority of these algorithms fails to detect tampering created using Facebook images. Facebook utilizes down-sampling followed by compression, which makes difficult to locate tampering created with these images. In this paper, the authors have proposed the tampering localization algorithm, which locates tampering created with the images downloaded from Facebook. The algorithm uses Factor Histogram of DCT coefficients at first 15 modes to find primary quantization steps. The image is divided into BXB overlapping blocks and each block is processed individually. Votes cast by these modes for conceivable tampering are collected at every pixel position and the ones above threshold are used to form different regions. High density voted region is proclaimed as tampered region.

Keywords: DCT Coefficient, Double Compression, Facebook, Factor Histogram, Passive Image Forensic

1. INTRODUCTION

Facebook (FB) provides plug-in for face detection, but doesn't check tampering present in the image. Due to the absence of tampering localization applications, the probability of an image being tampered increases. Tampering consists of covering or embedding false realities, where a segment from the source is replicated to the destination image. The destination image which undergoes aligned double compression is called as a background image. As 8X8 DCT grid can-

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not be aligned to the primary compression grid in tamapered region, it lacks double compression artifacts. JPEG based algorithms search double compression artifacts and declare the absence as a tampered region. There are different fingerprints recommended for double compression artifacts based on the DCT coefficient histogram. When an image is uploaded on Facebook, EXIF information shows that the current antiquities such as ownership, copyright, site, date, camera, lens, etc. are removed. Facebook provides a high quality uploading option which compresses images without changing the resolution. Without this Facebook option, an image undergoes a down sampling followed by compression, which removes prior compression artifacts and creates new. Single compression artifacts are removed by down sampling process and are introduced again by recompression. If a person downloads an image from the Facebook, tampers and recompress, then double compression artifacts get introduced in the untampered region. JPEG based algorithms fail to detect tampering where primary compression quality is greater than secondary (Lin, He, X. Tang, & C. Tang,2009; Farid, 2009; Bianchi & Piva, 2010; Bianchi & Piva, 2011; Bianchi & Piva, 2012; Zach, Riess, & Angelopoulou, 2012). Facebook downsamples and compresses the images with high quality while maintaining its visual effects. JPEG based tampering localization algorithms fail here due to this downsampling and high compression quality. Up to the best of our knowledge, tampering made with Facebook images has not been addressed by any of the JPEG based algorithm.

Previous work in this area includes, Farid (2009) who recompressed the double compressed image at different quality level and subtracted it from the same. He found the difference minimum, at the quality level of primary compression. This effect, called as ghost effect, identifies the primary compression quality of a double compressed image. As compression grid used for tampering cannot be aligned, leads to higher difference in tampered region with respect to untampered region, at primary compression quality. This high difference region can be used to identify tampering present in double compressed image. Zach et al. (2012) proposed the method to check difference images and located tampering present in the double compressed image. Lin et al. (2009) plotted histogram of double quantized and single quantized coefficients. They identified the periodicity of empty and over concentrated bins in the histogram of double quantized coefficients. They computed period of the histogram and figured out tampering posterior probability map for every 8 X 8 block. Bianchi & Piva (2010) proposed that the coefficients of double compressed images have a tendency to cluster at the DCT grid position of primary and secondary compression. They plotted DC coefficient histogram by shifting grid position at different location within 8 X 8 blocks and computed integer periodicity map from Discrete Fourier Transform of histograms.

Benford (1938) modeled logarithmic probability distribution of the first digit of sufficiently large naturally generated numbers. Fu, Shi & Su (2007) demonstrated that the probability distribution of first digits of uncompressed images and single compressed images follows Benford law and Generalized Benford Model respectively. Li, Shi & Huang(2008) used First Digit Probability Distribution (FDPD) for identifying double compressed images. Li, Zhao, Liao, Shih, & Shi (2012) and Amerini, Becarelli, Caldelli, & Mastio (2014) used FDPD in single compressed images and their aligned double compressed counterparts to train the SVM classifier for identifying possible tampering in double compressed images. Li et al (2012) used FDPD of all 9 first digits while Amerini et al. (2014) showed that probability distribution of 3 digits is sufficient to locate tampering. Li, Yuan & Nenghai (2009) recommended that some vertical and horizontal discontinuities get inserted with the periodicity of 8, when DCT is performed on 8 X 8 grids. Due to non aligned double compression such discontinuities appears inside 8X8 blocks. This effect was named as Blocking Artifact Grid (BAG) which was used to identify tampering present in the image. This BAG is sensitive to compression qualities and needs manual adjustment at