Chapter 6
Authentication and Error Resilience in Images Transmitted through Open Environment

Qurban A Memon
UAE University, UAE

ABSTRACT

Nowadays data compression and authentication are believed to be vital to image transmission through heterogeneous infrastructure or storage at a centralized place. Though compression and authentication have independently grown to be matured technologies, but currently integration of these technologies is understood to be a key factor in handling tampering in images transmitted through unsecure channels like cloud. In this chapter, an error-resistant approach is investigated to add to low cost image authentication scheme to increase visual quality as well as improve author and user satisfaction. The image authentication includes content based digital signature that is watermarked and later diffused in the whole image before JPEG2000 coding. To tackle manipulations in the image, edge information of the image is examined to offset manipulations in the image transmission through noisy or open and unsecure channels. The edge image is sent along with JPEG2000 coded image to determine corrupted coefficients. The simulation results are conducted on test images for different values of bit error rate to judge confidence in error concealment within the received images.

INTRODUCTION

Nowadays, it is widely understood that data compression is not only essential to speed up the transmission rate but also to provide other gains like low storage. In order to counter data manipulations and tampering during transmission, the image authentication has turned out to be equally important. But the drawback of compressed data transmission is that the compressed data are susceptible to channel impairments.

The two common standards to compress and code images before transmission and storage are JPEG and JPEG2000. The JPEG standard

DOI: 10.4018/978-1-4666-8387-7.ch006

is based on the discrete cosine transform (DCT) while JPEG2000 is based on the Wavelet transform. JPEG is the older standard and still widely used. The JPEG2000 is the newer standard. The original standard for digital images (IS 10918-1, popularly referred to as JPEG) was developed long time ago. Due to major advancement in computer technology and related research, it was decided by professional community that it is the timely need not only to find a standard that can make the digital image files as small as possible, but also find a new standard that can handle many more aspects. This was motivated by the fact that the JPEG2000 is better at compressing images (up to 20 per cent plus), and that it can allow an image to be retained without any distortion or loss. The communication and multimedia industry are shifting towards JPEG2000 standard for image transmission and storage. However, the JPEG2000 is still under improvements to reach the point where it could have its significant place in the world of imaging and telecommunications.

Data compression reduces the use of channel bandwidth; however compressed data are more vulnerable to channel noise. Therefore, the transmitted data must be resilient to channel noise and other impairments due to channel coding of binary bits (S. Khalid, 2009; L. Hanzo, et al, 2001; Y. Wang, Q. Zhu, 1998; Q. Memon, 2006). Several techniques have been proposed in the literature to address the problem of transmission errors by making transmitted data more robust to channel noise and to conceal corrupted data at the receiver. The authors (Mairal, C., Agueh, M., 2010) present a scalable scheme for robust JPEG 2000 images and video transmission to multiple wireless clients, using an adaptive bandwidth estimation tool. The objective seems to select suitable image layers and resolution for each wireless client, depending upon estimated bandwidth. The authors (Phadikar, A., Maity, S., 2010) propose JPEG200 compatible compressed domain algorithm using integer wavelet, and region-of-interest coding functionality. To find region-of-interest (ROI), threshold based image segmentation and morphological operations are used together to find ROI. Using simulation results, the authors claim that the scheme provides acceptable performance improvement with various lost blocks in ROI. In another research (Martinez-Ruiz, M., et al, 2010), the authors present the results of an initiative to transmit imagery content through a Link-16 tactical network using JPEG2000 compatible approach that involves wavelets to compress images. Specifically, the JPEG2000 code-stream is mapped into Link-16 free-text messages. The most important part of the JPEG2000 compressed image is transmitted through a more error resistant (and anti-jamming) Link-16 packed structure and the remaining of the image in less robust data structures but at higher data rates. The results claimed are preliminary and dependent on Link-16 network resources.

Cloud computing lets businesses to develop applications without installation and allows consumers to access their data at any computer with Internet access. This technology has provided more efficient computing environment by centralizing storage, memory, and processing by offering resources encapsulation in the form of dynamic, scalable, and virtualized services over Internet. This has led to huge development of digital applications such as telemedicine. With regard to provision of easily accessible and reconfigurable resources such as virtual systems and applications with low cost, it has attracted many researchers. On the other side, it also exposes to risks. For example, having a contract with a cloud computing service provider exposes clients to various risks of dealing indirectly with different entities for data handling, and computation. Data authentication and user authorization as well as information ownership are the main security issues that need to be addressed when considering cloud-based imaging services. It has turned out that encryption of data objects that are stored or exchanged in this environment is the most suitable measure of data security. In this arena, there exist research works that protect the right of service providers, and/or customers. As