Chapter 13
On the Implementation of a Fragile Medical Image Watermarking Technique Using Saliency and Phase Congruency

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ABSTRACT

The recent developments of enormous computer networks have invoked insecurities related to copyright theft of digital media. To be precise, the virtual sharing of medical images over networks with a novel desire of improved medical diagnosis has led to the tampering of sensitive patient identity information. In this chapter, the authors have exemplified the need of watermarking with fragile medical image watermarking using saliency and phase congruency. Initially, the saliency and phase congruency methodologies are applied on the original medical image to highlight the object features. Based on the feature map, a mask is generated which segregates the area of interest from the portions containing visual medical information. An encrypted text, containing identity of the patient, is embedded into the area of interest of the image. The results of imperceptibility and fragility criteria are satisfactory towards the implementation of a fragile watermark as the extracted watermark is found to be corrupted upon unfaithful image processing modifications.

INTRODUCTION

In the past decade or so, science and technology have developed in leaps and bounds. Over time, technology has evolved into different generation, as reported by P. Letaba, M. W. Pretorius and L. Pretorius (2015). These developments can be attributed to several reasons, well explained by Basalla, George (1988). As years have passed by, the world population has grown at a significant rate. With this, human mind has evolved and so has the curiosity of humans. Competition amongst the existing technologies was tremendous. To survive in the present technical era, there has been a need to improve existing technology and thereby develop modern unmatched technical specimens. The different nations hereby reap a sustained economic benefit. Also, the fact that modern techniques and technology leads to the betterment of society and global community emergence, is mostly undeniable.

The Digital Revolution, during the period of late 1950s to late 1970s, sparked off the shift from analogue technological methodologies to digital electronics. Digital Information, which is basically a discontinuous or discrete form of information, continues to remain at the forefront of all cutting edge technologies, as proposed by Negroponte, Nicholas (1995). There's a general sense of agreement to the fact that digital information sustains to dominate analogue information which is information in the form of a continuous function, as given by B. J. Bamgbade, B. A. Akintola, D. O. Agbenu, C. O. Ayeni, O. O. Fagbami and H. O. Abubakar (2015). None is screened to the statement that digital information has the capability to carry more information at a faster rate as compared to analogue information. Also, processing ease of the former form of information is far more superior compared to the latter. Since digital information is mostly obtained by sampling the analogue information that is analogue-to-digital conversion, well described by M. Verhelst and A. Bahai (2015) and E. J. Candes and M. B. Wakin (2008), the resulting discrete data or numbers can be easily encrypted through various ways. Thus, digital information is more secured and because of these reasons it should continue to be the primary medium of data storage and transmission for most of the state of the art technologies in the future, also stated by Lori McCay-Peet, Elaine G. Toms and Gary Marchionini (2017). Software, web pages and websites, data and databases, digital images, digital video, digital audio, are some of the notable examples of digital media. As suggested by the idiom 'Two sides of the same coin', digital information poses different threats which may lead to severe financial losses. These threats usually come up in two ways: either the confidentiality or integrity of data is at stake or the availability of information is hampered because of malicious activities. This manuscript focusses on the concerns raised by digital information's potential threat of copyright protection, described by M. J. Baeth and M. Aktas (2015) and B. Vukelić and K. Škaron (2013). There has been a persisting problem of copyright violation of digital information which happens through distribution and duplication of such media without the owner's consent. Since the issue of copyright infringement arose, architects of digital content have been trying to portray a secure and fully established solution to the aforementioned problem. The projected solution has to be fully equipped to handle the different security threats to information systems. But before contemplating on the solution, one has to be very clear with the problem statement at hand that is the different security threats need to be fully understood and kept in mind, in reference with Mouna Jouini, Latifa Ben Arfa Rabai and Anis Ben Aissa (2014).

As quoted by H.L. Mencken, "For every complex problem there is an answer that is clear, simple and wrong", the concept of information hiding came into existence as a countermeasure to copyright protection threats. Information hiding is a secure way of communication wherein the owner of digital media encapsulates certain information within the original content. This distinguishable imperceptible

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