

Algorithm Design of Digital Watermarking Scheme for Multi-frames Medical Images

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Abstract - With the advancement of technology in communication network, it facilitated digital medical images transmitted to healthcare professional via internal network (e.g. PACs) or public network (e.g. Internet), in which pose a threat to digital medical images security, such as image tampering, and results a clinical misdiagnosis and treatment. Thus a reversible watermarking is introduced to maintain the integrity of medical images. There have been a number of researches done on watermarking scheme on single frame medical image, in which it is impractical in real world environment, where modalities are consist of multi-frames. This paper presented a conceptual design on developing a reversible watermarking scheme (tamper localization and recovery watermarking scheme) on medical images in multi-frames environment. The watermarking process was applied on each frame in sequence. Time consuming has become a limitation of sequential watermarking process on multi-frames medical images, especially in a large dataset of medical images. In order to solve the sequential problem concern, a parallel computing is recommended. Parallel watermarking could be achieved by utilised multicore technologies.

Keywords – Digital watermarking, ROI, multi-frames, tamper localization and recovery, parallel computing, multicores

I. INTRODUCTION

With the technological advancement in communication network, transmission of medical images between hospitals has become a common practice nowadays, it has facilitated discussion and opinion exchange between doctors and radiologists for diagnosis purposes[1]. Thus, medical images in different radiological modalities such as X-rays, ultrasounds, and MRI in which contain vital medical information are exposed to an open network and hackers attack. Possible security breaches such as tampering of images like exaggerating a tumour size by image processing tools, may lead to misdiagnosis and wrong treatment. Therefore, the integrity and security issues of medical images need to be protected and medical images authentication will be required when a standardization of data exchange is implemented between hospitals in future. [2]

Integrity of a medical image can be achieved in three levels [3]:

1. tamper detection,
2. tamper localization, and
3. Possible recovery by approximating the tampered region.

Digital watermarking is a technique to insert information by modifying undetectable either the original data or some edited version of them [4]. Generally, digital watermarking comprised of three components [5]:

1. Watermark generator - Watermark(s) is generated for an application, which may be based on some keys.
2. Watermark embedder - Watermark(s) are inserted into the object, which may be based on some keys.
3. Watermark detector – to detect the embedded watermark in the object.

II. LITERATURE REVIEW

A. Tamper Localization, Reversible and Recovery Watermarking

The purpose of medical image security is to assure the confidentiality of patient data and maintain data integrity by preventing the image from tampering (Cao et al., 2003) [6]. Watermarking authenticate medical images contents and prevent any unauthorized modification. Tamper localization watermarking scheme could detect and locate tampered pixel on a medical image, and the tampered pixels could be recovered by retrieving original pixel values in embedded watermark. Table I has provide term definition of digital watermarking.

TABLE I
TERM DEFINITION OF DIGITAL WATERMARKING

Watermarking Term	Definition
Invertible / reversible / lossless	Invertible/reversible watermarking is a technique where the watermark can be removed and the image is restored to its original form.
Tamper Localization	Able to detect damage/modification and their location. [7].
Recovery	Recovery of the tampered region is useful in order to recover attacked images, know exactly what had been