Chapter 18
Performance Analysis of Compression Techniques for Chronic Wound Image Transmission Under Smartphone-Enabled Tele-Wound Network

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ABSTRACT

The healing status of chronic wounds is important for monitoring the condition of the wounds. This article designs and discusses the implementation of smartphone-enabled compression technique under a tele-wound network (TWN) system. Nowadays, there is a huge demand for memory and bandwidth savings for clinical data processing. Wound images are captured using a smartphone through a metadata application page. Then, they are compressed and sent to the telemedical hub with a set partitioning in hierarchical tree (SPIHT) compression algorithm. The transmitted image can then be reduced, followed by an improvement in the segmentation accuracy and sensitivity. Better wound healing treatment depends on segmentation and classification accuracy. The proposed framework is evaluated in terms of rates (bits per pixel), compression ratio, peak signal to noise ratio, transmission time, mean square error and diagnostic quality under telemedicine framework. A SPIHT compression technique assisted YD_bD_r-Fuzzy c-means clustering considerably reduces the execution time (105s), is simple to implement, saves memory (18 KB), improves segmentation accuracy (98.39%), and yields better results than the same without using SPIHT. The results favor the possibility of developing a practical smartphone-enabled telemedicine system and show the potential for being implemented in the field of clinical evaluation and the management of chronic wounds in the future.

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1. INTRODUCTION

The chronic wounds are of most serious concerns in the modern medical care system, as they may cause some severe health problems, mostly in the developing countries. Globally, managing and monitoring of chronic wounds are becoming a big challenge in the healthcare system. Mostly elderly people (over 60 years) are more prone to sufferings from chronic wounds (Boulton et al., 2005). The homebound aged patients cannot move frequently to the clinics, lose days' wages, and travel expenses apart from having no guarantee of appointments with the clinicians. Moreover, many cases are presumably of a minor and of non-emergency types and clinicians may charge a lot of money (Gray et al., 2010). Now-a-days, wound images are thus considered potentially informative to an expert for an accurate diagnosis of the wounds. However, larger the size of an image better is the level of diagnostic accuracy. The telecommunication infrastructure is not adequate in rural healthcare centers. The image sharing is mainly performed by the electronic exchange of wound images between expert clinicians and patients. Smartphone integrated telemedicine system is used to provide an interactive link between patients and expert clinicians. Telemedicine system provides various facilities to the healthcare providers/patients e.g., improved access to health information and services enhance patients' satisfaction, reduced healthcare and transportation costs. The patient can easily get the good treatment from expert clinicians who can handle the wounds with sufficient expertise. Igor et al. (2015) developed the automated computational diagnostic tools to acquire, storage, processing, and analysis the biomedical computerized-tomography data. This algorithm provides better sensitivity, good optimization results and also associated with electronic medical record systems as well as picture archiving and communication systems.

Medical images, in general, consist of the information with a large dataset that needs huge bandwidths for transmission, a large volume of storage space and lengthier transmission times. Increasing demands for telemedicine infrastructure has therefore led to great interests in research using image compression techniques, which can satisfactorily comply with the aforementioned issues. The data compression can improve the quality of multimedia data transmission, as reduced-data limits the bandwidth requirements for communication, which is too high for high-resolution wound image transmission (Akyildiz et al., 2007). Recent advances in smartphones that provide rapid acquisition, visualization, and interpretation of medical images, have revolutionized the procedure of wound treatment. The necessity of image compression depends on some factors e.g. large storage requirements for multimedia data, network bandwidths currently available for transmission and computational complexity for practical implementation. Proper medical data management schemes are therefore required for acquiring information, storing in a database, and processing through analyses. The current paper highlights a middleware concept that ensemble heterogeneous systems for interconnecting with each other (Mauro et al., 2018). The image compression and fusion methods were used to make simple Internet of Health Things (IoHT) computation and fast transmission. IoHT might be treated as more demanding now for providing better medical treatment modalities, especially for elderly patients. IoHT provides remote monitoring, smartphone-enabled healthcare systems, ambient assisted living, and wearable devices (Joel et al., 2018).

Under the purview of the current proposal, the wound images are transmitted directly without compression to the TMH with data compression, which is required for overcoming bandwidth limitations over the communication channel. The performance of the proposed scheme is analyzed in the present work. It is observed that the JPEG compression technique requires higher processing rate to enhance the quality of the image, whereas, SPIHT needs low processing rate to achieve a better quality of wound images. Here, the system performance is analyzed by applying different compression algorithms avail-