ABSTRACT

The objective of this work is to identify and address the technical issues in telemedicine technology. Telemedicine is a fast growing field with the advancements in telecommunication and information technology. The integration of mobile communication and biomedical instrumentation technology in telemedicine help health professionals to diagnose or monitor health status of their patients residing in a distant location. The telemedicine technology also supports the transfer of pathological and imaging reports of patients across the networks, so as to provide consultation by specialists. The Internet is already changing the way in which telemedicine is deployed and the extent to which it becomes widely available. The focus should be on low-cost, low-bandwidth Internet applications that facilitate discussion and the transmission of text, data and images. Telemedicine can help to develop new ways to deliver medical and health education to professionals and to the community.

One of the main challenges faced by telemedicine is the low bandwidth for transmission of medical images. Thus, in order to reduce the bandwidth utilization, compression techniques with maximum retained energy that is tolerable is investigated in this research. This thesis focuses on the image retrieval problem using compressed images and the impact of compression on the classification accuracy. It aims to overcome the bandwidth limitations of wireless networks which are an essential part of telemedicine in an emergency department, communicating either with an ambulance or with a remote disaster recovery team.

The first part of the thesis addresses medical image compression which is near lossless. Existing compression techniques using Haar wavelet and Huffman coding were investigated. An improved 3-pattern Huffman
coding was proposed, to increase the compression ratio without compromising on the Peak Signal to Noise Ratio.

A new compression technique, a hybrid of both the lossless and the lossy methods was presented, in order to achieve better compression ratios than the pure lossless methods. In the proposed system, the image is segmented into ROI and non-ROI and compressed accordingly. The aim was to achieve more compression than the existing near lossless compression techniques by applying both lossless and lossy compression techniques for the medical image.

Image Retrieval (IR) techniques for compressed images are investigated in the second part of the thesis. This thesis examines possibilities for feature extraction. A novel feature extraction method, Image Retrieval Specific Fast Fourier Transform IRS-FFT is introduced and compared to other known techniques. The existing classification algorithms for IRS FFT were also investigated.

A novel neural network approach for image classification was designed and implemented. The third part examines possibilities of image retrieval by a hybrid compression approach and the proposed neural network classifier. The learning rate and the momentum of the classifier were optimised by genetic parameters. The effect of the Genetic Optimised parallel Multilayer Perceptron Neural Network GOP MLP Neural Network on classification accuracy was analysed and implemented.

Experiments have been conducted on a MRI medical image database and their performances has been analysed and reported.