Chapter 10
Data Compression as a Base for eHealth Interoperability:
3D FWT Applied on Volumetric Neuroimages

Martin Žagar
University of Applied Sciences, Croatia

Branko Mihaljević
Rochester Institute of Technology, Croatia

Josip Knezović
University of Zagreb, Croatia

ABSTRACT

eHealth is a set of systems and services that enable the sharing of medical diagnostic imaging data remotely. The application of eHealth solves the problem of the lack of specialized personnel, unnecessary execution of multiple diagnostic imaging and rapid exchange of information and remote diagnostics. Medical imaging generates large amounts of data. An MRI study can contain up to several Gigabytes (GB). The exchange of such large amounts of data in the local network facilities is a significant problem due to bandwidth sharing which is even more significant in mobile and wireless networks. A possible solution to this problem is data compression with the requirement that there is no loss of data. The goal of this chapter is a conceptual compression prototype that will allow faster and more efficient exchange of medical images in systems with limited bandwidth and communication speeds (cellular networks, wireless networks). To obtain this conceptual compression prototype we will use wavelets.

INTRODUCTION

Despite the economic crisis, the market potential of eHealth is strong. The global telemedicine market reached $14.3 billion in 2013, is expected to grow to $35.1 billion in 2018 representing a compound annual growth (CAGR) of 16.9% (Kovač, 2014). The wellbeing market enabled by digital technologies (mobile applications, devices) is rapidly growing. The convergence between wireless communication

DOI: 10.4018/978-1-5225-0498-6.ch010

technologies and healthcare devices and between health and social care is creating new businesses where interoperability is the key enabler.

There are many benefits of eHealth systems as an effective complement to routine clinical care. Since health care is based not only on textual data, but also on image and video data, it is important to define algorithms and protocols which will analyse and compress such data in appropriate way so they can be base for interoperability of electronic healthcare record (EHR) as a central point of personal health information.

To fully understand the challenges of creating secure, interconnected electronic health records, it is important to review the content and purpose of a medical record, regardless of the form it takes. Every time a patient is treated by a health care provider, a record is made of the encounter. This record includes information that the patient provides, such as medical history, as well as the physician's assessment, diagnosis, and treatment plan. Medical records beside textual data also contain diagnostic images and videos, and metadata connected with them that indicate the results and other medical procedures. This chronological electronic health record is an important business and legal document. It is used to support clinical treatment decisions, to document services provided to patients for billing purposes, and to document patient conditions and responses to treatment should a legal case arise.

BACKGROUND

Application of ICT in health care and improving the overall health system and services are nowadays defined in most national strategies for the development of health in the world. Following this, eHealth as a set of systems and services that enable the sharing of medical diagnostic imaging data remotely is an important factor in the achievement of these strategies. The application of eHealth solves the problem of the lack of specialized personnel, unnecessary execution of multiple diagnostic imaging and rapid exchange of information and remote diagnostics. The increased availability of medical imaging technologies that yield 4D data (3D + time), combined with the low-bandwidth requirements of telemedicine, generate demands for new medical image compression methods. Medical imaging generates large amounts of data. An MRI study can contain up to several gigabytes (GB). The obtained image data together with other metadata (about the patient) packed in standardized formats such as DICOM and NIfTI are stored in a centralized data repository. From there the needed data are sent to the client device (PC) and presented to a specialist who performs diagnostics. The exchange of such large amounts of data in the local network facilities is a significant problem due to bandwidth sharing which is even more significant in mobile and wireless networks (Žagar, 2012). The application of mobile devices (e.g. tablet) as client devices in recent years has also become possible and interesting due to their increasing computational capabilities. It allows reading of diagnostic data and diagnostics at any place and at any time without restriction (Žagar, 2011). In such applications, the need for data compression is even more stressed because of the limited communication opportunities (cellular networks, wireless networks), and the limited storage capacity of the current study data for these client devices. The goal of this chapter is a conceptual compression prototype that will allow faster and more efficient exchange of medical images in systems with limited bandwidth and communication speeds (cellular networks, wireless networks). Communicated data are meant to be finally decompressed and displayed on mobile devices with limited computational capabilities *(Knezović, 2011*).