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Identity Concealment When Uploading Pictures of Patients in a Tele-Medicine System

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ABSTRACT

Tele-medicine systems run the risk of unauthorized access to medical records, and there is greater possibility for the unlawful sharing of sensitive patient information, including children, and possibly showing their private parts. Aside from violating their right to privacy, such practices discourage patients from subjecting themselves to tele-medicine. The authors thus present an automatic identity concealment system for pictures, the way it is designed in the GetBetter tele-medicine system developed under a WHO/TDR grant. Based on open-source face- and eye-detection algorithms, identity concealment is executed by blurring the eye region of a detected face using pixel shuffling. This method is shown to be not only effective in concealing the identity of the patient, but also in preserving the exact distribution of pixel values in the image. This is useful when subsequent image processing techniques are employed, such as when identifying the type of lesions based on images of the skin.

KEYWORDS

Confidentiality of medical records, E-health, Identity concealment, Image censorship, Tele-medicine

INTRODUCTION

Technology has not only significantly influenced the discovery of new drugs and medicines, but has also altered the way patients are cared for. Indeed, the use of information and communications technology (ICT) in the various aspects of healthcare delivery has spawned a range of services and possibilities, under what is generally known as e-health (Rifat, 2004; Wootton et al., 2009).

E-health services are often classified into three broad areas, namely a) healthcare administration; b) training and education; and c) delivery of clinical care. Each of these areas of e-health is of a considerable range of sophistication, from those that involve very little ICT and automation, to those that are heavily dependent on the most advanced features and services that ICT can possibly deploy.

Healthcare administration involves the management of health-related information and resources, including logistics issues dealing with the deployment of doctors, monitoring of public health metrics, as well as automated systems and decision-support systems for hospitals, clinics, and other health institutions. At its core is the management of patient records (Geissbuhler, Bagayoko, & Ly, 2007; Marcelo, 2009). Indeed, central to all e-health services, even in education and training, and especially

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in the delivery of clinical care, is the use and the management of patient records. Education and training for doctors, nurses, midwives, as well as for health workers of varied levels of competencies, also deal with patient data. Patient cases are either used as actual test cases for training (as medical cases in lecture slides, for example), or may be used in the course of an actual on-the-job training where patient records are used as basis for assessment and management of live patients (Oliveira et al, 2002; Geissbuhler, Bagayoko, & Ly, 2007; Bediang, et al., 2015).

The increasing use of electronic information systems in healthcare provides a new set of challenges to the maintenance of patient confidentiality. Picture Archiving and Communication Systems (PACS) provide a centralized repository for all imaging data (Faggioni, 2011) and deliver diagnostic images (e.g., x-rays, CT scans, MRI scans) and radiology reports electronically to clinicians at the point-of-care. Confidentiality in PACS and associated Radiology Information Systems (RIS) must be maintained on the same basis as any other aspect of the practice of medicine. Standards for patient confidentiality in RIS and PACS aim to clearly define how patient confidentiality should be maintained with specific regard to the use of PACS. Readers may refer to the following URL for the standards of the Royal College of Radiologists for the standards on the confidentiality of patient records in the United Kingdom: https://www.rcr.ac.uk/publication/standards-patient-confidentiality-and-ris-and-pacs. It is understood that such standards complement, but not replace, the legal, professional and contractual obligations that already are in existence.

These standards may vary from one country to another, and some countries have established their standards way ahead of the others. In the U.S., for example, the Health Insurance Portability and Accountability Act ("HIPAA") was crafted in 1996 to improve the efficiency and effectiveness of the health care system. It required the U.S. Department of Health and Human Services (HHS) to adopt national standards for electronic health care transactions and code sets, unique health identifiers, and security. HHS published a Privacy Rule in December 2000, which was later modified in August 2002 (http://www.hhs.gov/ocr/hipaa).

The "Privacy Rule", or the "Standards for Privacy of Individually Identifiable Health Information", addresses the use and disclosure of individuals' "protected" health information, as well as standards for individuals' privacy rights to understand and control how their health information is used. A major goal of the Privacy Rule is to assure that patients' health information are well protected while at the same time allowing for the efficient flow of health information for the proper care of patients. The rule strikes a balance that permits important uses of information, while protecting the privacy of people who seek care and healing, and is designed to be flexible and comprehensive to cover the variety of uses and disclosures that need to be addressed.

In the case of the use of ICT in the delivery of clinical care, as the third area of e-health services that is generally referred to as tele-medicine, the range of possible uses of ICT can go from a crude e-mail or fax-based "store and forward" system of patient cases, all the way to tele-surgery where a doctor who is physically far from the operating room is able to do all or part of the surgery via computer-controlled robots (Vasallo, 1999; Rodas, et al., 2005). Here again, there is direct access to patient information, with the patient possibly situated at some geographical distance from the health professional.

Clearly, with the increasing use of ICT in the storage, retrieval and exchange/sharing of medical information in tele-medicine, medical records are no longer confined to physical dossiers stored in filing cabinets. Patient information may be collected in one geographic location, and then uploaded to some database located in another location (or possibly in the "cloud"), and then accessed for assessment by a physician (and shared by and among medical doctors) located in yet another geographic location (Vassallo,1999).

Certainly, incorporating photographs with medical images provide the advantage of decreasing medical errors and improved diagnostic capabilities. Indeed, one of the common problems in storing medical images is the mislabeling or misidentification of medical examination images. Ramamuthry et al. (2013) argues for obtaining digital photographs of patients simultaneously with all medical imaging

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