Compression of Medical Images in Radiotherapy

Gordan NIŠEVIĆ[1]
Vojislav JOSIMOVIĆ[2]

BACKGROUND: *The main reasons for the compression radiotherapy and more generally medical images are transmission, storage and archiving costs. The results of the compression of the scanned simulator radiographic film, and portal image obtained with Electronic Portal Imaging Device (EPID) during the treatment with linear accelerator are presented in this paper.*

MATERIAL AND METHODS: *Digitized simulator radiographic film served as referent image for EPID. PC workstation with transparency scanner (HP Desk Jet 6100C/T) was located in physicist room and networked with EPID (Elekta iView) in linear accelerator (Elekta SLi) control room.*

RESULTS: *For digitized simulator radiographic film JPEG commercial compression schemes from Adobe Photoshop 5.0 were applied. A set of 30 images was analyzed, and byte compression ratio from 6.4 - 6.8 was achieved. In all cases images were adequate for their purpose and accurate measurements and comparisons were possible. EPID images were compressed with iView software (V1.1) JPEG format. The compression ratio was in range from 3.9 to 9.6, on the set of 143 analyzed images.*

CONCLUSION: *The set up outlined in this paper, in which PC workstation is networked with EPID PC, enables off-line analysis of EPID images, while the EPID is used by radiology technician. Applied compression schemes relieve significantly the burden from transmission and storage devices without any noticeable degradation of images.*

KEY WORDS: *Radiotherapy imaging; Image compression; JPEG; EPID*

[1] INSTITUTE OF RADIOLOGY, MILITARY MEDICAL ACADEMY, BELGRADE, YUGOSLAVIA
[2] MAXTEAM, BELGRADE, YUGOSLAVIA

INTRODUCTION

The main reasons for the compression radiotherapy and more generally medical images are transmission, storage and archiving costs (1). There are many algorithms for image compression: "lossless" which are fully reversible with no loss of data or "lossy" where there is a loss of data but the file sizes are smaller. The results of the compression of the scanned simulator radiographic film, and portal image obtained with Electronic Portal Imaging Device (EPID) (Figure 1) during the treatment with linear accelerator, are presented in this paper. There is an increasing demand for the implementation of radiotherapy imaging in routine patient treatment to obtain both the quality assurance of field alignment and documentation of actually given radiation treatments (2).

Figure 1. Electronic Portal Imaging Device (iView)

Address correspondence to:

Gordan Nišević, Institute of Radiology, Military Medical Academy, Belgrade, Yugoslavia

E-mail: gornis@beotel.yu

MATERIAL AND METHODS

The role of portal imaging system in RT network is increasing and it is gradually taking its place Patient images are stored by default

as standard 434 kB bitmap images - BMP (768x566 resolution). The iView supports many other common image formats including DT-IRIS, JPEG, TIFF, GIF etc. of the main image server. By employing TCP/IP protocol iView can be connected to other local area networks within the hospital, or even between hospitals (3). The use of DICOM 3.0 image transfer protocol enables the transfer of images from other external systems.
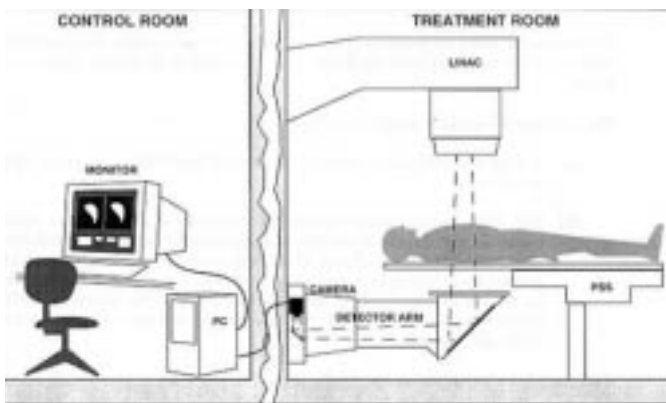

Figure 2. iView block scheme

PC workstation with transparency scanner (HP Desk Jet 6100C/T) was located in the physicist's room and networked with EPID (Elekta iView) in linear accelerator (Elekta SLi) control room (Figure 2).

Patient images are stored by default as a standard 434 kB bitmap images - BMP (768x566 resolution). The iView supports many other common image formats including DT-IRIS, JPEG, TIFF, GIF etc. The high resolution images are displayed on iView' s single 21" screen. Digitized simulator radiographic film served as referent image for EPID (Figure 3).

Figure 3. iView monitor layout: Referent and patient image

RESULTS

Commercial compression schemes were applied for digitized simulator radiographic film: JPEG baseline compression with quality set to the highest level (10) from Adobe Photoshop 5.0 software. A set of 30 images was analyzed, and byte compression ratio from 6.4 - 6.73 was achieved for referent images (see table). EPID images were compressed with iView software (V1.0) which supports JPEG format. Compression ratio was in the range from 3.9 to 9.6, on set of 143 analyzed images. Compressed images were evaluated by experienced radiotherapists. In all cases images were adequate for their purpose and accurate measurements and comparisons were possible.

Table 1. Summary results

	Referent image		Patient image	
	No of Images	Compression Ratio	No of images	Compression Ratio
JPEG Baseline Compression	30	6.40 – 6.73	143	3.9 – 9.6

COCLUSION

The set up outlined in this paper, in which PC workstation is networked with EPID PC, enables off-line analysis of EPID images, while the EPID is used by radiology technician. Applied compression schemes relieve significantly the burden from transmission and storage devices without any noticeable degradation of image quality. This is specially significant in new, sophisticated, image guided RT scenarios with increasing number of images acquired, stored and transferred through RT network.

REFERENCES

1. Clunie D. Lossless compression of grayscale medical images - effectiveness of traditional and state of the art approaches. "http://www.dclunie.com"

2. Visser G, Huizenga H, Althof VGM and Swanenburg BN. Performance of a prototype fluoroscopic radiotherapy imaging system. Int J Radiation Oncology Biol Phys 1990; 18:43-50.

3. iView Electronic Portal Imaging. ELECTA ONCOLOGY SYSTEMS NO 4513 370 16951 04-98, 1998.

4. DICOM (Digital Imaging and Communications in Medicine, PS 3.5 Data Structures and Encoding, NEMA, Rossyllin VA, 1999. "http://medical.nema.org/dicom/1999/draft/99 05dr.pdf"