Chapter 13
Methods for Assessing Still Image Compression Efficiency: PACS Example

Dinu Dragan
Faculty of Technical Sciences, University of Novi Sad, Serbia

Veljko B. Petrovic
Faculty of Technical Sciences, University of Novi Sad, Serbia

Dragan Ivetic
Faculty of Technical Sciences, University of Novi Sad, Serbia

ABSTRACT

Assessing the computational efficiency of an image compression technique plays an important part in evaluations used to estimate the overall quality of the compression. In this chapter, different methods for assessing computational efficiency will be explored as a part of the evaluations used to determine still image compression usability in image storage/communication systems such as a Picture Archiving and Communication System. Efficiency describes how well the image compression makes use of the available computing resources. It is not an obligatory part of evaluation and there is no unique method for assessing compression efficiency. The results of compression efficiency assessment are usually interpreted in the context of the hardware and software platform used in the evaluation. This dependence is addressed and different ways for its amelioration are discussed in the chapter. This is the groundwork for research in developing a platform-independent method for assessing compression efficiency.

INTRODUCTION AND BACKGROUND

The amount of memory needed to represent digital images can be reduced using image compression (Sayood, 2012). Original uncompressed image representation is encoded to another—compressed—image representation which occupies fewer bits. Images can be compressed in order to reduce storage and transmission requirements.

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There are many image compression techniques proposed and used in different image storage/communication systems. They employ different compression algorithms and they support different additional features such as region of interest (ROI) coding, error resilience, and data streaming (Przelaskowski, 2004). These compression techniques are often competitors and they can be used for the same tasks. For example, in many image storage/communication systems developers choose between JPEG, JPEG2000, and some other compression technique. Different methods, evaluation techniques, and metrics have been developed and used to compare image compression techniques and to assist in choosing an adequate compression technique for a specific image storage/communication system (Dragan&Ivetic, 2010). Examples of image storage/communication systems can be found in medicine, cartography, geo-informational systems, certain consumer-oriented web-based online systems, and other fields. Most of the examples in this chapter have been taken from medical image compression evaluations conducted for Picture Archiving and Communication Systems (PACS), because it is one of the most demanding image storage/communication systems (Erickson, 2006) and as such demonstrates the best what requirements image compression techniques have to fulfill. The wide scope of a PACS and the large number of demands made of its design also make it a good example of the complexity of compression technique evaluation.

A note on a terminological peculiarity—in this paper the authors stray from a loose consensus on terminology used to describe properties of compression techniques and algorithms. Specifically, 'compression computational efficiency' (or, abbreviated, compression efficiency) is used to denote the efficiency with which a technique-algorithm makes use of the available computing resources. While it is true that this information is generally represented by a measure called 'compression complexity' (Man, Docef, & Kossentini, 2005), and that Santa-Cruz, Ebrahimi, Askelof, Larsson, & Christopoulos (2000) used the term 'compression efficiency' to denote the ability of an algorithm to maximize the visual quality of a compressed image versus the number of bits used to represent it, the authors feel that this variation is justified. This paper takes pains to talk about the complexity of compression algorithms as something distinct from the behavior of those algorithms on actual hardware. Thus it would have been needlessly confusing to draw this distinction while using nearly indistinguishable terminology.

In most cases, compression efficiency is more of a computational efficiency measure of the implementation of a compression technique rather than a computational efficiency measure of a compression algorithm per se. If the compression algorithm is implemented according to standard, different implementations of the same compression algorithm should produce the same compression ratio and quality of the decompressed image. Therefore, compression efficiency is also a way to estimate the difference between these encodings (Man et al., 2005).

In authors previous research (Dragan & Ivetic, 2009a; Dragan & Ivetic, 2010) two aspects of image compression technique quality were identified:

- **Presentational:** Whether lossy compression preserved enough visual information for the given task.
- **Technical:** Used to define technical quality of compression technique itself which measures the overall cost of an image compression technique in terms of resource usage. Different metrics are used to assess the compression efficiency, types of compression features and quality of the features implementation, compression ratio, and other technical aspects of a compression technique.