Exploration and Development of the JPEG Compression for Mobile Communications System

Andik Setyono, Faculty of Computing and Informatics, Multimedia University, Cyberjaya, Malaysia & Faculty of Computer Science, Dian Nuswantoro University, Semarang,, Indonesia

Md. Jahangir Alam, Faculty of Computing and Informatics, Multimedia University, Cyberjaya, Sepang, Selangor, Malaysia

C. Eswaran, Faculty of Computing and Informatics, Multimedia University, Cyberjaya, Malaysia

ABSTRACT

The JPEG compression algorithm is widely used in communications technology for multimedia data transmission. This algorithm is also very efficient for mobile applications since it can achieve compression ratios more than 100:1, thus greatly facilitating the storage and transmission processes for images. Though lossless JPEG compression is an ideal solution, the compression ratio achieved with this technique is relatively very small. JPEG2000 provides higher compression ratio and quality compared to JPEG but the main problem with this compression technique is its complexity resulting in longer processing time thus making it unsuitable for mobile communications. In this study, the authors explore methods for enhancing the performance of JPEG compression standard for mobile applications. They show that by using a splitting technique along with the JPEG compression, one can transmit data files of size larger than the maximum capacity which is possible with the existing mobile network. To evaluate the performance of proposed method, the authors perform some simulations using the emulator on desktop computer and mobile phone. The parameters used for performance evaluation are the speed of the compression process, the compression ratio and the compressed image quality. The simulation results presented in this paper will be very useful for developing a practical mobile communication system for multimedia data using JPEG compression.

Keyword: *Compression, Joint Photographic Experts Group (JPEG), Mobile Communications, Mobile System, Peak-Signal To Noise Ratio (PSNR)*

1. INTRODUCTION

For storing large size files in limited capacity memories, they need to be compressed using appropriate data compression techniques (Rafael & Richard, 2001). Image compression is an important topic in the digital world. A bitmap image can contain considerably large amounts of data causing some problems in both computational complexity as well as data processing. Compression is important to manage large amounts of data for network, internet, or

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storage media (Santa, 2006). With small size, the compressed image will be easily transmitted in a network that has bandwidth limitation such as mobile communications network. There are two types of data compression, namely, lossy and lossless compression. Lossy compression is a compression technique in which the original data cannot be reconstructed back (data is lost). Lossy Compression aims to streamline the data which is usually used to compress multimedia data. Lossless compression is a compression technique that does not alter the original data information. Lossless compression does not cause data loss. This technique is suitable to be used to compress text data and programs (David, 2004). Joint Photographic Experts Group (JPEG) compression is a lossy compression which can be used with advantage for mobile communications (Tom, 2010; Yun & Huifang, 2000).

The JPEG algorithm is an image compression algorithm that has been developed and applied to information and multimedia communications technology (David, 2004). The performance results show that the JPEG algorithm can be successfully used on all software that support the information technology in photo and digital video cameras (Edi et al., 2010). In this paper, we focus on JPEG compression because this format is used widely and has already become a default format for digital images. Actually, JPEG2000 yields better compression ratio and image quality than the JPEG baseline standard (Rosenbaum, 2006; Medouakh, 2011). However this format is not very popular because it is expensive and it is also complex causing lengthy time process. JPEG2000 as well as lossless JPEG are not suitable to be implemented on the mobile phone for mobile communications, since mobile devices have shortcomings with respect to memory, display and processing power to perform these compression algorithms.

In developing a mobile system using multimedia data such as images as inputs, we must consider the available mobile technology and the bandwidth provided by the network operator. Mobile communication technology is already growing very fast. Currently, mobile phone device is supported by high-speed downlink packet access (HSDPA), where this technology is capable of transmitting data up to 3.6 Mbps (Hari, 2004). With an Internet application (website) which contains many images accessing and downloading will be very slow especially if the available bandwidth is limited. To transmit multimedia data including JPEG image file from client to server, we can use protocols such as file transfer protocol (FTP), hypertext transfer protocol (HTTP) and mobile messaging like multimedia messaging service (MMS) and e-mail. Many multimedia applications have been developed on mobile devices for accessing the Internet in a mobile environment. Mobile technology will continually be growing because with this technology we can perform various activities by using mobile application on mobile devices. The various applications that can be used to make connection with the Internet network which are offered in many mobile phones are of great help in alleviating human activities.

Usually mobile communication networks have limitation in the capacity for transferring files. This capacity depends on the bandwidth which is provided by the network operator. This is an important factor to be considered when developing a mobile client-server application. To solve the bandwidth problem, it is necessary to develop both pre and post processsing algorithms. Pre-processing denotes developing application on the client side and post-processing on the server side. Suppose that we send 1 MB image size from mobile phone, while maximum capacity that can be sent is 300 KB. Of course, the image file could not be sent without any prior processing on mobile network available. To overcome the problem, we can add the compression process first, but it should not affect the image quality. When using JPEG compression, the ideal quality factor is 75% and with this the quality of the image is still maintained (Anonymous, 2011). In addition, we can also add splitting and cropping processes