IMAGE COMPRESSION USING DISCRETE COSINE TRANSFORM

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours.

by

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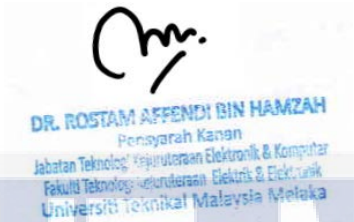
APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer System) with Honours The member of the supervisory is as follow:



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ABSTRAK

Pemampatan gambar ialah proses yang sering dilakukan setelah pemprosesan gambar digital dilakukan. Ia berurusan dengan mengurangkan kelebihan antara piksel pada gambar dengan bantuan transformasi. Saya kemukakan dalam makalah penyelidikan ini; konsep baru untuk memampatkan gambar dengan beroperasi sepenuhnya dalam domain DCT (Discrete Cosine Transform) menggunakan MATLAB. Kaedah ini dapat digunakan sebagai alat pemampatan gambar yang berdiri sendiri, atau dapat dimasukkan ke dalam kerangka pemampatan DCT berdasarkan blok, seperti JPEG. Seluruh kertas ini membentangkan kaedah Lossy Discrete Cosine Transform (DCT) yang disarankan untuk gambar dua dimensi. Penggunaan teknik pemampatan gambar yang dicadangkan menghasilkan, dalam banyak situasi, dibandingkan dengan standard JPEG yang berbeza tanpa kerugian, dalam prestasi yang serupa atau lebih baik. Tujuan keseluruhannya adalah untuk mengurangkan ukuran penyimpanan gambar dan pada masa yang sama mengekalkan kualiti gambar dengan cara yang berkesan. Hasil prestasi DCT yang sangat baik telah diperoleh melalui proses pemampatan sebelum dan sesudah proses pemampatan.

ABSTRACT

Image compression is a task frequently conducted after digital image processing is done. It deals with reducing the redundancy between the pixels on image with the help of transforms. I present in this research paper; a concept to compress the image by fully operating in the DCT (Discrete Cosine Transform) using MATLAB. The method can be used as a stand-alone image compression tool, or it can be incorporated into any block-based DCT compression framework, such as JPEG. That whole paper presents the Lossy Discrete Cosine Transform (DCT) method suggested for two-dimensional pictures. The use of the proposed image compression technique resulted, within many situations, in comparison to the different JPEG-standards without loss, in similar or better performance. The overall purpose is to reduce the image size while retaining efficient image quality. Excellent results of DCT performance have been obtained through before and after compression process.

DEDICATION

I dedicate; my sincere appreciation to both of my beloved parents. Without their sacrifices and encouragement, I will not be able to reach this stage. Thanks to Ts in particular. Dr. Rostam Affendi bin Hamzah and all who led and instructed me on my whole thesis. Do not even forget all my friends who were still with me throughout this incredible experience.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS

m	-	Matrix m
n	-	Matrix n
I	-	Original image
$\mathbf{I_C}$	-	Compressed image
$\mathbf{1_R}$	-	Reconstructed image
Y		Brightness (luma)
$\mathbf{C_b}$	-	Blue minus luma (B-Y)
$\mathbf{C_r}$	-	red minus luma (R-Y).
DC	-	coefficient with zero frequency in both dimensions
AC	-	remaining 63 coefficients with non-zero frequencies

LIST OF ABBREVIATIONS

DCT	Discrete Cosine Transform
MATLAB	MATrix LABoratory
PNSR	Peak-Signal-To-Noise Ratio
CR	Compression Ratio
MSE	Mean Square Error
SVD	Singular Value Decomposition
BP	Bright Pixel
BPP	Bits Per Pixel
RLE	Run-length encoding
JPEG	Joint Photographic Experts Groups
PNG	Portable Network Graphics
HE	Histogram Equalizer
JPG-LS	JPEG Lossless/Near-Lossless Compression Standard
MPEG	Moving Picture Experts Group
GIS	Geographic Information System
DWT	Discrete Wavelet Transform
RGB	Red, Green, Blue
YCbCr	Luminance; Chroma: Blue; Chroma: Red
IDCT	Inverse Discrete Cosine Transform
GIF	Graphics Interchange Format
TIFF	Tag Image File Format

SVG	Scalable Vector Graphics
2D	2-Dimensional

CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, digital photographs have become one of the important elements in our lives. Modern media is overwhelming with graphics such as images and movies. The growing demands for multimedia data and the need for rapid transmissions, including digital photographs and videos, have led to a great deal of interest in research into compression techniques to minimize the picture's physical size. In these cases, an efficient compression technique is introduced to develop both higher resolution images, less image size, and at the same time can maintain approximately similar information.

Image compression has multiple uses and plays a crucial function in successful storing or transmitting pictures. Image compression is designed to reduce image data redundancy. Reduced storage capacity enables many files to be stored in a certain storage space or memory space.

The discrete transform cosine (DCT) reflects sequence of data points with respect to a sum of cosine functions at different frequencies. DCT compression, also called compression of blocks, compresses data into separate DCT blocks collections. DCT blocks can have a range of sizes, including a regular 8x8 pixel DCT. The DCT has a powerful "energy compaction" property which attained great quality and high data compression ratios. In this method, there will be a small loss of quality but it cannot be seen thus it is appropriate to make a slight compromise on image quality.

1.2 Statement of the Purpose

The aim of the research is to reduce the size of the representation of graphics that helps to store more image and maintain the image quality by analyse the DCT performance before and after the compression process in effective way.

1.3 Problem Statement

Remote computing had also distributed large-scale data and the growth of massive storage and retrieval systems has increased enormously. In terms of allowing the transfer of large amounts of data between computer devices and remote access points, additional storage needs to be installed in order to cope with the increase in the size of the database. This leads to an increase in costs and equipment.

Higher resolutions mean that there more pixels per inch (PPI), resulting in more pixel information and creating a high-quality, crisp image. However, time taken to transmit the images also increase. Thus, user need to wait for long period of time to finish the transferring of data.

There is one way to solve this problem by using compression, where it is possible to encode the database and the transmission sequence effectively. Compression is only possible when the information is usually shown in a format that is longer than necessary. For instance, image data is linked to a certain amount of duplication. New image compression technologies are being aimed everywhere that deliver a low bit rate while preserving the fidelity of raw images. The transfer of image encryption therefore could save time, cost, and space throughout long-distance communication.

1.4 Objectives

The goals of this project are:

1. To compress the redundancy between the pixels on image by using Discrete Cosine Transform (DCT).
2. To decrease the image storage size and maintain the image quality.
3. To analyse the DCT performance before and after the compression process.

1.5 Scope of Project

This project's scope of work includes the image compression on JPEG and PNG images using Discrete Cosine Transform by MATLAB. It focuses on a group of people who want decrease the image storage in either an offline or online device. Other than that, this scope focused on the compression of the redundancy pixel in images. To make it clear, before and after compression images will be executed. Lastly, the performance of the Discrete Cosine Transform will be analyzed according to the output of the images.