DECLARATION

I hereby declare that this project report entitled

VIDEO CODING USING TCHEBICHEF MOMENTS TRANSFORM

is written by me and is the result of my own effort and research expect as citied in the references.

STUDENT NAME : _____ Date: 28/08/2014

(ALRYANA TOONG SIEW WA)

SUPERVISOR NAME: _____Date: 28/08/2014

(DR.NUR AZMAN BIN ABU)

BORANG PENGESAHAN STATUS TESIS*

JUDUL: VIDEO CODING USING TCHEBICHEF MOMENTS TRANSFORM
SESI PENGAJIAN: 2013/2014
Saya ALRYANA TOONG SIEW WA

Mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis dan projek adalah hak milik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Silatandakan (/)

_____SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

_____TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/ badan dimana penyelidikan dijalankan)

___/___TIDAK TERHAD

_____ _____
(TANDATANGAN PENULIS) (TANDATANGAN PENYELIA)

Alamat tetap :Kg Bukit Rok, 28200 Bandar Bera, Pahang.

DR.NUR AZMAN BIN ABU

Tarikh: 28 Ogos 2014 Tarikh: 28 Ogos 2014

CATATAN: * Tesis dimaksudkan sebagai Laporan Akhir Projek Sarjana Muda (PSM)

** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.

DEDICATION

To my beloved parents, Tong Tang Sang and Rubiah Binti Sekiau.

ACKNOWLEDGEMENT

I would like to take this golden opportunity to express my deepest gratitude and thanks to everyone that gives me support and giving a hand from the back to complete my final year project. I also thanks to the Almighty God because of His shower blessing that I am able to complete this study within the given time.

First of all, I wish my greatest and sincere appreciation to my supervisor, Dr. Nur Azman Bin Abu for this valuable ideas, guidance, support and patience to master me complete this project. Without his knowledge and positive comments I would not be able to finish this project. I would like to thank the AJK of PSM for BITC student for their support to guide the students and giving a guideline to achieve the good result.

Moreover, I would like to say thank you to the lectures of Faculty of Information and Technology (FTMK) at UTeM for their help either directly or indirectly to complete my study and final year project. Last but not least, I would like to thank you to my dearest parents and friend for their care and concern in my study.

Thank you all very much.

ABSTARCT

This goal of this final year project is to provide exposure to the real system development environment and faced with many challenges and problems encountered. Furthermore, these project also it to help student to show and improve their knowledge, soft skills and techniques to face a pressure and responsibility in the completion Final Year Project. Through this exposure, students are able to more understanding on the overall system development and handle the problems wisely.

Besides that, this final year project also known as the learning platform for the students to experience and enhance their knowledge that need to be recorded in the form of report.

ABSTRAK

Matlamat projek tahun akhir ini adalah untuk memberi pendedah kepada persekitran pembangunan system sebenar dan berhadapan dengan pelbagai cabaran dan masalah yang di tempuhi. Tambahan pula, projek ini juga adalah untuk membantu pelajar menunjukkan dan meningkatkan pengetahuan, kemahiran dan teknik dalam menghadapi tekanan dan tanggungjawab untuk menyiapkan Projek Tahun Akhir ini. Melalui pendedahan ini, pelajar dapat memahami lebih dalam tentang pembangunan keseluruhan sistem dan menangani masalah dengan bijak. Di samping itu, projek tahun akhir ini juga dikenali senagai platform pembelajaran untuk pelajar-pelajar dalam mengalami dan mempertimbangkan pengetahuan mereka yang perlu direkodkan dalam bentuk laporan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

TERMS	DESCRIPTION
TMT	Tchebichef Moment Transform
DCT	Discrete Cosine Transform
AVI	Audio Video Interleave
CDROM	Compact Disc Read Only Memory
RLE	Run Length Encoding
TV	Television
DVD	Digital Video Disc
MSE	Mean Square Error
ARE	Reconstruction Error
SSIM	Similarity Index
PSNR	Peak Signal-To-Noise-Ratio

CHAPTER I

INTRODUCTION

1.1 Project Background

According to (V Grech, 2003) a video with or without accompanying sound is produces very large hard disk files, especially if it is uncompressed. This type of files cannot be easily transported whether on a physical medium such as a CDROM or over the internet. There are several popular video file formats that have been used especially in the multimedia systems and telecommunications which are the formats can utilise a variety of codecs. The popular file formats is included Video for Windows (which uses the .AVI file extension).

AVI files are one optimal of the video media types that are play memory storage vital role in video formating file. Besides, AVI files is consists of heavy memory size and users are having trouble dealing with AVI videos. That is because not all of the computers are designed to support files of such a large size. Video compression processing is acted as an important role in modern multimedia applications to genereate data or source . To ease storage or transmission requirements the compression method is commonly performed on the video. Furthermore, the idea of compression is conducted is to save time and the number of bits that is sent between images. It is carried out by taking the difference between them instead of sending each frame again and again.

Data compression is one of the technique that can reduce the redundancies in data representation in order to decrease data storage requirements and comminucation cost. Reducing the storage requirement is equivalent to increase the capacity of the storage medium and hence the bandwith and time (Acharya and Ray, 2005). Compression is a way to reduce the number of bits in a frame but retaining its meaning and to decrease the space, file transfer time, saving time and communication bandwidth.

The idea of compression can be lossy or lossless. The lossless compression is when the data is decompressed; the result is a bit-for-bit perfect match with the original source. For the lossless compression of video is possible because it is rarely used, as lossy compression results is far higher compression ratios at an acceptable level of the quality. Video compression is one of the most important topics in the getting the best quality video and reducing the time to transmit.

AVI files are one optimal of the video media types that are play memory storage vital role in video formating file. Furhtemore AVI files is consists of heavy memory size and people are having trouble dealing with AVI videos. That is because not all of the computers are designed to support files of such a large size. Nowadays there are many methods that have been used to compress the large file size to get a better compression. This reserach is mainly disvuses on lossy video compression based on DCT as the tremsform method.

On the other hand, the discrete TMT is another new method that is introduced recently. The TMT technique that will be implemented in this project is to get a better quality of video compression ratio. There is a considerable amount of redundancy inside the digital video or real time. It is a relatively new transform method that uses TMT to provide a basis matrix and it is derived from the orthonormal version of Tchebichef polynominals (Mukundan, Ong, & Lee, 2011).

1.2 Problem Statement

This project is conducted mainly because of the existing problem in the current transmission applications for example computer communication, aircraft, broadcast television, remote sensing through satellite, facsimile transmission, sonar, radar, teleconferencing, and multimedia system which is stated by (Taskin & Sarikoz, 2008). But nowadays the real time application is the most popular according to the need of the users that used handheld device is getting arisen month by month. Based on the survey that have been conducted YouTube have reported that users were uploading 48 hours video to the service for every minutes. The main major to this problem is because YouTube has compresses all the videos while uploading the source but it is requirement a very high bandwidth transmission over the network.

Furthermore, there are three main reasons why present multimedia systems in video application require data that must be compress. Firstly, it is because the large storage requirement on multimedia data for video file. This is due to the larger video size is slow to be upload and download. In addition, the cost of storage has decreased drastically over the past few years due to the significant advancement in microelectronics and storage technology, the requirements of data storage and data processing applications is going up rapidly to stand out this achievement from Acharya and Ray (2005). The large video file will need a very high bandwidth over the network transmission.

Secondly, the reason is the larger video file size such as AVI file format will have a low quality of compression ratio. This is because the smaller files size the better quality of the file. The video file size is depends on many variables a follows:

i. Frame rate
ii. Colour depth
iii. Pixel dimensions
iv. Buffer size
v. Render quality
vi. Progressive or interlaced frames

vii. How frequent are the key frames (the frame where the all frame is recorded)

v. Audio sample rate

x. Constant or variable bit rate streaming

To determine the final size of video is measure by three measurements that count a lot in this process. First is the actual pixel dimension of the finished product whether HD (High Definition) or SD (Standard Definition). That is a lot of pixels per frame to stream. Second measurement is the length of the video to be play. The file size will change after rendering the video when we have made some changes on the video timeline. The third measurement is the frame rate of video. Usually most f the video there is about 30 frames per second (fps). By cutting of the number of frames in half, the video file size will be cut in half.

Thirdly, the reason is long duration to compress the large file size of AVI file format. The video files consume a large amount of data is slow to be compress or decompress . This probelm will lead to the need of a long duration to compress the video data before upload it to the real time application. The only worry about this video file size how long it might take to finish compression process. That is why multimedia data has to be compressed . On the compressing video process it is actually pretty simple. When the video form one frame to the next frame, some pixles change and some are exactly the same as in the frame before. The figure 3.1 will show how DCT compresion work in MPEG compresion of video.

1. Large storage requirement on multimedia data for video file because larger video file is slow to be upload and download.
2. Larger video file size have a low quality of compression ratio.
3. Long duration to compress the large file size of AVI file format.

1.3 Project Objectives

Video data ned to be compress to reduce the storage requirement and fast tranmission. Based on the problem above, there are some objectives for this research. Those objectives are as follow:

1. To develop a fast and efficient 240x320 TMT video I-frame compression.
2. To introduce and examine 240x320 TMT method in a video processing.
3. To analyze the compression techniques using TMT in terms of video quality,video reconstuction error and average bit-length or average per pixel per channel.

1.4 Scope

1.4.1 Target User

The video coding compression technique Tchebichef Moment Transform is a new solution for efficient I-frame video on a large image content distribution to the users. This problem is for the users who are having heterogeneous network and terminal capabilities system.

14.2 Project Limitation

On this project we will focus on the large image compression frame by frame as the video sequences lots of image frames per second. There is luminance and chrominance for each pixel are coded using a total 3 bytes (24 bits).

1.4.3 Functionality of Video Compression

Video compression is to reduce redundancy in video data which is spatial redundancy and temporal redundancy.

1.4.4 Entropy Coding

Entropy coding is use to reduce the repetition between the compressed data symbols and uncompressed data by using the variable length coding techniques.

1.5 Project Significant

This project is proposed for the users to get a good quality of AVI video with a better compression and decompression method without changing the original video quality. By introducing the Tchebichef Moment Transform (TMT) technique will help to reduce the redundancies . By introducing the Tchebichef Moment Transform (TMT) technique will help to reduce the time taken to transform images of different size efficiently (Abu, Wong, Rahmalan & Sahib, 2010).

1.6 Expected Output

By using the Tchebichef Moment Transform (TMT) technique we can generate a better quality AVI video that can be play in real time or digital video without having a problem in the network bandwidth and terminal capabilities.

1.7 Conclusion

As the conclusion, in this chapter it is just the overview for the whole project process. It it helps to understand the fucntion of video compression and how it is being compress and decompress. For the more details about method or techniques will be discuss in the next section which is Chapter 2.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In this chapter will explain clearly about the previous research done in this field. First, it will examine the research of various theories and basic image or video processing knowledge that is related to the video compression or coding. The overview, analysis and reading activities are mostly come out from many resources such as books, journals and articles.

2.2 Introduction of Video Compression

Most of the people in the industrialized world use video compression as much as they can for each day in their daily routine. Whether you're watching talent shows on TV, music clips on YouTube, movies on DVD where all the video storage and delivery items is depending on the compression technology that been used. The invention of the video compression technique the difficulty that has been through before this is going to be avoided by transmitting only the difference between consecutive images of the object. Even though it would take many years before this technique would actually be used in practice, it is still a foundation or base of many video compression standards until today. A very high data rate is requires for the uncompressed graphics, audio, and video data as it need a essential storage capacity whereas impossible in the case of uncompressed video data.

Nowadays, to reduce the data redundancy in the video it is require to use video compression coding technique by implementing an algorithm and codes with the combination of spatial image of I-frame compression and temporal motion compensation. In advanced it is a practical implementation of source coding in information theory. Most of the video compression algorithms are using a lossy compression processing. As in all lossy compression, there is a trade off between quality of the video, cost of processing the compression and decompression, and system requirements based on the research by (CS MSU video Group, 2007). Video compression typically operates on square-shaped groups of neighbouring pixels that we called macro blocks. In addition, these pixel groups or blocks of pixels are compared from one frame to the next while the video compression coded is sends only the differences within those blocks (Mor, Sharma & Kumar, 2013).

According to Laurin (2002), video contains are very large numbers of data which is storing the data .Then, it is transferring it over a network that has created the need of manage to be more efficiently and effectively. Due to the network problem to transmit the video in efficiently way it is require video compression as the solution. The process of digitizing and storing video without compression is accomplishable. That is because it highly impractical and expensive cost to process the uncompressed video.

Besides, the video compression techniques are play an important role for reducing the amount of information needed for image sequence without losing an excessive amount of original image quality. It is can be judged and seen by the human viewers. During transmission of sequences of video images it is typically require large amounts of electronic memory for data storage. It is occupy much bandwidth to transmit the video data. There are widely used image and video compression processing engine standards, such as JPEG and MPEG or MPEG2. The video compression that they used is the two-dimensional DCT to achieve near optimal compression of individual frames of video. There are two assumptions relies in video compression. Firstly, the human sensitivity is to the noise in the picture is highly dependent on the frequency of the noise. Secondly, a great deal of commonness between one image and the next I-frame for the moving pictures in video.

Furthermore, video data compression is concerned with reducing the amount of data required to reproduce a digital video source. The solution to prevent this problem is by mismatch between the large storage and transmission bandwidth requirements of video and the limited capacity of existing computer systems and communications over network. Moreover, it is a key component in facilitating the widespread use of digital video which is currently, although the range of video compression standards now available for example is MPEG-2. It is exhibit acceptable performance when the video is operating at a high bit rates for example is 64 Kbps. The problem is a very low bit rates and prompting the need for the development of the next generation video compression standards in the future. The Figure 2.1 below is about how the video compression works to compress the data.

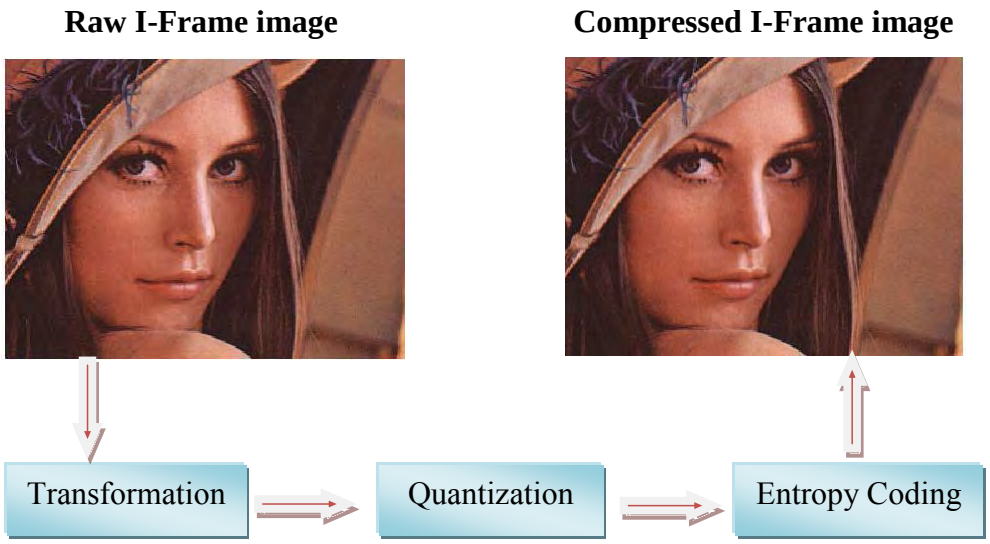

Figure 2.1: Video Compression Algorithm.

2.3 Data compression

According to (Sallauddin, 2012) data compression is the most common and indispensable method that has been used in the communication and telecommunication world technology where transmission bandwidth is limited access and needs a fast transmitting data over a network. However, data compression features can help to reduce the size of the database as well as improve the

performance of input or output of intensive workloads. While data is exchanged with the application an extra resources are required on the database server to compress and decompress the data. Figure 2.2 shows a model for data compression flow that performs a transparent compression method.

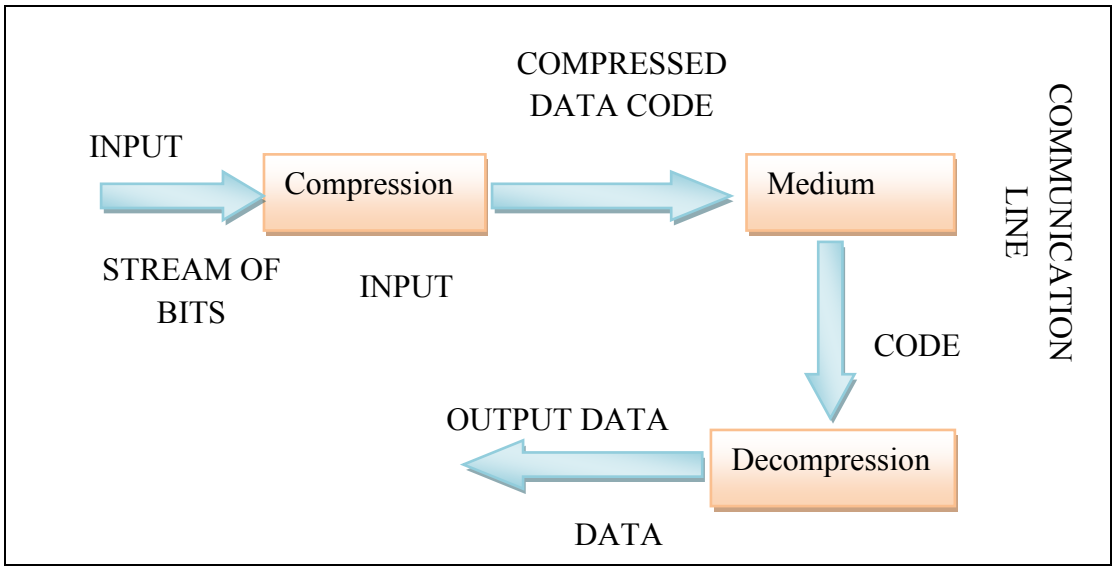

Figure 2.2: A model of data compression system.

The process of reducing the amount of data required to represent a source of information and also to preserve the originality of the content is needed as much as possible. Meanwhile, the main objectives of data compression is included to reduce the amount of data storage space required and reduce the length of data transmission time over the network. The type of data compression can divided into two which are lossless data compression and lossy data compression. Both of this data compression type is conducted to provide information where not all of the original data can be recovered when the file is uncompressed.

Lossless data compression algorithm is remaining the originality of each bit of data even though after the file is uncompressed (Sallauddin, 2012). In other words the integrity of the data is well preserved in the lossless data compression. Where the original data and the data after compression or decompression are exactly same as the method compress and decompress algorithm are exact inverse of each other where no part of data is lost the bits. Lossless algorithms means that we can return the original signals without any bits are been ignore while it was process.

Hence it is numerically identical to the original content on a pixel-by-pixel basis. The Lempel-Ziv (LZ) is one of the lossless compression methods the most popular among the algorithm for lossless storage (Ziv and Lempel, 1978). During decompression the redundant data is added and removed in compression method. It is used when we are cannot afford to lose any data in term of originality source. In video lossless compression is possible since it is rarely used as the lossy compression result in far higher compression ratio at an acceptable level of quality.

The lossy data compression is the inverse of lossless data compression where some loss of information is acceptable by dropping nonessential detail from the data source that can save storage space requirement. Lossy compression method is reducing a file by permanently eliminating certain information source especially redundant information. In this case only a part of the original information is still there although the user may not notice it when the file is uncompressed (Sallauddin, 2012). Generally lossy compression has been used for music files, images and video because there is a certain amount of data loss will not detected by most of the users.

For example, the human eyes are more sensitive to perceptive variations in luminance where it is to variations in colour. A lossy algorithm will ignore some bits of so that the data cannot return into the original bit. The inverse process of compression is decompression process whereas specific coders and decoders can be implemented very differently. The process extracts the substrings from the compressed string and tries to replace the indexes with the corresponding entry in the dictionary, which is empty at first and built up gradually. The idea is that when an index is received, there is already an entry in the dictionary corresponding to that index.