

**IMPROVED DISTRIBUTED WYNER-ZIV VIDEO
CODING BASED ON REED SOLOMON ERROR
CORRECTION SCHEME AND FRAME
ESTIMATION FOR WIRELESS TRANSMISSION**

CHIAM KIN HONN

UNIVERSITI SAINS MALAYSIA

2015

**IMPROVED DISTRIBUTED WYNER-ZIV VIDEO CODING BASED ON
REED SOLOMON ERROR CORRECTION SCHEME AND FRAME
ESTIMATION FOR WIRELESS TRANSMISSION**

by

CHIAM KIN HONN

**Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science**

September 2015

ACKNOWLEDGEMENT

First, I would, with my heart, like to show and express the highest gratitude and appreciation to my supervisor, Associate Professor Dr. Mohd Fadzli Bin Mohd Salleh for his considered advice, patience, excellence, support, enthusiasm, and guidance for this research during my studies. Special thanks to all members, lecturers, and staffs of the School of Electrical and Electronics Engineering of Universiti Sains Malaysia. Most importantly, I am grateful to my family members, especially my parent and my siblings for their huge support and unconditional love. They helped and gave me power, strength, and patience to complete works and this thesis. Lastly, my token of appreciation went to all my friends and colleagues for their continuous idea and feedback that improve the quality of this thesis and also who have made daily life interesting and joyful.

TABLE OF CONTENTS

Acknowledgement.....	ii
Table of Contents.....	iii
List of Tables.....	vii
List of Figures.....	viii
List of Abbreviations.....	xv
List of Symbols.....	xvi
Abstrak	xviii
Abstract.....	xx

CHAPTER 1: INTRODUCTION

1.1	Preface.....	1
1.2	Problem Statement.....	3
1.3	Objectives of the Research.....	4
1.4	Research Scope.....	5
1.5	Thesis Organization.....	6

CHAPTER 2: LITERATURE REVIEW

2.1	State of the Art of Distributed Video Coding.....	10
	2.1.1 Operation of Distributed Video Coding Model.....	10
	2.1.2 Frame Transformation and Frame Compression.....	11
	2.1.3 Overview of Theories of Distributed Video Coding....	14

	2.1.3 (a) Slepian-Wolf Theorem for Loseless	
	Distributed Compression.....	14
	2.1.3 (b) Wyner-Ziv Coding for Lossy Distributed	
	Compression.....	16
2.2	Basic of Techniques and Methods Used in Thesis	
	Research.....	18
	2.2.1 Reed Solomon Codes.....	18
	2.2.1 (a) Galois Finite Field.....	19
	2.2.1 (b) Reed Solomon Encoder.....	20
	2.2.1 (c) Reed Solomon Decoder.....	21
	2.2.2 Low Density Parity Check Codes.....	26
	2.2.3 Linear Interpolation Method.....	29
2.3	Common Quality Metrics.....	30
	2.3.1 Peak to Signal Noise Ratio.....	30
	2.3.2 Bit Error Rate.....	31
2.4	Review of Other Research Activities.....	32
	2.4.1 Stanford Architecture of Distributed Video Coding	
	Model.....	33
	2.4.2 DISCOVER Architecture for The Distributed Video	
	Coding Model.....	36
	2.4.3 Distributed Video Coding with Adaptive Video	
	Splitter.....	38
	2.4.4 Block Based Distributed Video Coding Architecture.	39
	2.4.5 Rateless Distributed Video Coding Architecture with	
	Skip and Intra Modes.....	42

2.4.6	Side Information Improvement for The Distributed Video Coding Model.....	44
2.4.7	Summary of Distributed Video Coding Model.....	45
CHAPTER 3: PERFORMANCE EVALUATION OF DIFFERENT ENCODING TECHNIQUES IN DISTRIBUTED VIDEO CODING		
3.1	Wyner-Ziv Encoder.....	48
	3.1.1 Quantizer.....	51
	3.1.2 Channel Encoder.....	53
3.2	Wyner-Ziv Decoder.....	53
	3.2.1 Channel Decoder.....	54
3.3	Simulation Setup.....	55
	3.3.1 Performance Measurement.....	56
3.4	Experiment Results.....	59
	3.4.1 Performance of Various Code Rates in AWGN Channel.....	59
	3.4.2 Performance in Various Doppler Frequencies of Rayleigh Fading Channel.....	64
	3.4.3 Performance of Various Code Rates in Rayleigh Fading Channel.....	70
	3.4.4 Evaluation of Rate Distortion of Output Video Sequence.....	74
3.5	Summary.....	85

CHAPTER 4: DISTRIBUTED VIDEO CODING WITH FRAME

ESTIMATION AT DECODER

4.1	Implementation of Proposed DVC Model.....	88
4.2	Detailed Operation of The Encoder Module	90
4.3	Separation of The Wyner-Ziv Frames with Frame Modulo.	92
4.4	Detailed Operation of The Decoder Module.....	93
4.5	Estimation of The Even-numbered Wyner-Ziv Frames.....	95
4.6	Simulation Setup.....	96
4.7	Experiment Results.....	98
	4.7.1 Transmission Through a Perfect Channel.....	99
	4.7.2 Transmission Through Rayleigh Fading Channel.....	107
4.8	Summary.....	115

CHAPTER 5: CONCLUSIONS AND FUTURE WORKS

5.1	Conclusions.....	116
5.2	Future Works.....	117

References

Appendices

LIST OF TABLES

		PAGE
Table 2.1	Relationship between Quality Metrics	32
Table 3.1	Various Code Rates of LDPC Codes and RS Codes	56
Table 3.2	Simulation Parameters (AWGN Channel)	74
Table 3.3	Simulation Parameters (Rayleigh Fading Channel)	75
Table 3.4	Simulation Result with Hall Monitor Video Sequence (AWGN Channel)	83
Table 3.5	Simulation Result with Hall Monitor Video Sequence (Rayleigh Fading Channel)	83
Table 3.6	Average Processing Time in AWGN Channel	84
Table 3.7	Average Processing Time in Rayleigh Fading Channel	84
Table 4.1	Simulation Parameters	96
Table 4.2	Characteristics of Input Video Sequences	97
Table 4.3	PSNR Values for Some Frames of Hall Monitor Video Sequence (Perfect Channel)	100
Table 4.4	Average Processing Time	106
Table 4.5	PSNR Values for Some Frames of Hall Monitor Video Sequence (Rayleigh Fading Channel)	109

LIST OF FIGURES

		PAGE
Figure 2.1	State of the Art of Typical Distributed Video Coding Model	11
Figure 2.2	Distributed Compression of Two Random and Statistically Dependent Data, X and Y	14
Figure 2.3	Achievable Rate Region for Distributed Compression of Two Statistically Independent Identically Distributed Sources, X and Y	16
Figure 2.4	Lossy Compression of a Sequence, X using Statistically Related Side Information, Y	17
Figure 2.5	Typical Structure of a Reed Solomon Codeword	21
Figure 2.6	Tanner Graph Representation of the Low Density Parity Check Codes	28
Figure 2.7	Stanford Architecture of Distributed Video Coding Model	34
Figure 2.8	Block Diagram for the DISCOVER Model	37
Figure 2.9	Distributed Video Coding Architecture with Adaptive Video Splitter	38
Figure 2.10	PRISM Architecture of Block Based Transform Domain	40
Figure 2.11	Wyner-Ziv Video Compression with Skip and Intra Mode Selection	43
Figure 3.1	Proposed Distributed Video Coding Model	49
Figure 3.2	Flowchart for the Proposed Distributed Video Coding Model	50
Figure 3.3	Compression in the Zig-zag Manner	52

Figure 3.4	Side Information Estimation	54
Figure 3.5a	Comparison between LDPC Codes of Code Rate $1/2$ and RS Codes of Code Rate $15/31$ in AWGN Channel with Hall Monitor Video Sequence	60
Figure 3.5b	Comparison between LDPC Codes of Code Rate $1/3$ and RS Codes of Code Rate $11/31$ in AWGN Channel with Hall Monitor Video Sequence	61
Figure 3.5c	Comparison between LDPC Codes of Code Rate $2/3$ and RS Codes of Code Rate $21/31$ in AWGN Channel with Hall Monitor Video Sequence	61
Figure 3.5d	Comparison between LDPC Codes of Code Rate $5/6$ and RS Codes of Code Rate $25/31$ in AWGN Channel with Hall Monitor Video Sequence	62
Figure 3.5e	Comparison between LDPC Codes of Code Rate $8/9$ and RS Codes of Code Rate $27/31$ in AWGN Channel with Hall Monitor Video Sequence	62
Figure 3.6a	Comparison of Various Code Rates of RS Codes in AWGN Channel with Hall Monitor Video Sequence	63
Figure 3.6b	Comparison of Various Code Rates of LDPC Codes in AWGN Channel with Hall Monitor Video Sequence	64
Figure 3.7a	Comparison of RS Codes of Code Rate $11/31$ in Rayleigh Fading Channel with Hall Monitor Video Sequence	65
Figure 3.7b	Comparison of LDPC Codes of Code Rate $1/3$ in Rayleigh Fading Channel with Hall Monitor Video Sequence	66

Figure 3.8a	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	67
Figure 3.8b	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 2 Hertz with Hall Monitor Video Sequence	67
Figure 3.8c	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 6 Hertz with Hall Monitor Video Sequence	68
Figure 3.8d	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 10 Hertz with Hall Monitor Video Sequence	68
Figure 3.8e	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 20 Hertz with Hall Monitor Video Sequence	69
Figure 3.8f	Comparison between LDPC Codes of Code Rate 1/3 and RS Codes of Code Rate 11/31 in Rayleigh Fading Channel of Doppler Frequency of 80 Hertz with Hall Monitor Video Sequence	69

Figure 3.9a	Comparison between LDPC Codes of Code Rate 1/2 and RS Codes of Code Rate 15/31 in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	70
Figure 3.9b	Comparison between LDPC Codes of Code Rate 2/3 and RS Codes of Code Rate 21/31 in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	71
Figure 3.9c	Comparison between LDPC Codes of Code Rate 5/6 and RS Codes of Code Rate 25/31 in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	71
Figure 3.9d	Comparison between LDPC Codes of Code Rate 8/9 and RS Codes of Code Rate 27/31 in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	72
Figure 3.10a	Comparison of Various Code Rates of RS Codes in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	73
Figure 3.10b	Comparison of Various Code Rates of LDPC Codes in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	73
Figure 3.11a	Rate Distortion Curve in AWGN Channel of Signal-to-noise Ratio of 20.0 decibels with Hall Monitor Video Sequence	77

Figure 3.11b	Rate Distortion Curve in AWGN Channel of Signal-to-noise Ratio of 22.5 decibels with Hall Monitor Video Sequence	78
Figure 3.11c	Rate Distortion Curve in AWGN Channel of Signal-to-noise Ratio of 25.0 decibels with Hall Monitor Video Sequence	78
Figure 3.11d	Rate Distortion Curve in AWGN Channel of Signal-to-noise Ratio of 27.5 decibels with Hall Monitor Video Sequence	79
Figure 3.11e	Rate Distortion Curve in AWGN Channel of Signal-to-noise Ratio of 30.0 decibels with Hall Monitor Video Sequence	79
Figure 3.12a	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 1 Hertz with Hall Monitor Video Sequence	80
Figure 3.12b	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 2 Hertz with Hall Monitor Video Sequence	80
Figure 3.12c	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 6 Hertz with Hall Monitor Video Sequence	81
Figure 3.12d	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 10 Hertz with Hall Monitor Video Sequence	81

Figure 3.12e	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 20 Hertz with Hall Monitor Video Sequence	82
Figure 3.12f	Rate Distortion Curve in Rayleigh Fading Channel of Doppler Frequency of 80 Hertz with Hall Monitor Video Sequence	82
Figure 4.1	Flowchart for the Proposed Distributed Video Coding Model	89
Figure 4.2	Encoder Part of the Proposed DVC Model	91
Figure 4.3	Decoder Part of the Proposed DVC Model	94
Figure 4.4	Linear Interpolator Module	95
Figure 4.5	PSNR Values for Each Frame of Hall Monitor Video Sequence (Perfect Channel)	101
Figure 4.6a	Visual Comparison for Frame 23 of Hall Monitor Video Sequence (Perfect Channel)	102
Figure 4.6b	Visual Comparison for Frame 56 of Hall Monitor Video Sequence (Perfect Channel)	102
Figure 4.6c	Visual Comparison for Frame 82 of Hall Monitor Video Sequence (Perfect Channel)	103
Figure 4.6d	Visual Comparison for Frame 110 of Hall Monitor Video Sequence (Perfect Channel)	103
Figure 4.6e	Visual Comparison for Frame 125 of Hall Monitor Video Sequence (Perfect Channel)	104
Figure 4.6f	Visual Comparison for Frame 197 of Hall Monitor Video Sequence (Perfect Channel)	104

Figure 4.6g	Visual Comparison for Frame 268 of Hall Monitor Video Sequence (Perfect Channel)	105
Figure 4.6h	Visual Comparison for Frame 289 of Hall Monitor Video Sequence (Perfect Channel)	105
Figure 4.7	PSNR Values for Each Frame of Hall Monitor Video Sequence (Rayleigh Fading Channel)	109
Figure 4.8a	Visual Comparison for Frame 8 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	111
Figure 4.8b	Visual Comparison for Frame 17 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	111
Figure 4.8c	Visual Comparison for Frame 49 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	112
Figure 4.8d	Visual Comparison for Frame 71 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	112
Figure 4.8e	Visual Comparison for Frame 138 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	113
Figure 4.8f	Visual Comparison for Frame 216 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	113
Figure 4.8g	Visual Comparison for Frame 240 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	114
Figure 4.8h	Visual Comparison for Frame 295 of Hall Monitor Video Sequence (Rayleigh Fading Channel)	114

LIST OF ABBREVIATIONS

AWGN	Addition White Gaussian Noise
BER	Bit Error Rate
CRC	Cyclic Redundancy Check
DCT	Discrete Cosine Transform
DVC	Distributed Video Coding
FEC	Forward Error Correction
GF	Galois Field
GOP	Group of Pictures
LDPC	Low Density Parity Check Codes
MSE	Mean Square Error
PSNR	Peak Signal to Noise Ratio
RD	Rate Distortion
RS	Reed Solomon
SER	Symbol Error Rate
SI	Side Information
SNR	Signal to Noise Ratio
WZ	Wyner-Ziv

LIST OF SYMBOLS

R_X	Rate of compression of source data, X
$H(X)$	Entropy of compression of source data, X
\hat{D}	Distortion between source data and reconstructed frame
Δ	Difference between source data and reconstructed frame
$D(i, j)$	DCT equation to calculate (i, j) -th element in DCT matrix
d_{ij}	(i, j) -th element in DCT matrix
N	Total number of pixels of a block of frame
$p(x, y)$	Grayvalue of the (x, y) -th pixel of a frame
Q_τ	Quantization matrix of predefined number of level, τ
q_{ij}	(i, j) -th element in quantization matrix
b_{ij}	(i, j) -th element in resultant block of frame after quantization
E	Number of errors in received RS codeword
A	Number of erasures in received RS codeword
T	Number of redundant symbols (RS codes) or bits (LDPC codes)
N	Number of codeword symbols (RS codes) or bits (LDPC codes)
K	Number of source symbols (RS codes) or bits (LDPC codes)
m	Number of bits per source or codeword symbols for RS codes
$r(z)$	Received codeword in polynomial form for RS codes
$c(z)$	Encoded codeword in polynomial form for RS codes
$e(z)$	Errors in received codeword in polynomial form
$g(z)$	Generator polynomial for RS codes
$s(z)$	Syndrome expressions

β	Primitive element in Galois field
$\sigma(z)$	Error locator polynomial for RS codes
Y	Degree of error locator polynomial for RS codes
Z	Locations of error vectors for RS codes
C	Encoded codeword vector for LDPC codes
U	Source data vector for LDPC codes
G	Generator matrix for LDPC codes
I_τ	Identity matrix of degree, τ
P	Coefficient matrix for LDPC codes
S	Parity check matrix for LDPC codes
s_{ij}	(i, j) -th element in S
w_i	Total number of 1 in every row of S
w_j	Total number of 1 in every column of S
F	Linear interpolation function
r_e	Total number of erroneous bits received
B	Total number of bits transmitted
ϕ	Index number of a frame in GOP
F_ϕ	ϕ -th frame in GOP
M	total number of frames in a video sequence
Ψ	Remainder
T	Time

**PENGEKODAN VIDEO WYNER-ZIV TERAGIH DIPERBAIKI
BERASASKAN SKIMA PEMBETULAN RALAT REED SOLOMON DAN
PENGANGGARAN RANGKA UNTUK PENGHANTARAN TANPA WAYAR**

ABSTRAK

Semenjak beberapa tahun yang lalu, terdapat peningkatan terhadap permintaan untuk aplikasi komunikasi multimedia yang laju, cekap, dan berkualiti tinggi melalui kabel dan sistem tanpa wayar. Ini telah membuka jalan kepada penyelidikan dalam bidang pengekodan video teragih (DVC) untuk berkembang. Objektif tesis ini adalah menganalisis kecekapan pelbagai skim pembetulan ralat kehadapan dalam DVC untuk melindungi sumber data dan mengurangkan jumlah bingkai yang dihantar oleh pengekod. Terkini, kod pemeriksaan keseimbangan padatan rendah (LDPC) dipilih sebagai teknik pengekodan saluran untuk mengekod bingkai Wyner-Ziv dalam DVC kerana kod LDPC mempunyai prestasi pembetulan ralat yang lebih baik berbanding dengan kod turbo. Walau bagaimanapun, kod LDPC menggunakan algoritma pengekodan dan penyahkodan yang kompleks. Dalam tesis ini, kod LDPC digantikan dengan kod Reed Solomon (RS) untuk mengekod bingkai Wyner-Ziv. Prestasi kod RS dalam melindungi sumber maklumat akan dibandingkan dengan kod LDPC. Oleh sebab kod RS menggunakan algoritma pengekodan dan penyahkodan yang kurang kompleks, keseluruhan jumlah masa sistem dapat dikurangkan dan hasil dapat diperolehi dalam masa yang lebih singkat. Keputusan kajian menunjukkan model yang dicadangkan mencapai pengurangan masa pemprosesan sebanyak antara 9.3% hingga 9.4%, bergantung kepada jujukan video kemasukan dan kualiti jujukan video keluaran yang dapat diterima. Kod RS

adalah terkenal dengan kebolehan untuk membetulkan ralat ledakan, yang kebiasaannya wujud dalam saluran yang pudar. Bahagian kedua tesis ini adalah pengurangan jumlah bingkai yang dihantar oleh pengekod. Hanya sebahagian bingkai dari kumpulan gambar yang dihantar oleh pengekod untuk mengurangkan jumlah keseluruhan masa sistem penghantaran. Bingkai-bingkai yang tidak dihantar haruslah dianggar di penyahkod supaya terdapat kumpulan gambar yang lengkap untuk pembentukan semula video keluaran. Keputusan kajian menunjukkan model yang dicadangkan adalah lebih cekap kerana jujukan video keluaran dapat dibentuk dalam masa yang lebih singkat. Model yang dicadangkan mencapai pengurangan masa pemprosesan sebanyak antara 4.0% hingga 4.7%, bergantung kepada jujukan video kemasukan. Tambahan lagi, kualiti bingkai-bingkai yang dianggar oleh model yang dicadangkan mempunyai kualiti yang dapat diterima berbanding dengan bingkai-bingkai kemasukan yang asal.

**IMPROVED DISTRIBUTED WYNER-ZIV VIDEO CODING BASED ON
REED SOLOMON ERROR CORRECTION SCHEME AND FRAME
ESTIMATION FOR WIRELESS TRANSMISSION**

ABSTRACT

Recent years have witnessed the increase in demand for fast, efficient, and high quality communication of multimedia applications through the wireless and wired transmission. This has opened up the research area in distributed video coding (DVC) to flourish. The objectives of this thesis are to evaluate efficiency of implementation of different channel encoding schemes in DVC in protecting the source data in channel impairment environment and also reduce the number of frames transmission from the encoder. Most recently, the low density parity check codes (LDPC) are chosen to be the forward error correction technique to encode the Wyner-Ziv frames in DVC as the LDPC has more superior error correction performance than the turbo codes. However, the LDPC involves complicated encoding and decoding algorithm. In this thesis, the LDPC is replaced with the Reed Solomon (RS) codes to encode the Wyner-Ziv frames. Performance of RS codes in protecting source message is compared with the LDPC codes. As the RS codes involve less complicated encoding and decoding algorithm, the overall system time is reduced and the output is obtained in a shorter time. Based on the experiment results, the proposed model achieves a reduction of about 9.3% to 9.4 % in processing time, depending on the input video sequence, with acceptable quality of output video sequence. The RS codes are known for their capabilities to correct burst errors, which are common in fading channel. The second part of this thesis is

the reduction of the number of frames transmission from the encoder. Only certain frames in the group of picture are transmitted from the encoder to reduce the overall transmission time of the system. The frames that are not transmitted shall be estimated at the decoder so that there will be a complete set of the group of picture at the decoder for the output video reconstruction. Based on the experiment results, the proposed model seems more effective and efficient as output video sequence could be obtained in a shorter time. The proposed model achieves a reduction of about 4.0% to 4.7 % in processing time, depending on the input video sequence. Moreover, the estimated output frames of the proposed model are also with acceptable quality as compared to the original input frames.

CHAPTER 1

INTRODUCTION

1.1 Preface

The change in the video coding paradigm is motivated by the demand to reduce the computational power for video compression and transmission [1], [2]. In the traditional coding paradigm of digital video, the architecture of the encoder is very complicated and complex. This is mainly due to the task of motion estimation, as all the encoder needs to make all the coding decisions, whereas the decoder only acts as a pure executer based on the orders from the encoder [2], [3]. However, this approach is unsuitable for applications where the users have the interest to produce and transmit video and multimedia, using the lightweight devices, such as their cell phones or mobile devices. Moreover, these devices usually operate with batteries, and hence, the power consumption is a constraint if they need high computational power [4], [5].

As this scenario is rapidly evolving, it calls for a new multimedia coding paradigm, to shift the high computational power to the decoder, in order to keep the encoder as simple as possible for video compression and radio transmission [6]. Distributed video coding (DVC) offers an alternative predictive video coding paradigm, to fulfill this purpose. DVC encodes video frames separately but decodes them jointly as there is no complexity constraint at the decoder [6], [7], [8]. Based on the Slepian-Wolf and Wyner-Ziv theories, the degradation in performance of DVC for separately encoding the video frames is small [9]. In another words, it is indeed achievable to encode two correlated sources independently while obtaining

the same efficiency as if the encoder is exploiting the knowledge of both sources [10].

This research of DVC with promising result has eventually led to growing interest in various applications, especially in the wireless transmission [11]. An example of application of DVC is in the monitoring or surveillance systems. There is a network of video sensors or video cameras [12], [13]. Each sensor does not communicate to each other and will independently send the video frames to a common receiving station. There is a central decoder to jointly decode these frames, which are correlated to each other [12], [13], [14]. Therefore, the every potential complex computation is shifted from the sensor sources with limited battery power to a central decoder which is connected to a main power supply [11]. As a result, the constraint of critical power that directly determines the lifespan of a wireless sensor node is solved. Other similar applications of DVC are in the compression of secure biometric data, which requires robust wireless video transmission but the information exchange between the source nodes is neither impossible nor unpractical [11].

As this is a relative new field of study, there is no standard model yet for the DVC [6]. Each researcher is adopting his or her own models or methods, with their own advantages and disadvantages. One model is proposed after another to boost the performance of the previous model or to solve the limitations of the previous model. The state of the art of detailed architecture and operation of every DVC model are discussed in the next chapter in section 2.4.