Chapter 1

INTRODUCTION

1.1 Background

A video contains a sequence of pictures/images/frames, in which there is more redundant information present, that can be removed with the help of video compression algorithms, after that video signal can more efficient for transmission or storage. Therefore compression is the process of removing redundancy in the image and video frames. There are four types of redundancies present in a raw image or video such as spatial redundancy i.e. the redundancy present in the same frame, temporal redundancy i.e. the redundancy present in between frames, color spatial redundancy i.e. a human eye is not sensitive to sudden color variations and phyco-visual redundancy i.e. high-level limitation of Human Visual System (HVS). Compression can be classified into loss less compression and lossy compression. Lossless compression achieves reduction of data and reconstructs original data without losing any information. Lossy compression achieves data reduction and reconstructs original information with loss of information. The video compression algorithms are based on lossy compression. In lossy compression the loss of information in reconstructed signal with high compression is achieved [1-2].
The image and video processing applications such as video conferencing, digital television, standard and high definition television, internet video streaming, mobile technology and computer communication requires large storage for handing large amount of data. Thus video contains a series of still images recorded uncompressed video occupies large amount of data. For instance, the raw format of one hour of color picture of size 1024 × 768 resolution at 30 frames per second require 1024x786x3x30x3600 about (255 GB) of memory and 566 Mbps speed. Video with standard definition has size of 720x576 with a frame rate of 25 frames per second, in 4:2:0 format and 8- bit colour depth requires memory of luma and chroma components are (720 x 576 x 25 x 8) + (2 x (360 x 288 x 25 x 8)) = 124.416 Mbps and for high definition which uses a resolution of 1920x1080 with a frame rate of 60 frame per second, 4:2:0 format and 8- bit colour depth requires memory of luma and chroma components are (1920 x 1080 x 60 x 8) + (2 x (960 x 540 x 60 x 8)) = 1.49 Gbps. In 4:4:4 format, amount of the data occupied by a still image with resolution of 720x576 at frame rate 25fps is 720x576x25x24=248.832Mb/s and High definition television which uses a resolution of 1920x1080 with a frame rate of 60 frame per second, 4:4:4 format and 8- bit colour depth takes 1920x1080x60x24= 2.98Gbps. For a two-hour movie in NTSC (National Television System Commission) 4:2:2 formats, the uncompressed video takes 151 gigabytes that is (720x486+2x360x486) x30x2x3600 = 151165440000 bytes [3-4].

In order to reduce the storage requirements, compression algorithms are plays an important role in video compression. Video compression algorithm means reducing redundancy and irrelevancy. Irrelevancy means perceptually unimportant information.

In video compression, in order to achieve better video coding efficiency, an International standard has been developed the image (JPEG) and video compression standards (MPEG and H.26X series). Video and image compression has a very active area of research and development for over 20 years and many algorithms for compression and decompression has proposed and developed. In order to achieve better coding performance, an International standard has been developed image and video compression standard such as the JPEG, MPEG and H.26X series of standards [5].
There are many video coding standards such as MJPEG and MPEG available for video coding; the video coding standards use different compression algorithm or coding tools in order to achieve more efficient coding efficiency. These compression algorithms are used for video processing or multimedia applications such as video teleconferencing systems, high definition television etc. A new video compression standard is developed for to improve the performance of the existing applications and to enable the applicability of video compression to new real-time applications. This new standard offer better video compression efficiency than previous video coding standards. The new standard developed jointly by ITU-T and ISO international bodies. The H.264 standard developed to achieve high the compression performance, over the existing standards. AVC standard removes spatial, temporal redundancy and achieved high compression performance by prediction techniques i.e. intra and intra prediction [6-7]. The advanced features of H.264 are lead to increase computational complexity.

1.2 Motivation

The motivation behind for the research work is to provide consistent picture quality, reduced in bit rate, reduce in encoding time with high compression for intra frame.

The existing video coding standards for coarse quantisation parameter provides reduce in the quality of image i.e. PSNR and increase in bit rate with increase in computational complexity.

Due to the block-based transform, video frames suffered in blocking artifacts and ringing artifacts. At high compression, the error introduced by quantization of the transform co-efficient produces compression artifacts which lower the perceived quality of an image.

In order to achieve better coding performance in terms of picture quality, bit rate, encoding time and compression of Intra frame coding in H.264 video coding standard, uses Rate Distortion Optimization technique with full search mode algorithm. But Rate Distortion Optimization algorithm is computationally complex and it is very difficult to implement for real time applications.
The previous algorithms developed by researchers (fast mode decision intra prediction algorithm) on Intra frame coding achieved only reduction of computational complexity but there is loss i.e. degradation in picture quality (PSNR) and increased in bit rate of reconstructed frame. These are the main motivating factors for proposed research.

To achieve reduce in bit rate, avoid loss or degradation in picture quality i.e. PSNR, reduction in encoding time and better compression, a efficient video coding algorithm for intra frame coding needs new approach, which can ability to deliver good picture quality, bit rate and compression to end users.

1.3 Organisation of the Thesis

The rest of the thesis is organized as follows:

Chapter 2 covers the literature review till date to cover proposed objectives

Chapter 3 covers the problem statement, objectives and methodology of proposed research work

Chapter 4 explains the basic concepts of video coding, video format brief insight of the video coding standards and overview of H.264 video coding standard

Chapter 5 explains detail of proposed research to achieve proposed objectives

Chapter 6 explains detail results and discussion of proposed research

Chapter 7 presents conclusion and further development