NOTATIONS AND ABBREVIATIONS	
CCTV	Closed Circuit Television
DCT	Discrete Cosine Transformation
ECG	Electro Cardiogram
SDTV,	Standard-Definition Television
HDTV	High Definition Television Video
MPEG	Moving Pictures Experts Group
AVC	Advanced Video Coding
DVR	Digital Video Recorder
VQ	Vector Quantization
DWT	Discrete Wavelet Transform
POTS	Plain Old Telephone System
ITU	International Telecommunications Union
ISO	International Organization for Standardization

IEC	**International Electro Technical Commission**
Mbps	**Mega Bits Per Second**
PTZ	**Plain Tilt Zoom**
IDCT	**Inverse Discrete Cosine Transformation**
VLC	**Variable-Length Coding**
VLD	**Variable-length decoding**
MSE	**Mean Square Error**
PSNR	**Peak-Signal-To-Noise Ratio**
MPPs	**Massively Parallel processors**
PCI	**Peripheral Component Interconnect**
IFS	**Iterated Function System**
PCA	**Principal Component Analysis**
APEX	**Adaptive Principal Component EXtraction**

RGB	**Red Blue Green**
NTSC	**National Television System Committee**
PAL	**Phase Alternating Line**
WMV	**Windows Media Video**
WAV	**Waveform Audio File Format**
JPEG	**Joint Photographic Expert Group**
CBR	**Constant Bit Rate**
VBR	**Variable Bit Rate**
kbps	**Kilobits Per Second**
PSNR	**Peak Signal to Noise Ratio**
BDM	**Block Distortion Measure**
SAD	**Sum of Absolute Difference**
RCR	**Relative Complexity Reduction**

RCR	**Relative Complexity Reduction**
SDS	**Selective diamond search**
DS	**Diamond search**

LIST OF PUBLICATIONS

1. “A Survey and Study of Image Compression Methods” International Organization of Scientific Research-Journal of Computer Engineering (IOSCR-JCE),e-ISSN:2278-0061,p-ISSN:2278-8727, Volume 16, Issue 4, Ver. V (Jul -Aug. 2014).

2. “A Novel Videos Compression Prototype for Large Scale Videos Using Content Mining Techniques”, International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Volume 1, Issue 4, Print ISSN: 2395-1990, Online ISSN: 2394-4099, July 2015.

3. “A Novel approach for Compressing Surveillance System Videos”, International Journal of Advanced Engineering, Management and Science (IJAEMS), Volume 2, Issuse-2, ISSN: 2454-1311, Feb 2016.

4. “Implementation of New Proposed Video Compression Technique for Surveillance System and Clinical Medicine Videos” International Journal of Engineering Research and Management (IJERM) volume 3, Issuse-2, ISSN: 2349-2058, Feb 2016.

SYNOPSIS

The shortened version of the synopsis submitted to the University is given below

Title of the Thesis

Design of Efficient Compression Techniques for Large-Scale Surveillance System Videos

Brief Description on the State of the Art of the Research Topic

Compression algorithms have been developed for various applications at an international level. These algorithms have been tested and standardized by several organizations. The methods are alternatives to a certain extent, because they were developed with different aims and are tailored to specific applications. Overall, the range of available standardized video compression methods covers practically all applications. Some compression algorithms permit a degree of variation within the standard to meet technology constraints. The most common video compression methods use the statistical similarity of adjacent pixels. The image is converted to a frequency space block by block using the DCT (Discrete Cosine Transformation). In video coding, it is also possible to use the strong time correlation of consecutive frames – the objects shown are usually static or move in a more or less constant manner. If the difference between the images is calculated with motion estimation, it is only necessary to transfer the changes from frame to frame.

Transforming a video sequence into a bit-stream is called coding or encoding. This is usually performed by an encoder inside or close to the camera. Transforming a bit-stream back to an image is called decoding. A decoder is needed each time the bit-stream has to be displayed. A device able to perform both functions is called a codec (coder/decoder). Compression is a reversible conversion (encoding) of data that contains fewer bits. This allows a more efficient storage and transmission of the data. The inverse process is called decompression (decoding).

Software and hardware that can encode and decode are called decoders. The performance of a video codec is always a trade-off among the three variables:

(i) Quality, (ii) Bit Rate, and (iii) Computational Cost.

The main function of video compression technologies is to reduce and remove redundant data (i.e. no motion and no change in scenery) in video so it can be effectively stored or sent over a network. Modern efficient compression techniques can achieve a significant reduction in file size without sacrificing video quality. Most CCTV compression algorithms used in CCTV are lossy compressions, because such algorithms offer higher compression ratio (the ratio of the resulting video file size compared with the original file size). Four of the most common type of compressions widely used in CCTV are: (i) Motion JPEG, (ii) MPEG-4, (iii) H.264, and (iv) JPEG2000

Definition of the Problem:

The high bit rates that result from the various types of digital video make their transmission through their intended channels very difficult. Even entertainment video with modest frame rates and dimensions would require bandwidth and storage space far in excess of that available from CD-ROM. Thus delivering consumer quality video on compact disc would be impossible. This is analogous to an envelope being too large to fit into a letterbox. Similarly the data transfer rate required by a video telephony system is far greater than the bandwidth available over the plain old telephone system (POTS). Even if high bandwidth technology (e.g. fibre-optic cable) was in place, the per-byte-cost of transmission would have to be very low before it would be feasible to use it for the staggering amounts of data required by HDTV. Finally, even if the storage and transportation problems of digital video were overcome, the processing power needed to manage such volumes of data would make the receiver hardware very expensive. Although significant gains in storage, transmission, and processor technology have been achieved in recent years, it is primarily the reduction of the

amount of data that needs to be stored, transmitted, and processed that has made widespread use of digital video a possibility. This reduction of bandwidth has been made possible by advances in compression technology. Advances in compression technologies aimed to minimize the storage space required for storing videos. Video compression technologies are about reducing and removing redundant video data so that a digital video file can be effectively sent over a network and stored on computer disks. With efficient compression techniques, a significant reduction in file size can be achieved with little or no adverse effect on the visual quality. The video quality, however, can be affected if the file size is further lowered by raising the compression level for a given compression technique.

Objective and Scope of Research Work

The objective of the research is stated as below.

Design of efficient compression techniques as a novel and enhancing the existing industry proven video compression techniques for compressing large-scale surveillance system videos that includes CCTV footages and medical clinical videos.

Methodology

Existing Compression Techniques for Large Scale Videos are studied and analyzed critically.

New Proposed techniques are created. The proposed algorithms are implemented using Java technologies and tested for the standard large scale videos.

Original Contributions

The following are the original contributions of this research.

(1) Contribution 1: Efficient proven compression techniques are designed for compressing large-scale surveillance systems and clinical medicine videos.

(2) Contribution 2: The algorithms of the existing proven video compression techniques in the industry are critically analyzed with their pros and cons.

(3) Contribution 3: The conducted research is aimed for development of compression solution for large-scale and extra large-scale videos. Special batching and task scheduling approached are introduced.

(4) Contribution 4: For Proof-of-Concept (PoC), the proposed algorithms are implemented using Java technologies and tested using real-time surveillance systems in educational and medical sector (large scale educational institution and hospital).

Publications

Four papers have been published in national/international journals as described in the 'List of Publications' section.

Conclusion

For security and surveillance, image compression is primarily used for storage and real-time transmission. As technology progresses, the market is demanding higher frame-rates as well as higher resolution video, primarily intended for transmission over LANs and relatively high speed WANs. JPEG and M-JPEG is suitable for the lower frame-rates, and wavelet is fine for high-bandwidth yet high-compression situations where the video needs to appear smooth but in fact much of the detail has been lost. MPEG-2 offers the best video money can buy but the MPEG-4 compression algorithm still offers the best video quality for the most common networks available today. After the interpretation of the implementation and analysis of the result of the proposed solution for compression surveillance videos, it is found that the proposed algorithm result in better compression ration compared to the existing video compression techniques. The compression ratio achieved is five times better than the current available compression techniques especially for CCTV video compression. As most of the surveillance cameras are expected to run 24/7, there'll be a huge amount of video data that needs to be recorded. The obvious question is how to handle the storage of the data. Uncompressed video of course gives the best possible quality. However, when it comes to

CCTV video, content rather than quality takes preference. Nobody wants to sacrifice a sizeable amount of disk space for the sake of visual quality. H.264is the latest and most widely used video recording standard; it is used not only in CCTV systems but also in all areas of digital recording. It provides you with better picture quality compared with older standards and it provides smaller file size compared with older compressing methods. In this research, the efficient video compression techniques for compressing surveillance videos are designed and the obtained results are critically analyzed for the improvisation of the design.