# Multimedia $2^{nd}$ Assignment

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***Abstract*— This paper contains information about limitations of Workstation Operating Systems, Multimedia File System and Information Representation System, MPEG Motion Video Compression Standard in detail and comparing its various variants, various applications areas of Multimedia technology and its detail for medical, entertainment, manufacturing, business and education areas brief description about intelligent Multimedia system and various lossy compression and lossless compression algorithms.**

## I. Introduction

Multimedia being a media and content form uses a combination of different content forms. The term is used in contrast to media which use only rudimentary computer display such as text-only, or traditional forms of printed or hand-produced material. Various aspects of Multimedia concern are discussed in this paper.

### A. Limitations of Workstation Operating Systems

A workstation is a nothing but a high-end microcomputer designed for various complicated applications. The current workstation market uses x86-64 microprocessors. Operating systems available for these platforms include following and limitations are discussed for same.

*1) Windows NT:* Windows Based
*2) Linux distributions:* Various Distribution of Linux
*3) Mac OS X:* Macintosh Based Workstation OS
*4) Solaris 10:* Solaris owned OS for workstation

### B. MPEG Compression Standards

Motion Picture Expert Group is group formed by ISO/IEC for making out the standards for motion video and audio compression and transmission. MPEG developed a large series of standards including from MPEG-1, MPEG-2, MPEG-3, MPEG-4, MPEG-A, MPEG-B, MPEG-C, MPEG-D, MPEG-E, MPEG-U, MPEG-V, MPEG-M and MPEG-7 intended for various purposes all of which are discussed in this paper.

### C. Mutltimedia File System

MMFS is intended to support continuous media intensive applications such as Personal Video Recorders, Video JukeBoxes and Video-on-Demand. It is designed to support the recording and playback of data streams at constant and variable rates. MMFS was designed with the following goals:

*1) Large Data Streams:* Provide PVR functionality allowing several data streams to be recorded simultaneously while also replaying a stream, which may be one of the streams being recorded. Provide the ability to fast-forward and rewind data streams.

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*2) Effective Use:* Make efficient use of disk storage, access times and bandwidth.

*3) Automation:* Automatic recovery of disk data structures on restart after a power failure or other interruption. Automatic formatting of a new disk or one that is irretrievably corrupt.

### D. Information Representation System

Information can often be better represented using audio/video/animation rather than using text, images and graphics alone. Information is distributed using computer and telecommunication networks. Information Representation System is one of crucial aspect in multimedia. There are various challenges one need to face while looking for a nearly perfect Information Representation System.

Information systems are used to represent the structure and behaviour of other systems (Weber 1997). They are intended to be the basis for coordinated action in some social system, for example in an organisation. The coordinated action is established by representation (conceptualisations or models) (FRISCO 1998). The representation is expressed as sentences in some defined language, and ranging from semi-formal languages such as entity relationship and the unified modeling language to the formal languages of mathematics and logic.

### E. Application Areas of Multimedia

Mutlimedia had already grasp its hold in various fields and enhancing it more in other left over fields also. Mutlimedia's use gets integrated when it is applied exactly at right place and at right time. Various fields in which Mutlimedia is applicable effectively are as below.

*1) Medical:* In diagonsis of various disease through various GUI

*2) Education:* Most effecient application. A common mutlimedia based education program EduSmart classes are running these days in various school and colleges.

*3) Manufacturing:* In CAD/CAM

*4) Business:* Includes various tools like Flash, Powerpoint etc.

### F. Intelligent Multimedia System

As multimedia computer systems evolve, they may become intelligent systems by utilizing expert system technology to assist users in selecting, retrieving, and manipulating multimedia information. These systems are recognised as Intelligent Multimedia System. Specialized intelligent systems, called "intelligent agents," will be developed that have limited, well-defined responsibilities, such as screening electronic mail.

Although intelligent agent systems may initially perform various generic level services for all kinds of users, but their real potential will be realized when they provide personalized services that are tailored to meet the user's specific needs.

### G. Lossy Compression Algorithms

Lossy Compression as the name depicts is Compression strategy for compressing various multimedia formats including still and moving images and audio also. Lossy compression is deployed where it is affordable to loss some data at the cost of better compression. Typically, a substantial amount of data can be discarded before the result is sufficiently degraded to be noticed by the user.

Lossy algorithms achieve better compression ratios by selectively getting rid of some of the information in the file. Such algorithms can be used for images or sound files but not for text or program data. The following algorithms are lossy and will be discussed in ahead sections.

*1) JPEG compression:* Joint Photographic Experts Group develop standard for Image compression using lossy compression mechanism.

*2) Fractal compression:* It is a lossy compression method for digital images, based on fractals. The method is best suited for textures and natural images, relying on the fact that parts of an image often resemble other parts of the same image

*3) Transform coding:* It is a type of data compression for "natural" data like audio signals or photographic images. The transformation is typically lossy, resulting in a lower quality copy of the original input.

*4) Vector quantization:* It is a classical quantization technique from signal processing which allows the modeling of probability density functions by the distribution of prototype vectors.

### H. Lossless Compression Algorithms

Lossless Compression is used where it is not affordable to have loss of even a minute information. The term lossless is in contrast to lossy data compression, which only allows an approximation of the original data to be reconstructed, in exchange for better compression rates. This thing can be applicabel in many cases like in ZIP files we need files to be compressed but never at the cost of information. The various algorithms discussed in this paper are.

*1) Arithmetic coding:* Arithmetic coding is a form of variable-length entropy encoding used in lossless data compression.

*2) Shannon Fano coding:* It is a technique for constructing a prefix code based on a set of symbols and their probabilities (estimated or measured).

*3) Huffman compression:* In this technique a particular code sequence is assigned to every number on basis of it's occurence in input data. More frequency will generate less code for that variable.

*4) LZW compression:* A particular LZW compression algorithm takes each input sequence of bits of a given length (for example, 12 bits) and creates an entry in a table (sometimes called a "dictionary" or "codebook") for that particular bit pattern, consisting of the pattern itself and a shorter code.

## II. Limitation of Workstation Operating Systems

Workstation Operating System are nothing but the operating systems that lies withing the range of Desktop O.S and Server O.S. They are capable of efficient run of workstation and mainframe computers. Various falls in the category and each is dicussed with its limitations.

### A. Limitation of Windows NT

Windows put a lot of effort in releasing this efficient version for network computing and to satisfy a workstation need but it lag various features and these were.

- Windows NT requires more system resource.
- Windows NT does not have a good reputation in term of server stability.
- Costs of applications usually higher than that of Unix.
- Window caused monoply leading to one sided development only.

### B. Limitation of Linux Distributions

Linux though being a highly efficient and appraised open source products but it also had not got any relief from not coming in this limitation category. Various Limitations are.

- Many variations of Linux makes it harder to choose the best one.
- Its interface is not that user friendly.
- Expertise needed to run.
- Hardware incompatibilty a lot of times.

### C. Limitation of Solaris10

Solaris is a Unix operating system originally developed by Sun Microsystems. It superseded their earlier SunOS in 1993. Oracle Solaris, as it is now known, has been owned by Oracle Corporation since Oracle's acquisition of Sun in January 2010. Although it is highly popular in workstation Operating system yet has various limitation as.

- It is not recommended to run Solaris on other architectures.
- Solaris does have GUI support - Common Desktop Environment, OpenWindows etc.
- Expertise needed to run.
- With other cheaper alternatvies such as Linux available, it proves to be costlier to acquire a license of Solaris.

## III. MPEG Motion Video Compression Standard

The MPEG stands for Motion Picture Experts Group and this community developed a series of standard for compression of audio and video data and consists of encoders and decoders to encode and decode the digital media. The encoder needs to be algorithmic or adaptive whereas the decoder is 'dumb' and carries out fixed actions. This is

considered advantageous in applications such as broadcasting where the number of expensive complex encoders is small but the number of simple inexpensive decoders is large. The MPEG's (ISO's) approach to standardization is novel, because it is not the encoder that is standardized, but the way a decoder interprets the bitstream. A decoder that can successfully interpret the bitstream is said to be compliant.

### A. Standards

The MPEG standards consist of different parts. Each and every part is designed for covering certain aspect of the complete specification. The standards also specify profiles and levels. Profiles are intended to define a set of tools that are available, and Levels define the range of appropriate values for the properties associated with them. MPEG has standardized the following compression formats and ancillary standards.

*1) MPEG-1 (1993):* Capable of codeing of videos and audios up to about 1.5 Mb/s (ISO/IEC 11172). This was the first MPEG compression standard for audio and video and is used on Video CD, SVCD and can be used for low-quality video on DVD Video.

*2) MPEG-2 (1995):* Provides Generic coding of moving pictures and associated audio information (ISO/IEC 13818). Transport, video and audio standards for broadcast-quality television. MPEG-2 standard was considerably broader in scope and of wider appeal supporting interlacing and high definition.

*3) MPEG-3:* MPEG-3 dealt with standardizing scalable and is capable of multi-resolution compression and was focused for HDTV compression but was found to be redundant (as of large features of MPEG-2) and was merged with MPEG-2, as a result there is no MPEG-3 standard.

*4) MPEG-4 (1998):* Coding of audio-visual objects (ISO/IEC 14496). MPEG-4 uses further coding tools with additional complexity to achieve higher compression factors than MPEG-2. In addition to more efficient coding of video, MPEG-4 moves closer to computer graphics applications

In addition, the various above specified standards, while not sequential advances to the video encoding standard as with MPEG-1 through MPEG-4, are referred to by similar notation:

*5) MPEG-7 (2002):* Multimedia content description interface. (ISO/IEC 15938)

*6) MPEG-21 (2001):* Multimedia framework (ISO/IEC 21000) MPEG describes this standard as a multimedia framework and provides for intellectual property management and protection.

Moreover, more recently than other standards above, MPEG has started following international standards. Each of the standards holds multiple MPEG technologies for a way of application.(For example, MPEG-A includes a number of technologies on multimedia application format.)

*7) MPEG-A (2007):* Multimedia application format (ISO/IEC 23000).

*8) MPEG-B (2006):* MPEG systems technologies (ISO/IEC 23001).

*9) MPEG-C (2006):* MPEG video technologies (ISO/IEC 23002).

*10) MPEG-D (2007):* MPEG audio technologies (ISO/IEC 23003).

*11) MPEG-E (2007):* Multimedia Middleware (ISO/IEC 23004).

*12) MPEG-V (2011):* Media context and control (ISO/IEC 23005).

*13) MPEG-M (2010):* MPEG eXtensible Middleware (MXM) (ISO/IEC 23006).

*14) MPEG-U (2010):* Rich media user interfaces (ISO/IEC 23007).

Various MPEG standards are represented in tabular form below.

TABLE I
MPEG GROUPS OF STANDARDS [2]

| Acronym for Standard | ISO/IEC Standard | Description | First Public Release |
|---|---|---|---|
| MPEG-1 | ISO/IEC 11172 | Coding limited to 1.5 Mbit/s | 1993 |
| MPEG-2 | ISO/IEC 13818 | Generic coding of digital media | 1995 |
| MPEG-3 | | Incorporated in MPEG-2 | |
| MPEG-4 | ISO/IEC 14496 | Coding of audio and visual objects | 1999 |
| MPEG-21 | ISO/IEC 21000 | Multimedia framework | 2001 |
| MPEG-7 | ISO/IEC 15938 | Multimedia content description interface | 2002 |
| MPEG-A | ISO/IEC 23000 | Multimedia application format | 2007 |
| MPEG-B | ISO/IEC 23001 | MPEG systems technologies | 2006 |
| MPEG-C | ISO/IEC 23002 | MPEG video technologies | 2006 |
| MPEG-D | ISO/IEC 23003 | MPEG audio technologies | 2007 |
| MPEG-E | ISO/IEC 23004 | Multimedia Middleware format | 2007 |
| MPEG-V | ISO/IEC 23005 | Media context and control | 2011 |
| MPEG-M | ISO/IEC 23006 | MPEG extensible middleware | 2010 |
| MPEG-U | ISO/IEC 23007 | Rich media user interfaces | 2010 |

## IV. MULTIMEDIA FILE SYSTEM

Multimedia Applications and Systems are getting more and more involved in our everyday lives. Their main purpose is to deal with various media types like pictures, video data, audio data and text. Moreover along with the sucessful transmission of the media focus is also on the proper storage of media on the source and destination sides. For this purpose on need a successfull file system.

### A. Need of Multimedia File System

Played Data has to arrive in real time (or at least until a certain strict deadline). A challenge for these systems is also the synchronization of pictures and the according sound.

Another difference to discrete data is the file size. Video and audio need much more storage space than text data and

the multimedia file system has to organize this data on disk in a way that efficiently uses the limited storage. So all these forced to create a multimedia file system

### B. File System Requirements

Various Requirement for File system to be efficient are as explained below.

- Storing/retrieving multimedia files.
- Maintain high throughput.
- Support RT and non RT requests.
- Guarantee a sustained level of service.

### C. Various File Systems

As technology advances and the user requirements increased so the file system gets advanced with the time. It resulted into various file system for storing, indexing and retrieval of the various media types in an efficient and effective way.

*1) Punched Cards:* The standard punched card, originally invented by Herman Hollerith, was able to solve the basic Purpose of text information storage was indeed a big achievement but it's flaws lead to further advancement in field of File system. Some retail applications are given below.

- Used as card sorter.
- Used as tabulating machine for accounting functions such as totaling price fields on cards in multiple categories.

*2) Program Punch Cards:* With the advent of computers, complex pre-formatted cards continued to be used for to hold data, but in addition, cards were printed with formats specific to the needs of programmers. Some of these were equal in complexity to the standard data processing cards.

These cards were printed in the early 1950's probably for use by programmers of the IBM 701, IBM's first general purpose computer.

*3) Window File System:* Possibility of WFS (Window File System) and LFS (Linux File System) was possible due to only the most remarkable invention of magnetic storage devices which is having the files systems with remarkable storage properties with the various parmaters like seek time, latency time in an improved manner.

WFS includes mainly FAT and NTFS file system for efficient storage and retreival of multimedia files. Main Goal of WFS were following.

- To provide better methods for the users to manage their data.
- It will also be possible to set relationships between different files.
- To provide a far richer data storage model than traditional file systems.

*4) Linux VFS (Virtual File System):* This abstraction from actual filesystem operations gave Linux the flexibility to support all kinds of filesystem implementations. Today there is a wide variety of supported physical filesystems (ext2, ext3, vfat, xfs,reiser, ..) as well as network (nfs, smbfs,..) and others (procfs,ramfs, devfs) integrated into the Linux kernel.

*5) Semantic File System:* This File system is futuristic one and is going to replace the old traditional file systems. Semantic file systems allow users to organize their files by content and provide methods to do that conveniently. This is surely needed, because beyond a certain scale limit, people cannot remember locations by explicit path names.

Semantic file systems provide access to files by queries. They support the creation of virtual directories, each pointing to files that satisfy a query.

## V. Information Representation System

Information systems is an applied discipline and its aim is to improve practice (Keen 1980). Information systems research must therefore be both relevant and rigorous (Keen 1991). It must be relevant in that the outcomes of the research should be usable and useful in practice, and accessible to practitioners. It must be rigorous in that it is soundly based in theory and undertaken in a systematic way using appropriate research methods.

This balance is desirable but difficult to achieve. Many understanding of representation in Information System had been built upon the Philosophical Postion and Semiotic Theory.

### A. Philosophical Position

A realist ontological position is adopted and we accept that the world consists of things with attributes that are related in a causal way (Burrell and Morgan 1979). More precisely, we adopt a critical realist position, in which we know the world only through our perceptions and that we recognize the fallibility of the knowledge we have about the world (Weber, p171). Definitions for data and information follow from the realist ontological position.

*1) Data:* Data is defined as a collection of symbols that are brought together because they are considered relevant to some purposeful activity (Mingers 1995).

*2) Information:* Information is carried by symbols and is an objective (although abstract) commodity that exists independently of any person who may interpret the symbols. The information carried by a symbol is causally implied by the occurrence of the symbol.

### B. Semiotic Theory

Semiotic theory concerns the use of symbols to convey knowledge. Stamper (1992) defines six levels for analysing symbols. These are as below.

- Physical
- Empirical
- Syntactic
- Semantic
- Pragmatic
- Social levels

The physical and empirical levels concern the physical media and use of the physical media for communication of symbols. They are not generally considered to be in the domain of information systems. The four semiotic levels that are of interest in representation in information systems are the syntactic, semantic, pragmatic, and social levels.

### C. Need of Information Representation System

- To transmit mutlimedia effectively.
- To represent still and moving media in an effective manner.
- For effective storage and retrieval of proper represented information.

## VI. Multimedia Application Areas

Multimedia can be used in various areas resulting into a lot of useful applications. Multimedia can be used in entertainment, corporate presentations, education, training, simulations, digital publications, museum exhibits and so much more. With the advent multimedia authoring applications like Flash, Shockwave and Director amongst a host of other equally enchanting applications, one's multimedia end product is only limited by one's imagination.

### A. Multimedia in Education

Multimedia combines several media and hence is extensively used in the field of education and training. Even in conventional method we use audio visual for imparting education, where charts, models etc. were used. Now a days the classroom need is not limited to that conventional method rather it needs audio and visual media. The software package named computer aided instruction is available that provides a friendly interactive method of learning.

### B. Multimedia in Training

There various systems and intelligent tutoring systems available to train the students in many areas starting from the mathematics of a primary sudden to a difficult surgical process for a medical student. The tutorials contains enough number of videos sequences clarify.

### C. Science and Technology

Multimedia had a wide application in the field of science and technology. Whether it is an industry or the case of sciences all are benefited by its use. The multi media application and beneficial for researchers as well as over the world. The multimedia system is capable of transferring audio, and clips in addition to the regular text.

### D. Multimedia in Business

The business application of multimedia includes, product demos, instant messaging. One the excellent applications is voice and live conferencing. A multimedia can make a audience come live. It is widely used in programs. Such a program can be used by a mechanic and peoples. There are a number of easy to use authoring programs and tools that can even let workers to create their own program. There are a number of applications available that slow to run more smoothly and effectively.

### E. Multimedia in Medical

Multimedia spanned its branches in each and every field whether we are talking for education, engineering and other fields. Also Medical field is not the exception. Multimedia also played a vital role in enhancing the various medical services. For medical, life sciences and healthcare applications, 3D animation has its own unique ability to visualise the invisible and is the ultimate media to show complicated scientific processes in a clear and accurate way which had become possible only due to Multimedia.

One another application is Mednet. This application is a distributed multimedia based project, which is being developed at University of Pittsburgh medical centre. At present this system is used at seven Hospitals and many diagnostic and research laboratories. Mednet provides the various following services:

- A real-time monitoring and multiparty consultation.
- Collaboration during brain surgery.

### F. Multimedia in Games

One of the most exciting applications of multimedia is games. Now a days the live internet pay to play gaming with multiple players has become popular. Generally most of the video games need joystick play.

## VII. Intelligent Multimedia System

As multimedia computer systems evolve, they may become intelligent systems by utilizing expert system technology to assist users in selecting, retrieving, and manipulating multimedia information. This paper has brief survey about various terms being used in intelligent multimedia system.

Intelligent systems will act as our assistants and play a variety of roles in this capacity. These systems are unlikely to become truly sentient in the foreseeable future; however, utilizing artificial intelligence techniques, they will exhibit behavior that mimics intelligence within limited realms of activity. Natural language interactions with these systems are likely to be possible within the narrow areas of their expertise, but unrestricted natural language dialogues are still beyond our technological capabilities. An intelligent system must help refine and create knowledge-it should have many of the qualities of coach, tutor, and colleague, encouraging the learner to question, conjecture, create, and experiment.

Specialized intelligent systems, called "intelligent agents," will be developed that have limited, well-defined responsibilities, such as screening electronic mail. Although intelligent agent systems may initially perform generic services for all kinds of users, their real potential will be realized when they provide personalized services that are tailored to meet the user's specific needs. In the context of multimedia computer systems, intelligent agents could perform several functions. They could:

- Monitor multimedia databases and capture relevant new information.
- Filter incoming multimedia messages.

- Assist the user in identifying and searching appropriate multimedia databases as well as downloading data from these databases.
- Help the user manage and access personal databases.
- Guide the user in analyzing retrieved information using statistical, textual, or other analysis tools.
- Help the user create new intellectual works from retrieved and original information.

## VIII. Lossy Compression Algorithms

Lossy Compression Algorithms are applied to have compression of audio, video and still images with some noticable information loss. Various Algorithms are discussed in this paper.

### A. JPEG Compression

In computing terms JPEG is most commonly used lossy compression technique for still images. Degree of compression can be adjusted. JPEG typically achieves 10:1 compression with little perceptible loss in image quality. JPEG compression is used in a number of image file formats. JPEG standard had been developedin various parts ranging from 1 to 5. Although a JPEG file can be encoded in various ways, most commonly it is done with JFIF encoding. The encoding process consists of several steps:

- The representation of the colors in the image is converted from RGB to YCBCR, consisting of one luma component (Y'), representing brightness, and two chroma components, (CB and CR), representing color.
- The resolution of the chroma data is reduced, usually by a factor of 2.
- The image is split into blocks of 8x8 pixels, and for each block, each of the Y, CB, and CR data undergoes a discrete cosine transform (DCT).
- The amplitudes of the frequency components are quantized.
- The resulting data for all 8x8 blocks is further compressed with a lossless algorithm, a variant of Huffman encoding.

### B. Fractal compression

Fractal compression is a lossy compression method for digital images, based on fractals. The method is best suited for textures and natural images, relying on the fact that parts of an image often resemble other parts of the same image.

*1) Encoding:* A challenging problem of ongoing research in fractal image representation is how to choose the f1,...,fN such that its fixed point approximates the input image, and how to do this efficiently. A simple approach for doing so is the following:

- Partition the image domain into blocks $R_i$ of size sxs.
- For each $R_i$, search the image to find a block $D_i$ of size 2sx2s that is very similar to $R_i$.
- Select the mapping functions such that $H(D_i) = R_i$ for each i.

In the second step, it is required to find a similar block so that the IFS can accurately represents the source, so a sufficient number of candidate blocks for $D_i$ need to be considered. On the other hand, a large search with many blocks may become costly. This bottleneck of searching for similar blocks makes fractal encoding much slower.

### C. Transform Coding

Transform coding is a type of data compression for "natural" data like audio signals or photographic images. The transformation is typically lossy and results into poor quality output. In transform encoding knowledge of application needs to be there so as to get ready for large loss of information.

The left over information then can be encoded via variety of methods and can be transmitted which after decoding will serve the purpose for which it was used but with degraded quality.

*1) Colour Television:* One of the most successful transform encoding system is typically not referred to as such the example being NTSC color television. After an extensive series of studies in the 1950s, Alda Bedford showed that the human eye has high resolution only for black and white, somewhat less for "mid-range" colors like yellows and greens, and much less for colors on the end of the spectrum, reds and blues.

Using this knowledge allowed RCA to develop a system in which they discarded most of the blue signal after it comes from the camera, keeping most of the green and only some of the red; this is chroma subsampling in the YIQ color space.

The result is a signal with considerably less content, one that would fit within existing 6 MHz black-and-white signals as a phase modulated differential signal. The average TV displays the equivalent of 350 pixels on a line, but the TV signal contains enough information for only about 50 pixels of blue and perhaps 150 of red. The PAL and SECAM systems use nearly identical or very similar methods to transmit colour. In any case both systems are subsampled.

## IX. Lossless Compression Algorithms

Lossy Compression Algorithms are applied to have compression of audio, video and still images with purpose to have a compressed output with no loss of information. This is applicable only when one can comprise for compression rates but not for information loss. Various Algortihms are explained below.

### A. Huffman Encoding

Huffman encoding is one of the popular encoding techniques for having a lossless compression. Huffman encoding produces a variable length code table for input string. It works on the idea of assigning a shorter code to that input character which is having more frquecny of occurrence in input than that of those which occur with least frequencies. An example of huffman encoding technique is dicussed in this paper. The two rarest symbols 'E' and 'D' are connected first, followed by 'C' and 'D'. The new parent nodes have the frequency 16 and 22 respectively and are brought together in the next step. The resulting node and the remaining symbol

TABLE II

SYMBOLS WITH FREQUENCIES

| Symbols | Frequencies |
|---|---|
| A | 24 |
| B | 12 |
| C | 10 |
| D | 8 |
| E | 8 |
| Total | 186 bit (3 bit/word) |

'A' are subordinated to the root node that is created in a final step. And this will result into table with encoded output.

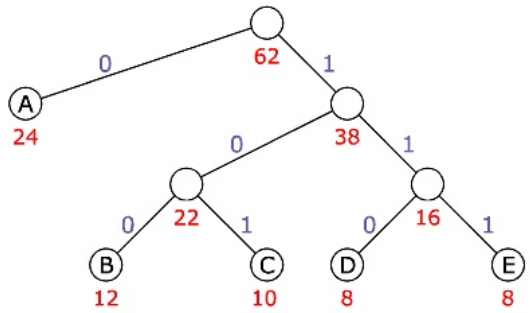


Fig. 1. Huffman Tree for Example

TABLE III

SYMBOLS WITH FREQUENCIES, CODE, CODE LENGTH AND TOTAL LENGTH

| Symbols | Frequencies | Code | Code Length | Total Length |
|---|---|---|---|---|
| A | 24 | 0 | 1 | 24 |
| B | 12 | 100 | 3 | 36 |
| C | 10 | 101 | 3 | 30 |
| D | 8 | 110 | 3 | 24 |
| E | 8 | 111 | 3 | 24 |
| Total | 186 bit (3 b/word) | | Total | 138 bit |

### B. Shannon Fano Encoding

At about 1960 Claude E. Shannon (MIT) and Robert M. Fano (Bell Laboratories) had developed a coding procedure to generate a binary code tree. The procedure evaluates the symbol's probability and assigns code words with a corresponding code length. Compared to other methods the Shannon-Fano coding is easy to implement. In practical operation Shannon-Fano coding is not of larger importance. This is especially caused by the lower code efficiency in comparison to Huffman coding.

*1) Algorithm Encoding:* It consists of various steps as listed below.

- Create table providing frequencies.
- Sort symbols according to frequency in descending order.
- Start with the entire table division.
- Seek pointer to the first and last symbol ot the segment.
- Divide the segment into two parts, both nearly equal in sum of frequencies.
- Add a binary 0 to the code words of the upper part and a 1 to the lower part.
- Search for the next segment containing more than two symbols and repeat division.
- Coding of the origination data according to to code words in the table.

### C. Arithmetic Coding

Arithmetic coding is the most efficient method to code symbols according to the probability of their occurrence. The average code length corresponds exactly to the possible minimum given by information theory. There are a few disadvantages of arithmetic coding. One is that the whole codeword must be received to start decoding the symbols, and if there is a corrupt bit in the codeword, the entire message could become corrupt. Another is that there is a limit to the precision of the number which can be encoded, thus limiting the number of symbols to encode within a codeword. There also exists many patents upon arithmetic coding, so the use of some of the algorithms also call upon royalty fees. Below is given the algorithm.

*1) Algorithm:*

- Start with an interval [0, 1), divided into subintervals of all possible symbols to appear within a message. Make the size of each subinterval proportional to the frequency at which it appears in the message.
- When encoding a symbol, "zoom" into the current interval, and divide it into subintervals like in step one with the new range.
- Repeat the process until the maximum precision of the machine is reached, or all symbols are encoded.
- Transmit some number within the latest interval to send the codeword.

To decode the message, a similar algorithm is followed, except that the final number is given, and the symbols are decoded sequentially from that.

## X. CONCLUSIONS

### A. Limitation of Worsktation Operating System

The very first topic discussed in this paper was Limitation of Workstation Operating System. Workstation are intended for large computation (less than servers and high than that of desktop computing). Various workstations including solaris10, Windows NT, Linux distribution had been discussed for their limitations. Concluding that particular scenario Linux distribution is far more better than Windows for serving Workstation requirements.

### B. Multimedia File System

As technology advancing and requirements are being uplifted necessity of effective file systems for storage, retrieval and indexing of multimedia is also increasing.

I discussed the various popular file systems available for multimedia content handling and their pros and cons. On the

analysis of which it can be concluded that ext file system and FAT are one of the most popular file system for effective storage, retrieval and indexing.

### C. Information Representation System

In this paper two differnt perspective view of Representation of Information Systems had been discussed namely viz. Philosophical approach and Semiotic Theory. Both view points were discussed. Also Beyond that Necessity of Information Representation System had also been discussed.

### D. Multimedia Application Areas

Multimedia is having its applications in almost every field now a days ranging from Medical Science, 3-D Technology, Mobing and still pictures, Education and Training etc. All of which were already discussed with the various examples.

### E. MPEG Compression Standard

Motion Picture Experts Group standards include variety of standards namely MPEG-1, MPEG-2, MPEG-3, MPEG-A, MPEG-B and many more intended for compression of various different type of media. These all already been discussed with their release dat and ISO/IEC standards and also with description that depicts the purpose of standard.

### F. Intelligent Multimedia System

Intelligent Multimedia System is a futuristic approach for having a multimedia system with collabration of NLP and ther artifical intelligence techniques. It will help in monitoring of database, finding relevant information, will help user accessing personal database in effective manner and many more.

### G. Lossy Compression Algorithms

Lossy Compressiong is used where information loss is not a botheration. Here the main concern is on large compression rates. Various effective compression techniques like JPEG, Fractal Compression and Transform Coding were discussed in this paper. JPEG compression is of larger interest and is widely used for still images.

### H. Lossless Compression Algorithm

Lossless Compression algorithms are applied where information loss is not bearable at all. Various Lossless compression techniques like Shannon-Fano Coding, Huffman-Coding and Arithmetic Coding were discussed in this paper. Arithmetic coding is one of the best Lossless Compression technique to be used.

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