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# Compression of Virtual Learning Images Based on Lossy and Lossless in Cloud Environment

**Sivakumar, R. D.[1] and Ruba Soundar K.[2]**
Ph.D. Research Scholar of Computer Science, Research and Development Centre, Bharathiar University, Coimbatore[1]
Associate Professor, Department of CSE, Mepco Schlenk Engineering College, Sivakasi, India[2]

**Abstract:** *This paper provides a comprehensive introduction to digital image, image compression and overview of E-learning. It presents the basic concepts and features of image compression techniques with different measuring qualities of image in the cloud environment for better storage space.*

**Keywords:** E-Learning, Cloud, Digital images, Lossy and Lossless Compressions

## I. INTRODUCTION

Digital images are constructed of picture elements called pixels. Typically, pixels are arranged in an array that is ordered is rectangular. The length of a picture is dependent upon the measurements of the pixel array. The image width will be the true number of columns, along with the image height may be the number of rows in to the array. Image dimensions are not to be confused because of the measurements of the world this is certainly genuine of an image. Image size specifically describes the actual quantity of pixels inside an image that is digital. The entire world that is real of an electronic digital image calls for starters additional factor called resolution. Resolution could be the scale that is spatial of image pixels. For instance, a graphic of 3300x2550 pixels insurance firms a quality of 300 pixels per inches (ppi) might have been a globe that is real measurements of 11" x 8.5". To clarify resolution terms, ppi is pixels per dpi and inches is dots per inch. Ppi relates to pixel arrays, while dpi identifies printer resolution. In reality both these quality terms are used interchangeably. Numerous image modifying applications default the resolution to 72 ppi. This might be real for saving JPG pictures in Image too.

### 1.1 Advantages of Digital Image

- The processing of images is faster and more cost-effective. One needs a shorter time for processing, along with less film and other photographing equipment.
- It is much more ecological to process images. No processing or fixing chemicals are needed to take and process digital images. However, printing inks are crucial when printing digital images.
- When shooting an electronic image, it can immediately see if the image is good or perhaps not.
- Copying an electronic digital image is easy, and also the quality of the image stays good unless it is compressed. As an example, saving an image as jpg format compresses the image. By resaving the image as jpg format, the compressed image will likely to be recompressed, and also the quality for the image will get worse with every saving.
- Fixing and retouching of images is now easier.

### 1.2 Image Formats

**Raw**

- A standard bit map format between different programs and computer systems.
- Used as a format for cell phone logos, for instance.
- Supports most colour formats (RGB, CMYK, grayscale, etc.)

Four raw files are:

- CR2: This picture extension stands for Canon RAW 2, and became created by means of Canon for pics taken the usage of its own virtual cameras. They're in reality based totally on the TIFF record kind, making them inherently excessive in quality.

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- CRW: This photo extension changed into additionally created via Canon, previous the existence of the CR2.
- NEF: This picture extension stands for Nikon electric powered format, and is a RAW file type created by Nikon Cameras. these photograph documents absolutely allow for widespread enhancing without changing document types, provided the enhancing takes location using a Nikon tool or Nikon Photoshop plugin.
- PEF: This picture extension stands for Pentax electronic format, a raw photo document type created by way of Pentax virtual cameras.

**bmp**

- Bit map format
- A standard for bit map images developed by Microsoft and International Business Machine
- Only functions in International Business Machine compatible PC computers.
- Common in Windows systems.

**tiff -> printed matters**

- Tagged Image File Format has been developed together with the Aldus scanner technique, and is one of the eldest commonly known file formats.
- There are at least three versions of the Tif-format (4.2, 5.0 and 6.0).
- Can utilize the effective LZW compression.
- A common saving format for scanning, because Tif images usually open in programs supporting this format.
- Image can be saved in RGB or CMYK formats
- PCs and Macs use different bit formats

**eps -> printed matters**

- Encapsulated PostScript
- Both vector and pixel images can be saved in this file format
- The file consists of a printing and a screen module.
- File sizes can be large.

**jpeg -> web**

- .jpg or .jpeg
- Joint Photographic Expert Group.
- An image compressing file format which suits well for photographs on the web.
- The way of compressing does not limit the number of colours, i.e. millions of colours are available.
- An image can be compressed as much as to 1/100 of the original.
- Browsers support this format without plug-in.

## II. E-LEARNING

As a rule, e-learning alludes to the electronic type of a formalized learning framework utilizing electronic assets. It offers an elective answer for customary instruction to fix up with the adjustments in the learning climate over the long haul. All in all, e-learning gives an advantageous component to the conveyance of learning materials to a wide scope of clients at an advantageous time and area. It gives an essential chance to expand the nature of instruction via administrations to encourage strategy exchange, limit building and information sharing. To complete these administrations, use of innovation is getting compulsory. Hence an interest to join Information's and Communications Technology (ICT) gets fundamental. Appropriation of ICT in e-learning assists with utilizing, circulate information, data among the learning local area. For this reason, particular e-learning strategies, for example, advanced coordinated effort; virtual meeting rooms, online learning, and PC based learning have created. These strategies for the most part empower instruction through the web and organization, which help move of abilities and acquiring materials.

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Obviously, its accentuation on a reasonable learning the executive's framework that implements foundation, for example, content conveyance capacities, online exercises, following student headway, evaluating learning results, and accomplishment.

### 2.1 Types of e-Learning

E-learning falls into the following four categories.

- **Asynchronous Learning** can be considered as conventional kind of learning. It includes self-guided learning, Internet-based, CD-based, or network-based, Intranet-based or. Understudies can get in contact with the educator through messages, online conversation gatherings and online release sheets. For study materials, joins are given instead of the educator.
- **Synchronous Learning** empowers gatherings of understudies to take an interest in a learning action together simultaneously, from any spot. Ongoing coordinated internet adapting regularly includes online visits and videoconferencing, as these devices permit preparing members and educators to ask and answer inquiries immediately while having the option to speak with different members.
- **Adaptive E-Learning** is a new and innovative type of e-learning, which makes it possible to adapt and restructure learning materials for each individual learner. Taking a number of parameters such as student performance, goals, abilities, skills, and characteristics into consideration, adaptive e-learning tools allow education to become more individualized and student-centered than ever before.
- **Linear E-Learning** mentioning to human-PC collaboration, straight correspondence implies that data passes from sender to recipient, no matter what. On account of e-learning, this turns into an extremely restricting element, as it doesn't permit two-route correspondence among instructors and understudies. This kind of e-learning has its place in training, in spite of the fact that it's getting less applicable with time. Sending preparing materials to understudies through TV and radio projects are exemplary instances of straight e-learning.

### 2.2 Role of images in E-Learning

E-Learning getting to know facilitates college students to create and communicate new thoughts. It get the hazard to uplift of competencies and benefit knowledge aside from school and higher education. One of the top importance of e-learning is that it allows students and instructors develop superior talents.

A getting to know control machine – additionally called an e-learning platform - is a cloud-primarily based software program package that allows platform to supply studying content and resources to their employees. An e-mastering platform is often internet-and cloud-based totally to facilitate 24/7 get admission to e-getting to know guides and applicable training. The merits are

- It promotes energetic and unbiased studying;
- Efficient manner of turning in guides because the assets are to be had from everywhere and at any time
- Students can have interaction with their friends from all over the International via institution discussions and private chats
- The reading fabric may be accessed unlimited wide variety of instances.

Feelings and visible statistics are processed in the same part of the human brain. Visible stimuli and emotional reaction are connected in a simple way and these together generate what it call recollections. As a result, effective photos and visible metaphors create strong impressions and lasting reminiscences in newcomers.

As students are being constantly visually stimulated, the usage of imagery in the class environment may be very beneficial and powerful device. Images are included students study materials to tap into their inherent creative nature whilst promoting interest to detail, essential wondering, and resourcefulness.

The four core learning patterns within the VARK model encompass visible, auditory, studying and writing, and kinesthetic. E-learning is not just a change of technology. It is a part of a redefinition of ways to as a species transmit knowledge, abilities, and values to more youthful generations of students.

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## III. IMAGE COMPRESSION

Image compression algorithms must assume that there exists correlation between neighbouring pixel values, called spatial redundancy, and correlation between different colour planes (in colour images), called spectral redundancy. Video compression algorithms exploit the correlation between adjacent frames in a sequence of images (video), called temporal redundancy. The amount of redundancy in an image depends on the correlation existing among the pixels in the image, which in turn relies on the types of image. There are five types of image:

- A bi-level image, pixels in this image can have one of two values so that each pixel is represented by one bit.
- A grayscale image, a pixel in such an image can have one of the n values 0 through n-1, denoting one of 2n shades of gray.
- A continuous tone image (natural image), adjacent pixels are very close in this type image so that the degree of correlation presence among the pixels is high.
- A pixel in such an image is represented by either a single number (in case of a grayscale image) or by three components (in case of a color image).
- A discrete-tone image (graphical image), this is normally an artificial image. Adjacent pixels in a discrete-tone image often are either identical or vary significantly in value. Compression can be achieved by removing redundancy in input image file. Each type of image may have a feature of redundancy, but they may occur in different ways. Therefore, there is no compression method that is good for all images. In this thesis deals with methods to compress grayscale image because it is the basic image type, all other image types can be illustrated as a grayscale or a set of grayscale images. In principle, the image processing methods designed for grayscale images can be directly applied to color and video images by processing each color plane, or image frames separately.

The fundamental goal is to plan a pressure framework reasonable for handling, stockpiling and transmission, just as giving satisfactory computational intricacy appropriate to viable usage. The essential principle of pressure is to decrease the quantities of pieces expected to address a picture. In a PC a picture is addressed as a variety of numbers, numbers to be more explicit, which is known as a digital image. The picture exhibit is generally two dimensional (2D), On the off chance that it is high contrast and three dimensional (3D) in the event that it is shading picture. Advanced picture pressure calculations misuse the repetition in a picture with the goal that it tends to be addressed utilizing a more modest number of pieces while as yet keeping up worthy visual quality. Elements identified with the need for picture pressure include:

- The enormous stockpiling prerequisites for sight and sound information
- Low force gadgets
- Network transfer speeds presently accessible for transmission
- The impact of computational intricacy on common sense execution.

In the cluster each number addresses a power an incentive at a specific area in the picture and is called as an image component or pixel. Pixel esteems are generally sure numbers and can run range from 0 to 255. This implies that every pixel of a BW picture possesses 1byte in a register.

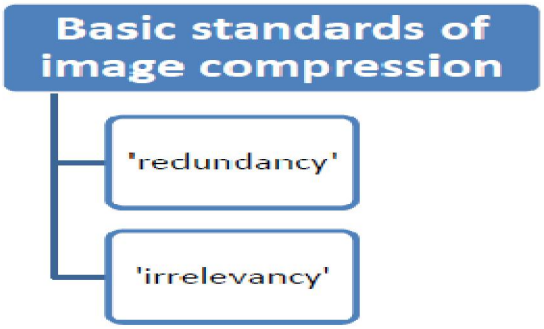


**Figure 1.1:** Principles of image compression.

The ratio of width to height of an image is called the aspect ratio. In Standard Definition Television (SDTV) the aspect ratio is 4:3, while it is 16:9 in a High-Definition Television (HDTV).

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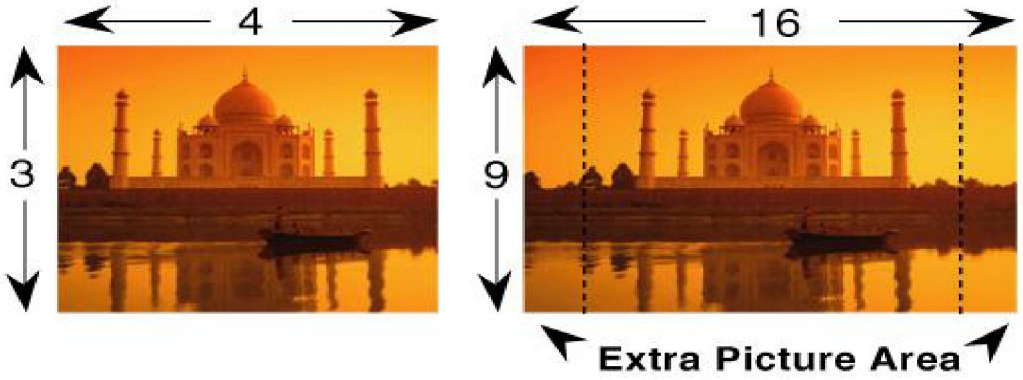


Figure 1.2: Aspect Ratio a) 4:3, b) 16:9

### 3.1 Types of Image Compression

Reducing the size of an input images for the web can help to gain precious milliseconds of load time. Compression algorithms are strategies that decrease the quantity of images used to address source data, along these lines diminishing the measure of room expected to store the source data or the measure of time important to send it for a given channel limit. The planning from source images into less objective images is alluded to as compression. The alteration from the target symbols 'back into the source symbols representing a close approximation form of the original information is called decompression. Compression system consists of two steps, sampling and quantization of a signal. The choice of compression algorithm involves several conflicting considerations. These include degree of compression required, and the speed of operation. Obviously if one is attempting to run programs direct from their compressed state, decompression speed is paramount. The other consideration is size of compressed file versus quality of decompressed image. Compression is also known as encoding process and decompression is known as decoding process. Digital data compression algorithms can be classified into two Categories: lossy and lossless compression.

#### 3.1.1 Lossy Compression

Lossy Compression strategy offers a compromise between pressure speed, compacted information size and quality misfortune. This strategy isn't invertible. When there is some capacity to allow misfortune, the pressure factor can be more prominent. Consequently, realistic pictures can be packed more than text documents or programs. Lossy pressure is utilized in computerized cameras, DVDs, Internet communication and in MP3 players. A couple of sorts of Lossy pressure techniques are Discrete Cosine Transform (DCT), Joint Picture Experts Group (JPEG), Vector Quantization, Fractal pressure and Wavelet change (Anil Jain 1995). Square graph of a lossy pressure technique is appeared in Figure 1.3. To further shrink the size of the data, it is possible to discard information while preserving most of the features important for human perception. The size of an image can be reduced to almost any size, with the consequence of increasing the impact on the visual fidelity of the reconstruction. This technique known as lossy compression can be understood as a trade-off between the compression ratio and the reconstruction quality of the image, usually referred to as the rate-distortion optimization problem in compression research.

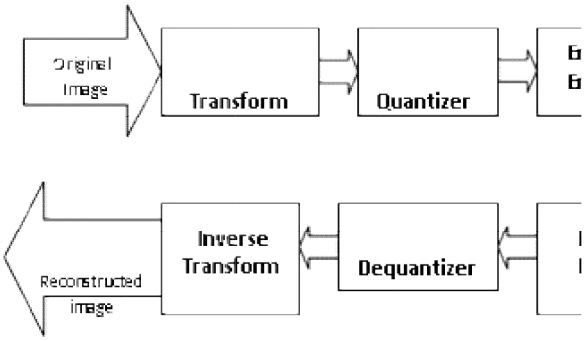


**Figure 1.3:** Lossy Image Compression System

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### 3.1.2 Lossless Compression

In lossless compression schemes, the reconstructed image, after compression, is numerically identical to the original image. This method is invertible. However lossless compression can only achieve a modest amount of compression. For this kind of compression to be effective, there must be some redundancy in the original data. This is used to optimize disk space on office computer such as spreadsheets, text file or program without the introduction of errors, but only up to a certain extent. In text and program files, it is crucial that compression be lossless because a single error can seriously damage the meaning of a text file, or cause a program not to run. A few types of lossless compression methods are Huffman coding and Run length coding.

### 3.2 Image Compression Models

It deals with reducing amount of data required to represent a digital image. The reduction process is the removal of redundant data. Compressed image is decompressed to reconstruct the original image. Data compression is reducing amount of data required to represent in a quality of information.

Two distinct structures**: Encoder**: An input image f(x,y) is fed into the encoder which creates the set of symbols from the input data. **Decoder:** The encoded information is fed into decoder where reconstructed output image f(x,y) is generated.

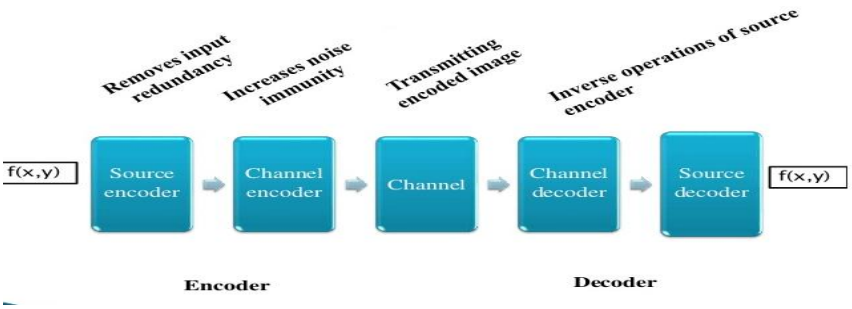


**Figure 1.4:** Image compression model.

**Mapper**

- Transforms input data format designed to reduce inter-pixel redundancies in the input image.
- Reversible operation. May or may not reduce the amount of data required to represent the image.

**Quantizer**

- Reduces the accuracy of the mappers output.
- Reduces the psycho visual redundancies of the input image.
- Not reversible operation.
- It must be omitted when error free (lossless) compression is desired.

**Symbol encoder**

- Creates a fixed-or variable length code to represent the quantizer's output.
- Maps the output in accordance with the code.
- In most cases variable length code is used. Reversible operation

The info picture is gone through a mapper. The mapper lessens the interpixel redundancies. The planning stage is a lossless method and henceforth is a reversible activity. The yield of a mapper is gone through a Quantizer block. The quantizer block diminishes the psych visual redundancies. The packs information by taking out some data and henceforth is an irreversible activity. The quantizer block utilizes JPEG pressure which implies a lossy pressure. Thus if there should be an occurrence of lossless pressure, the quantizer block is dispensed with. The last square of the source encoder is that of an image encoder. This square makes a variable length code to address the yield of the quantizer. The Huffman code is a regular illustration of the image encoder. The image encoder diminishes coding redundancies.

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### 3.3 Image Compression Methods

There are many techniques in both lossy and lossless techniques.

The techniques used in lossy image compression are,

- Discrete Cosine Transform (DCT)
- Discrete Wavelet Transform (DWT)
- Block Truncation Coding (BTC)

The techniques used in lossless image compression are,

- Huffman Coding
- Run Length Encoding (RLE)

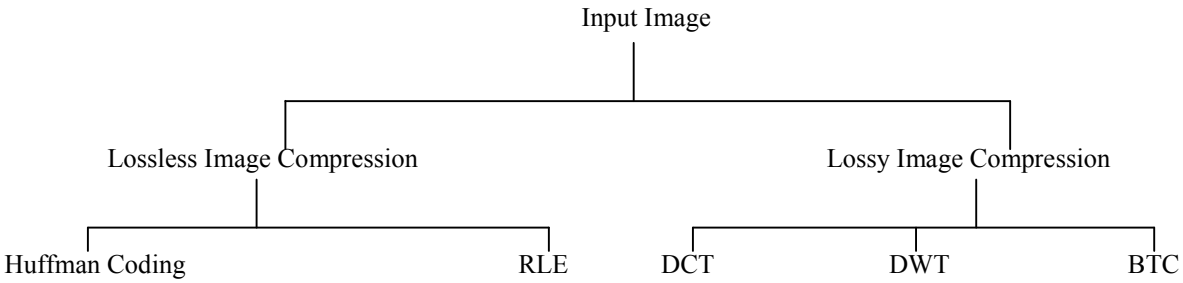


**Figure 1.5:** Compression Process

#### 3.3.1 Discrete Cosine Transform (DCT)

The fundamental goal of the picture pressure frameworks dependent on change techniques is to store information effectively and furthermore to give a decent tradeoff between the pressure rates and the sign to clamor proportions. DCT gives better outcomes regarding mean square blunder and pressure proportion esteems contrasted with some other procedure for dark scale clinical images. DCT is in the base of JPEG picture pressure. DCT is additionally quick contrasted with others and is likewise best for pictures with smooth edges. It changes a sign from its spatial area to recurrence space. The pictures after reproduction are in-versely relative to the estimations of quantization. It packs the main data into few co-efficients. A dark scale clinical picture is taken and compacted utilizing DCT and reverse DCT is utilized for remaking back. This cycle is done twice. This interaction of pressure is done twice in order to lessen the spatial goal of the picture in the initial step and after this the picture is partitioned into blocks and compacted again in the second step. So the initial step is finished utilizing MATLAB equation, Furthermore, the besides, the picture is part into squares of 8 by 8 where each square goes through 2DCT. The encoding and disentangling measure follows for full pressure measure utilizing IDCT to help 8 by 8 pixel for every accuracy. In this pressure all the co-efficient from the upper left corner in the grid are thought of so we have taken a number i.e., 20000 so the high information is packed well. In this way, after the overall pressure and decompression measure the yield may not be in the first reach (0, 255), so the yield is resized. Along these lines, accordingly the out packed picture is gotten which is contrasted and the first contribution for blunders.

#### 3.3.2 Discrete Wavelet Transform (DWT)

Perhaps the most generally utilized change procedures for picture pressure of drug ical pictures utilizing wavelets is Discrete Wavelet Transform (DWT). This DWT is exceptionally valuable for compacting signal and furthermore shows better outcomes for clinical dark scale pictures. While utilizing DWT the significant boundaries that are thought about are trying the picture, wavelet work, number of cycles and figuring intricacy. These wavelets changes are utilized to measure and improve signals in fields like clinical imaging where picture debasement isn't tolerated. A similar information picture which is taken before for DCT is presently compacted utilizing the DWT pressure strategy. The picture is changed over from tangle to dim and afterward it is partitioned into 4 pieces as (low, low), (low, high), (high, low), (high, high). The picture is gone through DWT pressure and afterward the picture is again resized to unique size. In this manner the picture is compacted using DWT.

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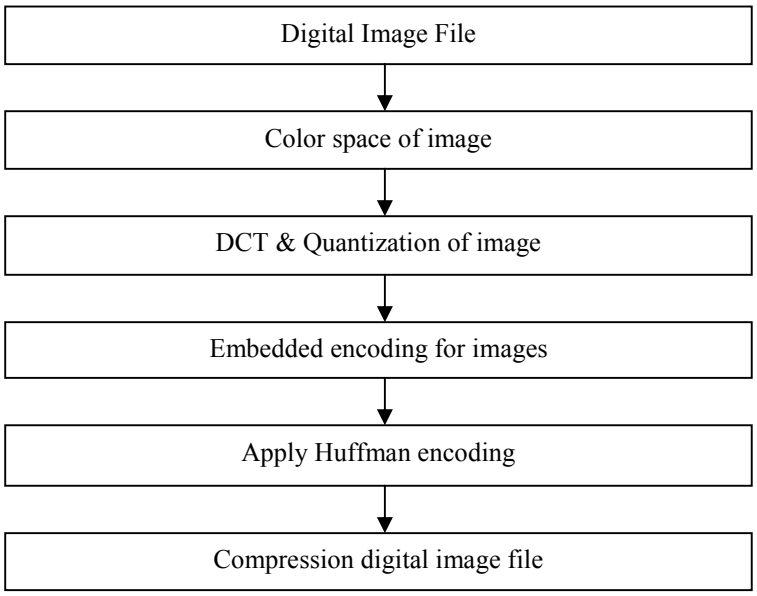


**Figure 1.6:** Wavelet Transformation compression technique

### 3.3.3 Block Truncation Coding

Block Truncation Coding (BTC) is a kind of lossy picture compression approach for greyscale images. It divides the original pictures into blocks and then makes use of a quantizer to lessen the wide variety of grey degrees in each block while preserving the equal mean and standard deviation.

It's far an early predecessor of the famous hardware DXTC method, despite the fact that BTC Compression technique became first tailored to coloration lengthy earlier than DXTC using a completely similar technique called Color Cell Compression. BTC has additionally been tailored to video compression.

BTC become first proposed by way of Professors Mitchell and Delp at Purdue university. Another variation of BTC is Absolute Moment Block Truncation Coding or AMBTC, in which instead of using the standard deviation the primary absolute second is preserved in conjunction with the mean. AMBTC is computationally less difficult than BTC and also generally effects in a lower Mean Squared Error (MSE). AMBTC changed into proposed by means of Maximo Lema and Robert Mitchell.

The use of sub-blocks of 4×4 pixels offers a compression ratio of 4:1 assuming eight-bit integer values are used during transmission or storage. Larger blocks allow extra compression but excellent also reduces with the growth in block length due to the nature of the set of rules.

### 3.3.4 Huffman Algorithm

The overall thought in the Huffman encoding calculation is to allot the short code-words to those squares of contribution alongside the high prospects and the long code-words are assigned to those which are having the low probabilities.

The Huffman code measure is subject to the two perceptions referenced underneath:

- Regularly discovered images will have the more limited code-words as contrast with the image which discovered less oftentimes.
- Two images which discovered least oftentimes may have the equivalent length. The Huffman code is set up by joining together two least potential characters and that are rehashing in this cycle similarly as there is just the one character is remaining. A code-tree is consequently arranged and afterward a Huffman code is created from the labeling of code tree. It is the best prefix code that is produced from the arrangement of the probabilities and which has been utilized in the various uses of the pressure.

These created codes are of different length of code which is utilizing necessary number of the pieces. This concept brings about an abatement in normal length of the code and consequently the entire size of the packed information is

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decreased as contrast with the original one. The Huffman's calculation is the principal that gives the solution to the issue of developing the codes with less excess.

### 3.3.5 Run Length Encoding (RLE)

RLE is a shape of lossless data compression wherein runs of facts (sequences in which the same facts value occurs in lots of consecutive records factors) are stored as a single value information and remember, as opposed to as the original run, that is maximum efficient on data that carries many such runs, for instance, easy images such as icons, line drawings etc.,

RLE may also be used to consult an early portraits record format supported by using CompuServe for compressing black and white images, however become extensively supplanted with the aid of their later GIF.

RLE additionally refers to a little-used picture format in home Windows 3.x, with the extension rle, that is a run-duration encoded bitmap, used to compress the windows 3.x startup display screen. The following steps are solve the problems

- Select the head character from the source series.
- Join the selected specific to the destination series.
- Be calculated the change of ensuing incidents of the select character and add the recall to the destination string.
- Select the following character and reiteration phases b) c) and d) if the finale of the string is not reached.

## IV. IMAGE MEASUREMENTS

The 'compression ratio' (CR) and 'bit rate' (BR) are used to measure the amount of image compression, while the 'Root Mean Square Error' (RMSE) and the 'Peak Signal to Noise Ratio (PSNR)' are used to measure the resulting error of image compression. Contrast is a measure of image visual quality.

### 4.1 Compression Ratio

The compression ratio is defined as the ratio between the size of the original image and the compressed image. This ratio is an indication of amount of compression achieved by the compression algorithm for an image. In general, a high CR value indicates more compression and a low CR value indicates less compression.

CR =size of original image / size of compressed image

### 4.2 Bits Per Pixel (BPP)

The bits per pixel is defined as the number of bits used to represent a single pixel in an image. High bpp value indicates less compression and similarly low bpp indicates more compression.

bpp = size of compressed image / Number of pixels in the image

### 4.3 Mean Square Error (MSE)

The mean square error is defined as the mean of the square of the difference between the original image f(x, y) and the reconstructed image f'(x, y) and is calculated by,

$$\mathrm{MSE} = \frac{1}{\mathrm{MXN}} \sum_{X=1}^{M} \sum_{Y=1}^{N} f(x-y-f1(x-y)^2$$

### 4.4 Root Mean Square Error (RMSE)

The root mean square error measure is simply the square root of the MSE measure and is calculated by,

$$\sqrt{\mathrm{MSE}} = \frac{1}{\mathrm{MXN}} \sum_{X=1}^{M} \sum_{Y=1}^{N} f(x-y-f1(x-y)^2$$

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### 4.5.Peak Signal to Noise Ratio (PSNR)

The peak signal to noise ratio measures the visual quality of the reconstructed image. The signal is the original image, and the noise is the error caused during the compression process. A high PSNR indicates a high reconstruction quality. The PSNR, in decibels (dB) can be evaluated by,

$$PSNR = 10 \log_{10} ((MAX)^2/MSE))$$

### 4.6 Percent Rate of Distortion (PRD)

The percent rate of distortion defined measures the amount of distortion caused in the reconstructed image. A low PRD indicates effective reconstruction and is calculated by

$$PRD = \frac{\sqrt{\sum_{X=1}^{M} \sum_{Y=1}^{N} f(x-y-f1(x-y)^2}}{\sqrt{\sum_{X=1}^{M} \sum_{Y=1}^{N} (f(x-y)^2}} \qquad 1.8.6$$

### 4.7 Correlation Coefficient (CC)

The correlation coefficient defined measures the correlation existing between the original and reconstructed images. A maximum of 1 value for CC indicates efficient reconstruction and is calculated by,

$$CC = \frac{\sqrt{\sum_{X=1}^{M} \sum_{Y=1}^{N} f(x-y-f1(x-y)\cdot}}{\sqrt{\sum_{X=1}^{M} \sum_{Y=1}^{N} (f(x-y)^2} \sqrt{\sum_{X=1}^{M} \sum_{Y=1}^{N} (f1(x-y)^2}} \qquad 1.8.7$$

## V. CLOUD COMPUTING

Cloud computing is a general term for anything that involves delivering hosted services over the internet. These services are divided into three main categories: infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). A cloud can be private or public. A public cloud sells services to anyone on the internet. A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people, with certain access and permissions settings. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services. Cloud infrastructure involves the hardware and software components required for proper implementation of a cloud computing model. Cloud computing can also be thought of as utility computing, or on-demand computing. Cloud Computing includes

- **Google Docs, Microsoft Office 365:** Users can access Google Docs and Microsoft Office 365 through the internet. Users can be more productive because they can access work presentations and spreadsheets stored in the cloud at anytime from anywhere on any device.
- **Email, Calendar, Skype, WhatsApp:** Emails, calendars, Skype and WhatsApp take advantage of the cloud's ability to provide users with access to data remotely so they can access their personal data on any device, whenever and wherever they want.
- **Zoom:** Zoom is a cloud-based software platform for video and audio conferencing that records meetings and saves them to the cloud, enabling users to access them anywhere and at any time.
- **AWS Lambda:** Lambda allows developers to run code for applications or back-end services without having to provision or manage servers. The pay-as-you-go model constantly scales with an organization to accommodate real-time changes in data usage and data storage.

### 5.1 Cloud Computing Characteristics

Self-service provisioning: End users can spin up compute resources for almost any type of workload on demand. An end user can provision computing capabilities, such as server time and network storage, eliminating the traditional need for IT administrators to provision and manage compute resources.

Elasticity: Companies can freely scale up as computing needs increase, and scale down again as demands decrease. This eliminates the need for massive investments in local infrastructure, which may or may not remain active.

Pay per use: Compute resources are measured at a granular level, enabling users to pay only for the resources and workloads they use.

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Workload resilience: Cloud service providers often implement redundant resources to ensure resilient storage and to keep users' important workloads running often across multiple global regions.
Migration flexibility: Organizations can move certain workloads to or from the cloud or to different cloud platforms as desired or automatically for better cost savings, or to use new services as they emerge.
Broad network access: A user can access cloud data or upload data to the cloud from anywhere with an internet connection and using any device.
Multi-tenancy and resource pooling: Multi-tenancy lets numerous customers share the same physical infrastructures or the same applications, yet still retain privacy and security over their own data. With resource pooling, cloud providers service numerous customers from the same physical resources. The resource pools of the cloud providers should be very large and flexible enough so they can service the requirements of multiple customers.
Cloud computing is a network of servers connected the usage of the internet. Its fundamental feature is to share records, assets, and software. The net acts because the invisible cable that connects the whole lot. This includes all virtual servers everywhere in the globe.


**Figure 1.7:** Cloud Environment in Compression

### 5.2 Cloud Architecture of Image Compression

The information proprietor is the person who packs and encodes the report (text, picture and word record) that he needs to transfer on the cloud worker. After which he plays out the AES encryption to scramble the plain record, intermediary re-encryption and property based encryption to give interesting access design to every customer. At that point he arranges the information into various classifications by connecting diverse intermediary key produced utilizing the intermediary re-encryption technique. The information proprietor is the person who has the need of altering and furthermore erasing the substance put away on the cloud worker.

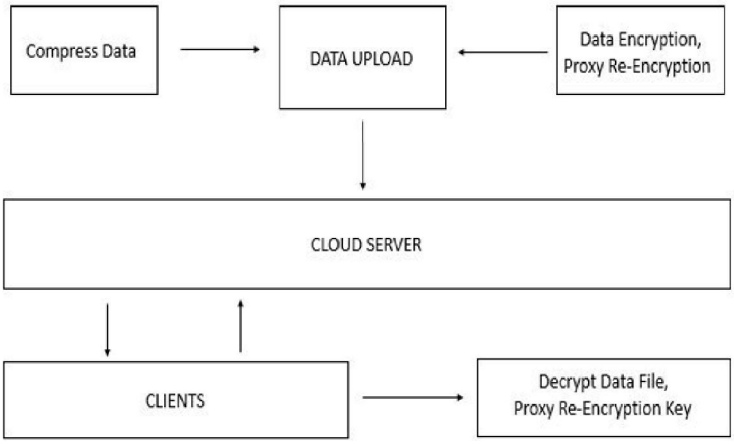


**Figure 1.8:** Cloud Architecture of Image Compression

At that point he plays out the trait based encryption to give novel access construction to every customer. After every one of these means the information proprietor transfers the packed and encoded document, re-encryption key and

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access structure on to the cloud worker. Just approved customer can sign in utilizing his private key. After, it gets an exceptional access structure that has been doled out by the information proprietor. Customers demand the cloud worker for the re-encryption key and records that he needs to download. At long last customer unscrambles the re-encryption key and afterward decodes the packed and encoded record utilizing this key.

Input: Text, Word or Pdf document, video, audio and images. Output: Text, Word or Pdf document, video, audio and images.

Step 1: Initially the cloud server is started.
Step 2: Then the data owner login using the data upload interface.
Step 3: Data owner compresses the data.
Step 4: The encrypts the data.
Step 5: Performs PRE (Proxy Re-Encryption), using client's public key.
Step 6: Further he performs KP-ABE (Key Policy Attribute Based Encryption).
Step 7: Generates different categories using the proxy key generated during the PRE, Upload the data.
Step 8: Authorized clients who are authenticated by the data owner login using the requested private key.
Step 9: Download required files.

The data owner is upload the data or document (text, image and word document) to the cloud server and client will access the data by using is personal user name and the passwords.

Browse the compressed and encrypted file to upload and click upload

### 5.3 Cloud Storage

Cloud storage is a cloud computing version that stores data at cyber through a cloud computing provider who manages and operates statistics storage as a provider. It's delivered on call for with just-in-time capacity and charges, and eliminates buying and handling your very own statistics storage infrastructure.

### 5.4 Clustering

Clustering is the process of grouping similar objects into groups. This is extensively used in image compression. The clustering center of each partial area is acting as a representative of the corresponding type. It is the basis of pattern recognition.

The K-Means Clustering algorithm is one of the simplest unsupervised learning algorithms that solve the well-known clustering problem. The K-means algorithm is a extensively used VQ technique known for its efficiency and speed. This is an iterative clustering algorithm that generates a codebook which is a set of cluster centroids from the training data using an appropriate distance function suitable for the given application.

### K-Means Clustering Algorithm

The various steps of the standard K-Means clustering algorithm is as follows:

1. The number of clusters is first initialized and accordingly the initial cluster centers are randomly selected.
2. A new partition is then generated by assigning each data to the cluster that has the closest centroid.
3. When all objects have been assigned, the positions of the K centroids are recalculated.
4. Steps 2 and 3 are repeated until the centroids no longer move any cluster

### 5.5 Block Truncation Coding

Block truncation coding is well known technique for image compression, It divides the original image into small sub blocks of size n x n pixels and after the division of image, it reduces the number of gray levels within each block, reduction of gray level is performed by a quantizer. Threshold reconstruction values are calculated for each block and a bitmap of the block is obtained for that values. It replaces all the pixels whose values are greater than or equal (less than) to the threshold by a 1(0), in this bit map. Then for each segment (group of 1s and 0s) of the bitmap, reconstruction value is calculated. To improve the nature of the BTC pictures, a few techniques have been proposed, like Vector Quantization (VQ) which improves the pressure proportion. Vector quantization is the way toward quantizing the estimations of the pixels of the squares of pictures. This is likewise called as square quantization. The

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pixel esteems are encoded from a multidimensional vector space (picture pixels) into a limited arrangement of qualities from a discrete subspace of lower measurement (block pixels).

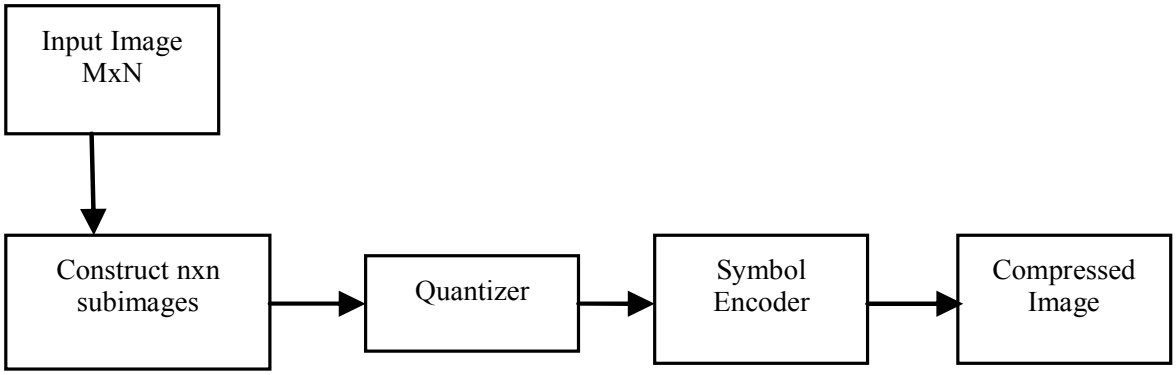


**Figure 1.9:** BTC Image Compression

BTC has been considered as a highly efficient lossy type image compression technique for digital gray-level images. BTC has many advantages such as simple, efficient and low computation complexity. BTC preserves the standard mean and standard deviation of each image block. The BTC based schemes are suitable for image retrieval requiring fast execution. BTC produces two quantizers (high and low quantizers) and a bitmap image at the end of the encoding process is used for generating feature vectors. The main idea of the BTC method is to maintain certain statistical moments of each block by having two quantization levels and one-bit-plane per block. To improve the performance further, Lema and Mitchell introduced a new lossy compression method popularly known as AMBTC which stands for Absolute Moment Block Truncation Coding. Image compression practices give a solution for storing the details in very little space as you can by minimizing a visuals file in proportions to a degree that is acceptable of quality. An image that is electronic a representation of the two-dimensional image as being a finite set of digital values called image elements or pixels. These pixels are kept in computer memory as raster map or image, an array that is two-dimensional of integers. The CNNs are formed as interconnected layers composed of input, hidden, and production levels. The weight that is initial of all of the interconnections and inputs are typically initialized to random or zero. All of the CNNs operate in two phases. Various learning or training guidelines are utilized in order to classify the systems as supervised, unsupervised, or strengthened. During training, the weights of each layer within the system are modified for minimal mean error that is squared target and real production in case of supervised learning or even to optimize differences when considering the output classes in the event of unsupervised or competitive learning, which approximates the input pattern of this image. The aim that is main of scientific studies are how we can keep the images within the E-learning environment better simply by using image compression with Generative Adversarial Block truncation coding.

### 5.6 Deep Neural Networks

Handling the image database with minimal storage complexity, minimal computational complexity and optimal quality is a significant task. To obtain these solutions, many image processing techniques are evolved. In the domain, image compression and decompression are more needed at any cost for effectively handling the complex image databases. The most effective tool found for the task for image recognition is a deep neural network, specifically a Convolutional Neural Network (CNN). CNN is an architecture designed to efficiently process, correlate and understand the large amount of data in high-resolution images.

Now days, E-Learning resources are widely used around the internet based knowledge sharing environments. In the E-Learning environment, multiple types of data resources are managed. Particularly, organizing the images is more crucial task where multiple qualities of images are appeared inside the E-Learning network databases. This problem expects solutions from effective image compression techniques. CNN is a DL technique used to analyze images using effective ConvNet filtering techniques. In this proposed system, the BTC enabled image blocks and NEMSVM observations are given into DLCNN units. Let the image is given as 4*4 matrix, $C^M$ then the ConvNet filters of DLCNN are determined at the range of 2*2 matrix, $F^M$. Consequently, the DLCNN initiates the deeply constructed results gathered from NEMSVM and BTC blocks. The filters of DLCNN are implemented for series of DNN layers that contains image evaluation functions. In this deep CNN based analysis process, the given E-Learning images are

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strongly weighted using various image parameters such as pixel intensity, pixel quantity in a block, pixel distortions, average block noise ratio, overall image noise ratio, frequency variations and uncertain image components.

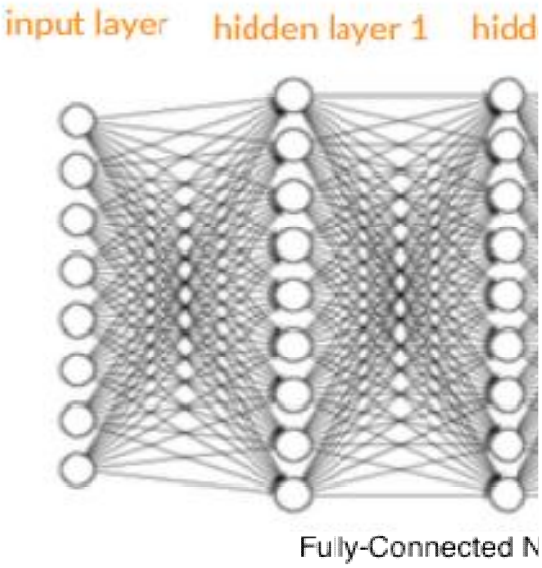


**Figure 1.10:** Neural network for Image Processing.

## VI. CONCLUSION

In this paper elaborated the image compression basics, image compression algorithms for efficient storage in Cloud environment. The issues in image compression data have to be analyzed at first so as to find out the solution and improve the quality level of compressed image. A review of image compression technique and different methodologies with respect to compression algorithms in Cloud environment discussed.

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