Video Compression Using Matlab

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Abstract

Video compression is the main topic of this research. HD quality videos with smaller sizes are required for video calls, conferences, and transmission. We can get better video compression by implementing the suggested strategy. A successful low-memory solution must be offered in order to implement the SPIHT algorithm. The sorting and refining stages are merged into a single scan run in this updated technique. In order to alter the original SPIHT algorithm, we introduce two new ideas: the number of mistake bits and the absolute zero tree. This study looks at the coding method for compressing medical videos. By successfully reducing spatial redundancy, the proposed method has the advantage of enhancing the visual quality of the video coding. To facilitate the efficient identification of the different complex geometries seen in movies, the bandelet transform also referred to as a non-separable transform is first studied. After describing the lifting operation in the bandelet transform, we decreased the artifactual influence caused by the quad-tree decomposition stage, improving the visual quality of the medical video series. Finally, the efficiency of the proposed technique is tested and evaluated on medical footage using a set of objective measurement parameters.

Keyword: Image Processing, SPIHT Algorithm, Python, Deep Learning, Prepossessing

INTRODUCTION

Videos are typically employed in multimedia applications as a series of sequential frames. A video file takes up a lot of memory in order to be stored and sent. Image compression aims to provide a special way to retrieve a file without sacrificing image quality. Video compression is the process of reducing the size of frames by removing unnecessary information.

According to the literature on compression techniques, lossy coding can produce extremely undesirable artifacts that significantly change the content of the data. In these circumstances, it is crucial to recognize a particular type of irreversible transformation. Several transformation techniques have been proposed for data compression in previous studies, such as the wavelet transform [1], curvelet transform [2], contourlet transform [3], wedgelet transform [4], ridgelet transform [5], and discrete cosine transform [6,]. All of these have shown how data can be decreased with minimal changes to orientation, resolution, etc. However, because to their limited directionality, the provided transforms are not applicable to many diagnosis applications. To overcome these limitations and achieve notable advancements in the field, high-dimensional signals are necessary. The theory of multi-scale geometric analysis (MGA) has developed a number of MGA transformations, chief among them the DBT (Discrete Bandelet Transform) [7, 8], which is ideal for capturing geometric regularity.

Because of this, numerous researchers have looked into and proven the usefulness of bandelet transforms for a variety of applications [9–11]. The bandelet transform is accurate and practical since the search operation is applied to the set of blocks generated during wavelet decomposition, not the function itself. The success of the bandelet is usually limited by the video's level of clarity. Expanding the bandelet transform for high-order geometry is the aim of this study, which reduces computational costs and improves video quality. Therefore, the bandelet transform will be guided by the selected complicated geometry. Although it uses a lifting approach and is done differently, it is consistent with the complex geometric patterns of video [12]. Because the lifting approach computes the high and low frequency sub-bands simultaneously and has an invertible lifting structure, it has the advantage of allowing transforms to be constructed without going through the Fourier domain. The bandelet transform calculation is improved by using the lifting structure. The sub-band coders efficiently code the resulting coefficients.

The Embedded Zerotree Wavelet (EZW) is the first sub-band coding technique introduced by Shapiro [13]. The EZW encoder is then enhanced by Said and Pearlman's work, which introduced the efficient partitioning set in the tree hierarchical encoder (SPIHT) [14]. In this study, motion estimating algorithms have been used to minimize temporal redundancy [15]. Evaluation measures such as PSNR, MSSIM, VIF, and others can be used to assess and quantify the quality of a recovered image. The paper's following sections are arranged as follows: The bandelet transform is covered in Section 2, the SPIHT approach is introduced in Section 5, the biorthogonal wavelet CDF9/7 is covered in Section 4, the lifting scheme notion is explained in Section 3, and the suggested algorithm is reviewed in Section 6 to provide a brief demonstration of its effectiveness.

RELATED WORK

An essential phase in the process of developing software is evaluating the literature. It is crucial to consider time factors, cost savings, and commercial enterprise robustness before expanding the device. Finding the operating systems and languages used to expand the device comes next, after those prerequisites are satisfied. When a programmer starts building a device, they need several kinds of outside assistance. Advanced programmers, books, and websites can all provide this assistance. We expand the suggested tool by taking into account the aforementioned issues prior to system creation.

Examining and assessing all requests for improvement is a major task for the mission development branch. The most crucial stage in the software program improvement approach for every difficulty is the literature evaluation. Time considerations, aid requirements, human resources, economics, and organizational skills should be identified and examined prior to developing equipment and related designs. Finding the software program specifications for your particular PC, the operating system needed for your assignment, and the software programs needed for the switch are the next steps after these variables have been considered and thoroughly investigated actions such as expanding equipment and related characteristics.

The "prioritize inspections" approach was established in 2012 to replace routine inspections with business surveillance. This approach categorized businesses into four groups according to health risks, and those that were deemed high risk were monitored more closely. Health centres in five provinces gathered data on each business and submitted it to the Centre of Environmental and Occupational Health

(CEOH) using a suggested form. All provinces saw an increase in high and medium danger inspections during this program [1].

The purpose of this essay is to examine the ways in which Iran's industrialization process impacts social capital. Design, technique, and strategy A system of simultaneous equations has been introduced to examine the impact of industrialization on social capital. The coefficients have been estimated using the three-stage least squares method and panel data from the 30 provinces in the country between 2001 and 2006. Findings: The findings indicate that Iran's level and makeup of social capital are significantly impacted by industrialization. A significant portion of this advantage has been offset by the worsening of the income disparity brought about by industrialization, even while it has raised the level of income through which bridging social capital has expanded [2].

Serious chemical accidents still occur in OECD member nations and around the world. The hydrogen fluoride leak in Gumi (Korea) in 2012, the ammonium nitrate explosion in West Texas (United States) in 2013, or more recently, the explosion of a chemical facility in Tarragona (Spain), the port of Beirut (Lebanon) in 2020, and the blast in Leverkusen (Germany) in 2021, are just a few examples of the numerous major accidents that have occurred in recent decades and resulted in fatalities, serious injuries, environmental damage, and enormous financial losses. Guidelines for the safe design and operation of hazardous facilities are provided in this third edition of the OECD Guiding Principles for Chemical Accident Prevention, Preparedness, and Response. It seeks to assist industry and government agencies in taking the necessary steps to both prevent chemical mishaps and lessen the effects of those that do happen. These guidelines are applicable to permanent facilities where hazardous materials are created, processed, handled, stored, utilized, or disposed of in amounts and forms that could increase the likelihood of a chemical disaster. The technical guidelines that enable the execution of the Council's 2023 Decision-Recommendation concerning Chemical Accident Prevention, Preparedness, and Response are based on these guiding principles [3].

The Areal Location of Hazardous Atmospheres (ALOHA) model was used in this scenario-based case study from 2015 to predict the emission of a toxic chemical from a chlorine warehouse in Shourabad, Ray, Iran. The most recent Iranian census, conducted in 2011, was used to determine the area's population [4].

Relative humidity, air temperature, and wind speed were among the atmospheric factors. Additionally, we provided information on the source of the contamination, including chemical condition, diameter, length, and volume. For every season, the simulation was run again. A geographic information system was used to map the threat zones that were simulated. Probat was used to determine the proportion of residents who died or were injured [5].

EXISTING SYSTEM

The study looks into a coding technique for compressing medical videos in an existing system. Higher visual quality video coding and effective spatial redundancy reduction are two benefits of the method proposed. In order to efficiently detect the various complicated geometries present in video, the bandelet transform—also referred to as a non-separable transform—is first examined. To improve the visual quality of the medical video sequence, we minimized the artifactual effect brought on by the quad-tree decomposition step after explaining the lifting operation in the bandelet transform. Lastly, a

set of objective measurement parameters is used to test and assess the effectiveness of the suggested strategy on medical footage.

Disadvantages

- Because it is proprietary, it is difficult to extend the functionality through other parties.
- The language is less expressive.

REQUIREMENT ANALYSIS

Evaluation of the Rationale and Feasibility of the Proposed System

Better compression and performance can be obtained by combining H.264 with modified SPIHT. The SPIHT is altered to get around the drawbacks of the standard SPIHT, which needed extra memory to store the three lists (LIS, LIP, and LSP). While the transform portion is changing during the following phase, the encoding block remains fixed.

PROPOSED SYSYTEM

The H. 264 video encoder carries out three important processes - prediction, transform, and encoding - to give a compressed H. 264 bit stream. The decoder then carries out complementary processes - decoding, inverse transform, and reconstruction - to produce the decoded video stream

Advantages

- The matrix is its fundamental data element.
- A simple number is seen as a one-row, one-column matrix.
- Vectorised processes.
- For interactivity, the graphical output is optimized.
- Toolboxes can significantly increase the capability of Matlab.
- The primary benefits of digital protocols are their high bandwidth and dynamic range, their ease of digital processing, and their resistance to noise, distortion, and interference.

SYSTEM ARCHITECHTURE

The requirements are defined and the order of a high degree of the device is established in relation to the description of the software's general characteristics. Many web pages are described and their relationships developed during the architectural design process. The main components of the software are broken down into conceptual records systems and processing modules, and the connections between the modules are explained. The modules listed below are defined by the suggested system.
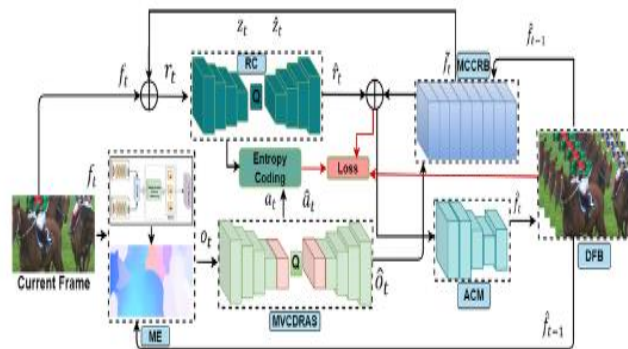
Fig 1. System Architecture

SYSTEM MODULES

1. Image acquisitionsystem.
2. Pre-processing.
3. Feature extraction.
4. Segmentation.
5. Classification.

Modules Descriptions

1. Image acquisitionsystem

The process of obtaining an image from a source is known as image acquisition. Hardware systems like cameras and databases can accomplish this, and some encoders and sensors are also used.

2. Pre-processing:

The primary goal of picture pre-processing is to improve data, such as images that emphasize certain aspects or lessen undesired distortions; in other words, we may say that the image is free of undesirable disturbances.

3. Feature extraction

An initial collection of raw data is separated and condensed into more manageable categories as part of the dimensional reduction process.

4. Segmentation

It is the process of turning a pixel from a picture into a labelled image. You can process the key parts of an image rather than the full image using this method.

5. Classification

The challenge of precisely recognizing what is in the picture. The model will go through that process when it has been trained to identify different classes. For instance, you could train a model to identify the three distinct animals in the picture.

SYSTEM METHODOLAGIES

We will learn about the quality assessment of fruits and vegetables in this section. Making use of machine learning and artificial intelligence. We'll also talk about our proposed procedure to find the recognize quality in products of the soil. In this paper, Convolutional Neural Network techniques were utilized.

Python:

Fig 2: Figure of Python

Python is a high stage interpreted, interactive and item-oriented script. Language Python is designed to be clean to study. English uses key phrases often where different languages use punctuation and has much less syntactic buildings than in other languages.

- **Python is interpreted —** Python is processed through an interpreter at runtime. There is no need to configure this system earlier than executing it. It is comparable with PERL and PHP.
- **Python is interactive -** you may sit in Python at the command line and write your programs directly with the interpreter.
- **Python is object-oriented -** Python helps an orientated fashion or programming method that encapsulates code in items.
- **Python is a language for beginners -** Python is an extraordinary language entry-level programmer and supports the improvement of a wide variety of packages from simple word processing to web browsers and video games.

Image Processing:

Fig 3: Figure of Image Processing

Image processing is the system of changing an image right into a virtual form and doing some operations on it to acquire a better photograph or to extract a few beneficial records from it. This is a form of code distribution where the centre is a picture, together with a picture or video, and the output image or functions can be related to that photo. Typically, the picture processing machine consists of processing photos in two dimensions through making use of classical strategies already established. Today its miles one of the quickest developing technologies with its applications in various commercial enterprise components. Image processing is likewise a primary vicinity of research in engineering and laptop technology.

Image processing basically includes the following three steps:

- Import an image using optical or digital images.
- Image analysis and processing, such as information compression and photo enhancement, in addition to identifying patterns that are not visible to the human eye, including satellite pix.
- Output is the closing step wherein the result can be a change of image or a document based on the analysis of the image.

RESULT & DISCUSSION

The suggested DCT and DWT technique produced a high compression ratio of 83.25 and PSNR value of 55.21 for the Xholophone.avi movie. In a similar vein, Rhino video obtained a PSNR of 60.64 and a compression ratio of 74.29. A dog video file with a moderate PSNR of 43.39db achieves the highest compression ratio of 98.59. Similar video compression approaches, such as the Innovative Video Compression Technique using Discrete Cosine Transform (DCT) [4], Video Compression System for Online Usage Using DCT [6], and Hybrid DCT-DWT Algorithm [7], are also used to compare the performance of the suggested method. The comparative analysis findings of the three video compression techniques now in use, including DCT-DWT and the suggested method, are displayed in Table 2.

CONCLUSION

This study suggests QWT+SPIHT, a low bitrate medical video coding system based on the SPIHT algorithm and the quincunx wavelet. Without altering the video's content, the quantity of superfluous data is greatly reduced, and the video's quality is raised. The quincunx wavelet offers better content framing and more flexibility. Every generated quincunx coefficient is encoded using the SPIHT. The gathering of medical videos is used to assess the efficacy of the QWT+SPIHT. The results obtained on different bitrates show a significant improvement over the traditional procedures, especially for low bitrate values. The restored video exhibits a subjective quality suitable for the medical field. Furthermore, our proposed approach requires a small amount of time for coding and decoding operations.

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