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Corrupted Video Recovery Using CODEC Specifications

Avinash Deshmukh, Prof. Manisha Desai

Dept. of Computer Engineering, RMD Sinhgad School of Engineering, Savitribai Phule Pune University, India

Assistant Professor, Dept. of Computer Engineering, RMD Sinhgad School of Engineering, Savitribai Phule Pune University, India

ABSTRACT: Recovery of a damaged or altered video file plays a Important role in digital forensics to resolve criminal cases.There are many approaches exist to recover a video file but they uses file structure rather than frame structure. If video file is severely fragmented or even has a portion of video overwritten by other video content, the recovery of existing approaches may fail. The proposed approach recovers video by using frame structure. A video frame is the minimum meaningful unit of video data. Proposed approach also addresses how to extract video frames from a portion of video to be restored as well as how to connect extracted video frames together according to the codec specifications.The goal of this paper is to implement a better filtering technique that makes the noisy video frames to noise free video frames.Median filters are the greatest nonlinear digital filters based on order statistics to solve the present problem. Median filters are known for their capability to remove salt and pepper noise and preserves the shape.In this paper we proposed A Modified Decision Based Unsymmetrical Trimmed Median filter (MDBUTM) algorithm for the restoration of gray scale, and color video frames that are extremely corrupted by salt and pepper noise. This proposed algorithm shows better results.

KEYWORDS: Video file restoration, frame-based recovery, video file specifications, corrupted video data.

I. INTRODUCTION

Recovery of corrupted or damaged video files has played a crucial role in role in digital forensics.Recently, a large amount of video contents have been produced in line with wide spread of surveillance cameras and mobile devices with built-in cameras, digital video recorders, and automobile black boxes. In criminal investigations, video data recorded on storage media often provide an important evidence of a case. As an effort to search for video data recorded about criminal, video data restoration and video file carvinghas been actively studied. Most existing video data restoration techniques attempt to restore the source data using meta-information recorded in the header of a file system. The meta-information of file system contains file information such as file name, time of modification, physical location, link, etc. When the operator deletes a file, the corresponding file information in the Meta information of file system is updated as deleted although the video contents physically remain in the medium. Even though a video content exists in the media, it is challenging to recover the video data if the relevant meta-information is removed or altered. Conventional file restoration techniques find the Meta information of the deleted files to search for physical locations containing the actual file contents. However, the file cannot be restored if not all the file links are connected. Since a video file typically has a large volume of the data, it is highly likely to be fragmented although the meta-information remains in the file header.

When part of the file was overwritten, restoration of a video file with meta- information only may not be successful in most situations. To tackle these problems, various techniques have been proposed by which if the file *start markers* and *end markers* are discovered based on the file signature, relevant data are collected to restore the video data. Video frames are often corrupted by impulse noise. In general, the impulse noise in video frames is present due to bit errors in transmission or introduced during the signal acquisition stage. Based on the noise values, the impulse noise is classified in to two; they are salt and pepper noise and random valued noise. Salt and Pepper noise is simpler to restore but, the random valued noise is more difficult to restore. Salt and Pepper noise can corrupt the frame where the corrupted pixel takes either maximum or minimum gray level. Many different non -linear filters have been

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proposed for restoration of salt and pepper noisy video frames. Among all the methods for removal of impulse noise, the median filter is used widely because of its effective noise suppression capability and high computational efficiency. Non-linear digital filters, based on order statistics are median filters (MF). Median filters are well known for their capability to remove impulse noise without damaging the edge information.

II. RELATED WORK

R. Poisel and S. Tjoa, "Forensics investigations of multimedia data: A review of the state-of-the-art," [3] Digital forensics is one of the cornerstones to investigate criminal activities such as racket, computer security violations or the distribution of prohibited content. The importance and significance of this research fields attracted various research institutes leading to substantial progress in the area of digital analysis. One important piece of evidence is multimedia information. For this cause this paper provides an overview of the state-of-the-art in the forensic investigation of multimedia information, the association between the various research fields and further potential research activities.

H. T. Sencar and N. Memon, "Overview of state-of-the-art in digital image forensics," [4] Digital images can now be easily created, changed, and controled with no clear outline of having been subjected to any of these operations. There are currently no established methodologies to verify the authenticity and integrity of digital images in an automatic manner. Digital image forensics is an emerging research field with important implications for ensuring the credibility of digital images. In an attempt t to assist these efforts, this chapter surveys the recent developments in the field of digit al image forensics. Proposed techniques in the literature are categorized into three primary areas based on their focus: image source identification, discrimination of synthetic images, and image forgery detection. The main idea of the proposed approaches in each category is described in detail, and reported results are discussed to evaluate the potential of the methods.

L. Huston, R. Sukthankar, J. Campbell, and P. Pillai, "Forensic video reconstruction," [5] this paper describes an application that enables quick reconstruction of interconnected events, sparsely captured by one or more surveillance cameras. Unlike related efforts, our approach does not require indexing, advance knowledge of potential search criteria, nor a solution to the generalized object-recognition problem. Instead, we strategically pair the intelligence and skill of a human investigator with the speed and flexibility of a parallel image search engine that exploits local storage and processing capabilities distributed across large collections of video recording devices. The result is a system for fast, interactive, brute-force video searching which is both effective and highly scalable.

R. Poisel and S. Tjoa, "Roadmap to approaches for carving of fragmented multimedia files," [7] File carving is a recovery technique which does not consider file tables or other meta-data which is used to organize data on storage media. As files can be recovered based only on their content and/or structure this technique is an indispensable task during digital investigations. The main contribution of this paper is a survey about new approaches in the file carving research field and a roadmap that outlines the necessary steps towards video file carving. So far many approaches for the recovery of digital images have been proposed. After a short discussion of relevant representatives in this domain we focus on the applicability of these approaches to the recovery of multimedia files. Further this paper discusses ideas from the forensics wiki for their applicability to such a file carver. Finally our findings are summarized verbally and visually as a roadmap.

L. Aronson and J. Van Den Bos, "Towards an engineering approach to file carver construction," [8] File carving is the process of recovering files without the help of (file system) storage metadata. A host of techniques exist to perform file carving, often used in several tools in varying combinations and implementations. This makes it difficult to determine what tool to use in specific investigations or when recovering files in a specific file format. We define recoverability as the set of software requirements for a file carver to recover files in a specified file format. This set can then be used to evaluate what tool to use or which technique to implement, based on external factors such as file format to recover, available time, and engineering capacity and data set characteristics. File carving techniques are divided into two groups, format validation and file reconstruction. These groups refer to different parts of a file carver's implementation. Additionally, some techniques may be emphasized or omitted not only because of file format support for them, but based on performance effects that may result from applying them. We discuss a simplified variant of the GIF image file format as an example and show how a structured analysis of the format leads to design decisions for a file carver.

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G. Richard, V. Roussev, and L. Marziale, "Advanced file carving approaches for multimedia files," [11] File carving is a recovery technique that recovers files based on information about their structure and content without matching file system information. As files can be recovered from their content and/or file structure this technique is indispensable during digital forensics investigations. So far many approaches for the recovery of digital images have been proposed. The main contribution of this paper is a discussion of existing and new approaches for the recovery of multimedia files. After a short discussion of relevant multimedia file formats we present an overview of the current state-of-the-art in file carving. In the main part we focus on the implementation of a file carver for fragmented multimedia files. Finally, we summarize our findings and give an outlook with regard to post-processing files that have been recovered successfully.

N. Memon and A. Pal, "Automated reassembly of file fragmented images using greedy algorithms," [13] the problem of restoring deleted files from a scattered set of fragments arises often in digital forensics. File fragmentation is a regular occurrence in hard disks, memory cards and other storage media. As a result, a forensic analyst examining a disk may encounter many fragments of deleted digital files, but is unable to determine the proper sequence of fragments to rebuild the files. In this paper, we investigate the specific case where digital images are heavily fragmented and there is no file table information by which a forensic analyst can ascertain the correct fragment order to reconstruct each image. The image reassembly problem is formulated as a k-vertex disjoint graph problem and reassembly is then done by finding an optimal ordering of fragments. We provide techniques for comparing fragments and describe several algorithms for image reconstruction based on Greedy heuristics. Finally, we provide experimental results showing that images can be reconstructed with high accuracy even when there are thousands of fragments and multiple images involved.

III. **PROPOSED ALGORITHM**

Digital images are contaminated by impulse noise during image acquisition or transmission due to malfunctioning pixels in camera sensors, faulty memory locations in hardware, or transmission in a noisy channel. Salt and pepper noise is one type of impulse noise which can corrupt the image, where the noisy pixels can take only the maximum and minimum gray values in the dynamic range. Non-linear filtering techniques like Standard Median Filter(SMF), Adaptive Median Filter (AMF) are widely used to remove salt and pepper noise but these methods effective only at low noise densities. To overcome this drawback, Modified Decision Based Unsymmetric Trimmed Median Filter (MDBUTMF)is used to remove salt and pepper noise at very highdensities.

Fuzzy logic and MDBUTMF Algorithm:

In this algorithm, at high noise density, the processing pixel is replaced by the mean value of elements within the window. This will lead to blurring of fine details in the image. To avoid this problem, we have introduced fuzzy thresholding to preserve the edges and fine details of image hence, proposed new algorithm is the combination of fuzzy logic and Unsymmetric trimmed median filter. The proposed algorithm combines Fuzzy logic with Decision based Unsymmetric Trimmed Median Filter to process the image which is highly corrupted by impulse noise. The algorithm starts with the detection of impulse noise. That is, if the processing pixel lies within the maximum and minimum gray level values, then it is noise free pixel, it is left unchanged. If the processing pixels take the maximum or minimum gray level then it is noisy pixel which is processed by the proposed algorithm. The steps followed in the proposed algorithm are given below:

Mathematical Model

Let S be the system to extract video frames from the portion of video to be restored as well as to connect the extracted video frames together as per codec specifications using extract frames, extract signature of frames ,verification of frame signature, connect frame set.
S={VD,Ex,ES,VF,CFS }

Where,

S = System

VD= Video Dataset
Ex=Extract frames of unallocated space
ES=Extract Signature of frame data

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VF= verification of frame.
CFS=connect frame set.

1: Input:

Given a dataset VD = {v1,v2,.....vn}

Where,

v1,v2 are corrupted videos use in system. Each video has a set of frames F={f1,f2,....,fm} where f1,f2 etc.

Are the frames from each video.

2. ES (Extract signature of frame data)

ES={F,Dh,}
Where ,
F is the frame set of unallocated space.
Dh= Decoder header which contains signature

Eg. f1=0x0000011
f2=0x0000012
f2=0x0000013
f2=0x0000014
These are the decode header for given video frames.
Hence decode header=0x1-0x4
So start code signature= 0x000001.

3.VF (verification of frame)

VF={Dhs,DIs}
Where,
Dhs=Decoder header signature
And DIs=Data information signature
DIs={Dh,vs,ol}
Where,
Dh=decoder header
vs=video size
ol=offset location

These two pieces of information confirms that the video was encoded by an MPEG-4 Visual codec. Frame data is verified by the MPEG-4.

4. Output: CFS (connected frame set)

CFS={Vf,s}
Where,
Vf=verified frames of video
s= size information of each frame recored in meta-information
System will use this information to connect the frames.

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IV. PSEUDO CODE

Step 1: Read Noisy Image.
Step 2: Select 2D window of size 3x3 with centre element as processing pixel. Assume that the pixel being processed is Pij.
Step 3: If Pij is an uncorrupted pixel (that is, 0<Pij<255), then its value is left unchanged.
Step 4: If Pij = 0 or Pij = 255, then Pij is a corrupted pixel.
Step 5: If ¾ th or more pixels in selected window are noisy then increase window size to 5x5.
Step 6: If all the elements in the selected window are 0"s and 255"s, then replace Pij
with the mean of the elements in the window else go to step 6.
Step 7: Eliminate 0"s and 255"s from the selected window and find the median value of the remaining elements. Replace Pij with the median value.
Step 8: Repeat steps 2 to 6 until all the pixels in the entire image are processed.

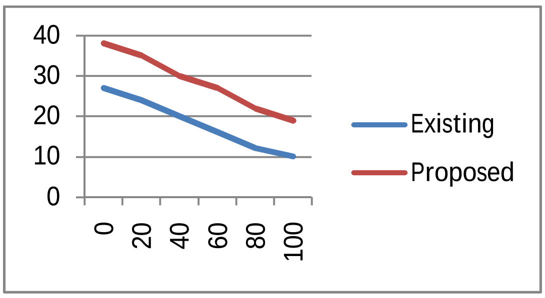
V. EXPERIMENTAL RESULTS

The performances of the proposed algorithm are quantitatively measured by the Peak Signal to Noise Ratio (PSNR)

$$\text{PSNR in dB} = 10\log_{10}\left(\frac{255^2}{\text{MSE}}\right)$$

$$\text{MSE} = \frac{\sum_i \sum_j (Y(i,j) - \hat{Y}(i,j))^2}{M \times N}$$

where MSE stands for Mean Square Error, M x N issize of the image, Y represents the original image, Y ˆdenotes the denoised image. The PSNR values of the proposed algorithm are compared against the existing algorithms



Y axis: PSNR in db
X axis: Noise Density in %

From the above graph, it can be evident that the PSNR value of the proposed algorithm is better than the existing algorithm at high noise densities

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VI. CONCLUSION AND FUTURE WORK

In this paper, we recover corrupted video by using CODEC specifications. Our Recovery is frame based, we can also recover video using file structure rather than frame structure but problem with this is that partially overwritten restoration is not possible. Hence by using frame-based recovery we can recover partially overwritten as well as severally fragmented video files

The additional thing which we are doing from base paper is we are reducing noise from video by using MDBUTMF algorithm and fuzzy logic which gives better performance. In future, one can explore or extend MDBUTMF algorithm in order toreduce noise in a video.

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BIOGRAPHY

Avinash Deshmukh Research Scholar at RMD Sinhgad School of Engineering, Savitribai Phule Pune University. He has received B.E. in Computer Engineering from Savitribai Phule Pune University, Pune. Currently he is pursuing M.E. in Computer Engineering in RMD Sinhgad School of Engineering, Savitribai Phule Pune University, Pune.

Prof. Manisha Desai received the B.E. from University of Pune and M.Tech Degrees in Computer Engineering from Defence Institute of Advance Technology, Pune. She is working as Assistant Professor in Department of Computer Engineering, RMD Sinhgad School of Engineering, Pune. She is having more than Three year experience.