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Digital Forensic Application using Deep Learning

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Abstract

Visual information is increasingly being used in digital forensic investigation due to popularity of intelligent mobile devices and the low price of surveillance systems.Now a day's most of the digital video considered as evidence source such as to identify, analysis. The purpose of the development of this paper is to assist the forensic investigation by analyzing the video. To develop this of technique we proposes the video and image enhancing techniques using them built forensic analysis sysyem. In that convolution neural network algorithm identifying abnormal action as per the frame conversion and HOG.

Keywords- *forensic investigation analysis, video/image enhancement, object detection, deep learning*

I. INTRODUCTION

In forensic investigation, digital cameras and mobile devices are routinely seized as evidence sources. Video and images retrieved from these devices are widely used in crime evidence investigation, which can provide key forensic evidence items, piece together existing evidence items, or establish links between evidence items in particular case. The Closed Circuit Television (CCTV) systems are widely used for malls, banks, traffic intersections to park, stores, or even home, where video evidences are retrieved from these system can be used as evidences much more thane ver before.

In the past few years, the 'Image enhancement' techniques have been proposed, most of themcanbegroupedinto spatial domainmethods and frequencydomainmethods. These techniques shows good potential to improve the quality of images, but only a few of them can be used for low quality of footage, such as CCTV footage, mobile video clips etc. Many C3CTV surveillance system export footage in their own formats, which need to be re-format or converted to a suitable format that easier for investigation. However, this can often cause the lower of quality and information loss, which makes the examination process difficult.

The main aim of forensicvideoanalysisis to identifystrongevidence items atdifferentlevel. In this paper, we focus on the contents of the video to develop efficient video analysis techniques from the view point of forensics.[1]

II. LITERATURE SURVEY

In "Video-Based Evidence Analysis and Extraction in Digital Forensic Investigation", paperJianyu Xiao, Shancang Li, QingliangXu stated that the emergingforensicvideoanalysis techniques mainly focus on following aspects : (1) Law enforcedforensicvideoanalysis ; (2) Forensicanalysis for video and multimedia ;(3) Image/videocomparison ; and (4) Enhancedforensicvideoanalysis. In this work, it focus on the 'improved forensic video analysis' by using the most recent video and data analysis techniques.[1]

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In"Application of forensic image analysis in accident investigations", paper proposed by Dr. Ellen Verolme and Dr.ArjanMieremet, stated that it demonstrate the applicability of forensic techniques for accident investigations by presenting a number of cases from one specific field of expertise: image analysis. With the rapid spread of digital devices and new media, a wealth of image material and other digital information has become available for accident investigators. It show that much information can be distilled from footage by using forensic image analysis techniques[2]

In "Reconstruction of Hidden Representation for Robust Feature Extraction" ,paperZeng Yu and Tianrui Li suggested a way that It was demonstrated that the reconstruction error of the input has a lower bound and minimizing the Frobenius norm of the Jacobia matrix of hidden representation has a deficiency and may encourage getting a much worse local optimum value. Based on this evidence, a new deep neural network, DDAE, for unsupervised representation learning was proposed by using the idea of learning invariant and robust features for the small change on both input and hidden representation. The idea was implemented by minimizing the reconstruction error after injecting noise into both input and hidden representation. It is shown that our model is flexible and extendible. It is also demonstrated that minimizing the reconstruction error of hidden representation for feature representation is more robust than minimizing the Frobenius norm of the Jacobia matrix of hidden representation[3]

In "Wavelet-Domain Color Image Enhancement Using Filtered Directional Bases and Frequency-Adaptive Shrinkage", paper Sangjin Kim, Wonseok Kang, Eunsung Lee, and Joonki Paik stated that theMost traditional noise reduction methods tend to over-suppress high-frequency details. For overcoming this problem first decompose the input image into flat and edge regions, and remove noise using the alpha map computed from wavelet transform coefficients of LH, HL, and HH bands. After removing noise in the flat region, further remove noise in edge regions by adaptively shrinking wavelet coefficients based on the entropy. Moreover, it present a new directional transform using wavelet basis and Gaussian low pass filters. The wavelet coefficients of edge regions are inverse transformed by using the filtered wavelet bases. Experimental results show the proposed algorithm can reduce noise without losing sharp details and is suitable for commercial low-cost imaging systems, such as digital cameras, CCTV, and surveillance system[4]

In Facial Comparison from CCTV footage: The competence and confidence of the jury", paper Heather Walker, Ann Tough stated that CCTV footage is commonly used in the court room to help visualise the crime in question and to help identify the offender. Unfortunately the majority of surveillance cameras produce such poor quality images that the task of identifying individuals can be extremely difficult. This study aimed at determining whether the task of identifying the offender in CCTV footage was one which a jury should be competent to do, or whether expert evidence would be beneficial in such cases. The ability of potential jury members, the general public, was tested by asking participants to play the role of a jury member by means of an online survey. Potential jury members viewed CCTV in which a simulated offence took place, and were subsequently asked to compare still images of a defendant to the offender to try to determine if they were competent and confident about making a judgement as to whether the defendant committed the crime. Factors such as age, gender and profession of the potential jury members were considered, as well as the type of crime committed, in order to establish if these play any role in the decision made by potential jury members. These factors did not appear to play a significant role; however confidence was also investigated and it became very evident that this was a factor that must be taken into consideration when determining the requirement for expert contribution in facial comparisons[5]

III. METHODOLOGY

There is no spacing for digital or physical investigations, my research attention focused on identifying the fundamentals of a digital investigation. If there are many ways to answer the questions, then what do they have in common? One of the results of this work was the Computer History Model, which describes what occurred in a computer and can be used to model digital investigation techniques. The Computer History Model is unique with respect to the previously proposed process models because it

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is based on mathematical theory of computation models and is not simply an arbitrary grouping of steps and phases.

A. PROPOSED WORK :

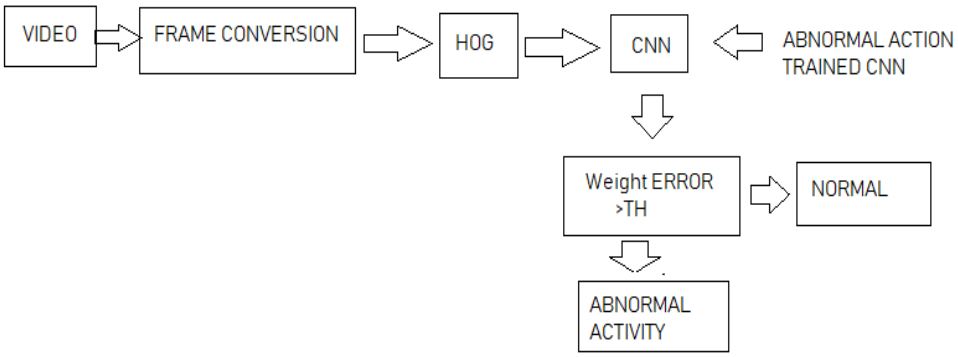

Figure 1: Block Diagram of Digital Forensic Application.

(a) Diagram Description :
Frame Conversion- The Frame Conversion block passes the input through to the output and sets the output sampling mode to the value of the Sampling mode of output signal parameter, which can be either Frame-based or Sample-based.
HOG-The histogram of oriented gradients (HOG) is a featuredescriptor used in imageprocessing for the purpose of objectdetection. The technique counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edgeorientationhistograms, scale-invariantfeaturetransform descriptors, and shapecontexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy.
CNN- Using the results of the frame conversion and HOG convolutional neural network will starts the work. according to that results CNN will identify the abnormal images. Classifying the frames using certain types of conditions i.e normal as well abnormal.

(b) Existing System:
In recent, the new technologies make it much easier to create, collect, and analyses these image materials. The advances of emerging techniques such as mobile devices, low cost image/video capturing devices together with information processing such as artificial intelligence, machine learning, etc.

(c) Proposed System:
It is clear that in above proposed framework the forensic video analysis can be classified into following two main categories: video type analysis and video contents analysis.

(d) Forensic video type Analysis:
In forensic video type analysis, one of main aims is to examine whether the video is illegally re-produced. This analysis also conducts video source identification and video steganography analysis to uncover hidden information. Specifically, the video source identification is an important evidence source to identify the sources camera or devices that token this video or image.

(e) Video Contents Forensic Analysis:
Actually, the traditionally methods is very time consuming and inefficient when huge volumes of video footage are available. In many case, the analysis significantly relies on the investigator. With the advances of emerging techniques, such as facial recognition, objects detection, deep learning, etc., it makes the automated forensic video analysis possible, however there are still many challenges need to be addressed.

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A. REVIEW OF VIDEO ENHANCEMENT ALGORITHMS

Algorithm 1:- Video Enhancement Algorithm Using Contrast LimitedAHE
Input: Video or camera input V
Output : Labeled V
1: v← video capture(V)
2: vg ←video group(v)
3: for each frame f ∈vg do
4: Initialize array Histogram to zero;
5: for every contextual pixel j do
6: Hist[g(j)]=Histl[g[j]+1
7: end for
8: CHistl =Pl k=0 Hist(k)
9: l0 =CHistl ×L/W2
10: vg ←update(f ,l0)
11: end for
12: V ←update(v,vg)

It is noted that in Algorithm 1, we have to calculate the Hist[g(j)] for each pixel is computationally expensive, for an image with size M x N, it cost O(M x N x W2). To further improve the performance of image quality.

Algorithm 2:- Color and Shape-based Object Detection and Tracking Algorithm
Input: Video or camera input V
Output: Labeled V
1: v←videocapture(V)
2: vg ←video group(v)
3: for each frame fi ∈vg do
4: fhsv ←covColor(fi,COLOR_RGB2HSV)
5: fshsv ←split(fhsv)
6: for each channel c∈{hue,saturatin,value}do
7: threshld(fshsv[c],dth[c],low[c],upper[c])
8: end for
9: fresult ←bitwise_and(dth[0],dth[1],dth[2])
10: end for
11: V ←update(v,vg)

In Algorithm 2 we apply features provided by the Open CV and CUDA to make it can work with real time video streaming from camera.

IV. REVIEW OF RESULT

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Figure 2. CLANE example(left: Original;right: Histogram).

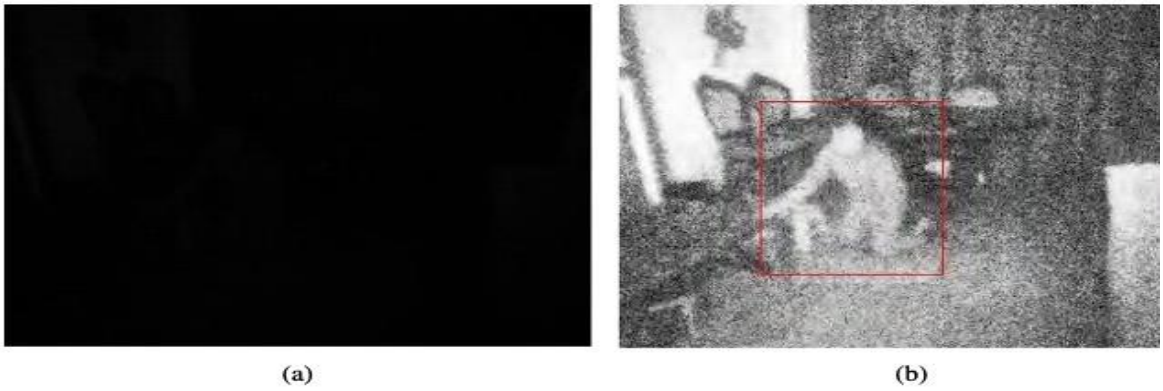

Figure 3. Enhanced CCTV footage frame in a night visual. (a) Original frame (b) Enhanced frame

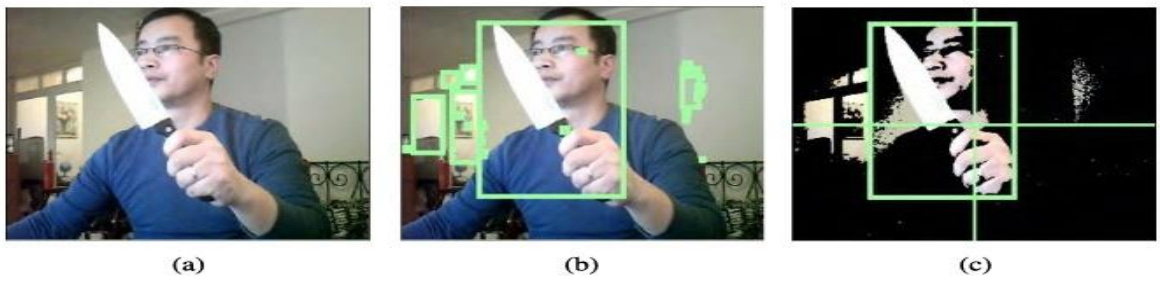

Figure 4. (a) original frame (b) Enhanced multiple objects recognition (c) Enhanced single objects recognition

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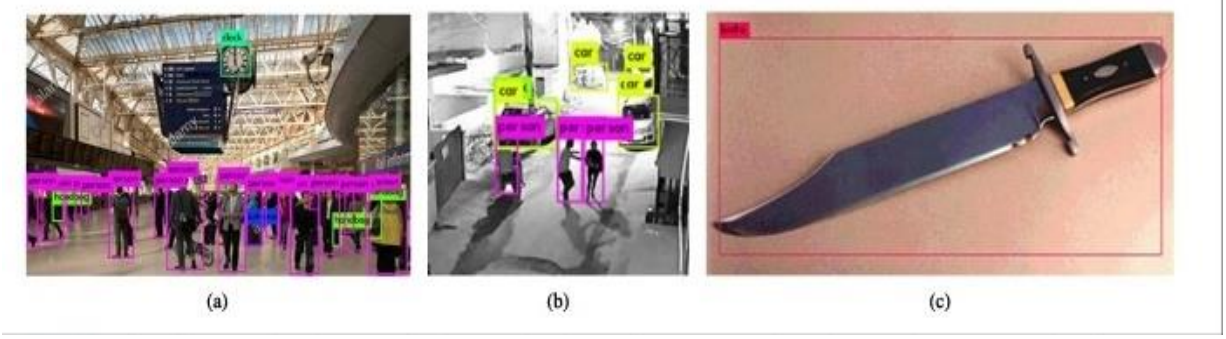

Figure 5. Object detection and tracking using deep learning algorithms (a) Image objects detection (b) CCTV footage object detection (c) Specific object detection image

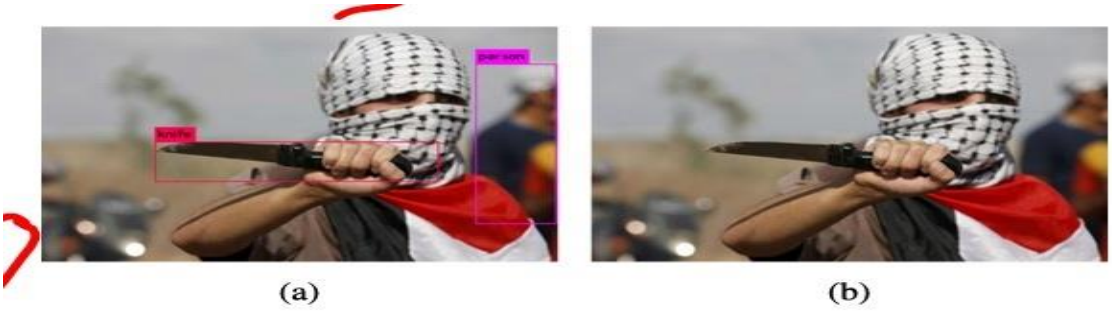

Figure 6. Object tracking in real-time video (a) Labeled image (b) Original image

V. CONCLUSION

It is noted that in digital forensic investigation, the low quality CCTV footages are widely used to extract potential evidence items. In this work, we proposed a framework for video based digital forensics investigation, and further we developed a way to enhance the quality of video to extract as much as evidence items. Specifically, we proposed a method to extract more evidence items in a reverse way. It is also useful for anti-crime or fast response when crime activities or behaviors are detected. In the future works, we will further establish the links between existing evidence items and the detected evidence item.

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