An Object Detection using Image Processing in Digital Forensics Science

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Abstract—Object detection is one of the most important sectors in digital forensics science. The object detection technique is valuable for a number of purposes for instance: medical diagnosis scanners, traffic monitoring system, airport security examination, law regulation firms, and for diverse local or international data rescue departments. The purpose of my paper is to deliver an object detection method to detect a weapon in a camera image by relating a detailed analysis of weapon detection techniques such as image enhancement, image segmentation, image feature extraction, and image classification. However, the applicable techniques are created through the computation of different mathematical and algorithms models.

Keywords—Artificial Neural Networks; Back Propagation; Histogram Oriented Gradients; Gun Detection; Knife Detection.

I. INTRODUCTION

Due to the growing rate of street crimes in our city; the surveillance cameras should be installed inside and outside the public places. The surveillance cameras help people to stay alert by detecting an unethical activity within a second, and the surveillance cameras can be useful for further investigation purposes such as tracking an identity of a criminal or a victim. Although, the surveillance cameras are being used in public offices to monitor the ethical and unethical behaviour of their employees or their visitors for instance. The process of identifying minor details such as the use of a weapon in crime situation either a gun or a knife is not accessible to everyone. Therefore, a small number of experiments were conducted to identifying a weapon from CCTV evidence.

However, the growing demand for CCTV cameras used for surveillance purposes is stressful for people who operate multiple screens of these CCTV cameras. In the past few years, the multiple CCTV cameras were installed for surveillance purposes, but the monitoring purpose of all these cameras became a challenging task for everyone.

For instance, the number of CCTV screens were increased but the concentration of human on each screen was decreased. Therefore, since after a growing demand for CCTV cameras for surveillance purposes the authorities hired people for working on automated surveillance algorithms.

So, how these automated surveillance algorithms work for CCTV cameras? The automated surveillance algorithms help authorities by denoting an unethical circumstance such as attacking a person or personal property, carrying an inappropriate object in luggage, snatching a car or a mobile phone on street, creating a disruption on public places etc. Until the day, the automated surveillance algorithms are considered for multiple scanning purposes and it helps to generate an examine output report through automated software processing [1].

Even though the application of automated algorithms was introduced in a few years back, and these algorithms became widely prominent for their uses in the radiology department under health sector and traffic monitoring department under public transportation sector.

Hence, better visual quality enhances the main purpose of CCTV cameras by screening clear footage of the crime. Regardless, the process of identifying minor details such as the use of a weapon in crime situation either a gun or a knife is not accessible to everyone. Therefore, a small number of experiments were conducted to identifying a weapon from CCTV evidence [2].

As required to my research work, I will be proposing an object detection algorithm that can help me identify a knife in a camera image. However, the background of my work was needed to be a focus on proper visual quality and high resolution of a camera; but I couldn't arrange a high-quality camera thus I used low-resolution images from google.

A. Object Detection Overview:

An object detection processing will be working into four stages as illustrated in figure 1:

a) Image Enhancement:

Image enhancement is the process of noise reduction that can improve the visual quality of a blurred image. The image enhancement process will be conducted by using the Wiener Filter. That filter can reduce the noise from an image with absolute outcome [3].

b) Segmentation:

Segmentation is a process that breaks a wider image into small blocks and each block can be assigned a pixel with a random value. The process of segmentation will be conducted through "Sliding Window"

c) Feature Extraction:

Feature extraction extracts distinctive features of an object to detect in an image such as geometric features and appearance features. Geometric features define size, shape, position of the required object in an image while the appearance features define an appearance of the required object in an image.

d) Classification:

The classification of object detection is to use for image segment which is based on artificial neural networks. The purpose of this project to classify the object through image segmentation and feature extraction. In this project to use the back-propagation and multi-feed neural networks for classifying the object by using an image.

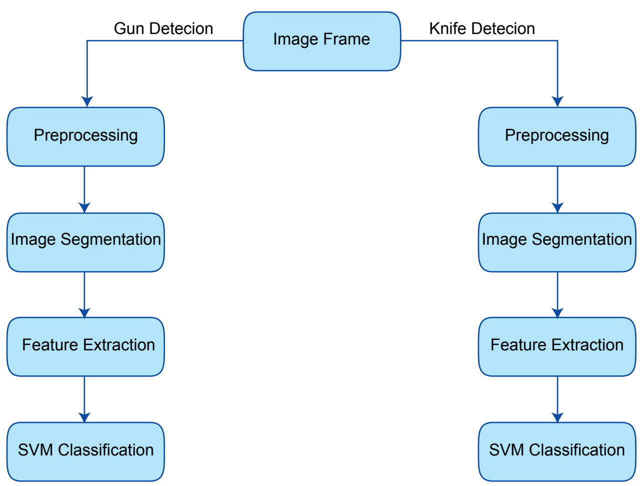

Fig. (1). Proposed System

II. LITERATURE REVIEW

The usage of CCTV camera was originated during the Second World War. In 1942, the first CCTV camera was installed by a German company 'Siemens AG' for observing the inauguration of V2 rockets that was the world's first long-range missile ever.

The German engineer Walter Bruch was in authority, and he monitored all of the CCTV live transmission. Even though the outcome of the first surveillance camera was used to observe only live transmission, and it couldn't store any video or information for future purposes.

In 1951, since the launch of a first video tape recorder, the processing to the detention of live camera videos became easier and it actually helped people to store and delete their camera videos.

Later, in 1973, New York City was the first city for using surveillance camera officially to monitoring a public street to control street crimes. However, the street crime didn't decrease much but the concept of surveillance cameras began increasing across the noted public areas. Until the day, there were only analogue setups to work on surveillance cameras in which the surveillance video had many lines per frame, the final output of analogue video transmission had no audio, and it carried a limited range of video definition at 480i and 576i resolution.

The analogue video transmission was done through the old television broadcasting system (i.e. antenna and dish system). Therefore, at the beginning of the CCTV era, the 2d cameras were used for surveillance setup.

Later, the invention of charge-couple-device CCD was a turning point for the history of CCTV cameras that made the practice of surveillance cameras easier and accessible for local business sectors. How CCD worked for local business sectors: because the charge-couple-device CCD was sensors that made possible to record still and moving images by capturing light and converting it into digital data stored in digital logic gates. After the invention of charge-couple-device CCD, in 1996, a Swedish company named Axis Communication introduced the world's first network camera also known as "Neteye 200" for converting surveillance recorded video from analogue format to digital format. For instance, this camera made things easier for internet users, and it was the world's first camera ever used as web server [4].

Since the transformation of surveillance recorded videos from analogue image processing to digital image processing was developed successfully, it became easier for people to relate with digital image processing. For instance: In 2003, for the first time in history, a face recognition algorithm was used in surveillance camera video to track the identity of missing kids from Phoenix.

Over time, various automated algorithms were introduced to enhance the effectiveness of digital image processing. Why the concept of digital image processing is such an essential technology: because digital image processing helps its user over analogue image processing by allowing a wide range of computer algorithms to work on particular task on camera images such as editing, restoration, neural networks, classification, filtering segmentation, feature extraction, pattern recognition, pixilation, and projection.

Hence, there are the different automated algorithm for each kind of digital image processing, for instance: there are feature extraction and learning algorithms to deal with an object in an image such as detecting a face, mode of transport, house, this processing is also known as object detection or object recognition. It depends on many factors as in segmentation, detection, inconsistency or consistency, categorization, and position of that particular object whom you need to identify through digital image processing.

Over time, the objection detection techniques were improved with the use of motion and shift segmentation when a user can make subtraction in the background of an image. Later, the concept of computer stereo vision was introduced in which a user could see the 3D view or extraction from digital camera images such as images acquired by CCD camera. In 2005, it became possible to detect objects at multiple measures and position in an image by deploying a technique of a sliding window with image processing [5].

Later, the famous feature extraction method histogram oriented gradient (HOG) was introduced by Navneet Dalal and Bill Triggs [6]. This histogram gained massive popularity for its human detection feature. This method worked through edge directions of an object as the image is divided into small components such as cells and pixels through which a histogram compilation proceeds. Though many automated algorithms were introduced in past years for objection detection, they usually focused on finding of huge objects such as humans, number-plates, buildings, paintings, furniture, and old or new kind of vehicles. Therefore, the readings left me with the impression that the number of automated algorithms were made to detect suspicious activities on daily basis but very few of the automated algorithms were suggested in the ground of weapon detection.

A. *Weapon Detection in Image Processing:*

Until the day, the target killing and snatching are rambling around the country. Criminals roam around buses, universities, schools, banks, malls, holding a small weapon in their hands, and killing off innocent people. Though there are on and off going algorithms still working for weapon detection since 2007 [7].

In 2007, the first concept of firearm detection was proposed by Iain Darker and his team, they tried to work on automated surveillance algorithm by proposing a firearm detection algorithm with the use of motion segmentation, this algorithm was also known as scale invariant feature transform (SIFT). Along with firearm, the alternative class of weapon that can be measured for automated surveillance object detection is a knife.

Though the research work on knife detection was also being considered in the past few years the number of published papers were not sufficient enough. In a few papers, authors were successful to pull an experiment on knife detection algorithms [8].

Douglas Kemiac introduced a new technique to use for knife detection by deploying a human-oriented gradient (HOG) feature extraction algorithm and an artificial neural networks (ANN) algorithm. Kemiac suggested that the process of knife detection can be done using dominant edgy direction algorithm [9].

For this process, Kemiac assumed a pictorial scenario in which a knife was centred in a vertical position, and then Kemiac marked dominant edges by approaching to line segment on all extracted edges on a knife. After measuring the line segments, Kemiac found the connecting direction of each line segment, he featured a vector reliant on the concentrations of dominant edges and straight line segments [10].

Another approach was introduced by Edward, Cootes and Taylor, and they named their model an active appearance model (AAM). Basically, active appearance model was considered to recognize particular statistical shapes and appearances to a new image, such as to analyzing an image to detect a knife in an image.

They analyzed an image through applicable sets of key points, they found 40 knives in an image by rotating the image from 15 degrees of angle to 24 degrees of angle to find all the possible shapes in 360 direction of an image.

Another approach clustering algorithm was conducted by J.C.Dunn. This algorithm could detect boundaries and surface, by using second-degree curves in the analytical arrangement and knife detection was reliant on the connecting point between identical curves [11].

In this method, the ratio of success was dependent on distance, intensity and connectivity.

So far, I couldn't find a paper defining an automated algorithm that can work on both quality enhancement and knife detection. None of the above-mentioned paper was implemented in a real-time situation [12].

III. OBJECT DETECTION METHODS

For conducting my experiment, I will be working on neural network theory. Neural network works on layers, those layers are designed by a number of interrelated nodes working for different tasks. In the neural network, patterns are represented as an input to the neural network that interconnects to hidden layers through connection layers and then delivers a result to an output layer.

A. *Image Enhancement:*

Image enhancement is the process of noise reduction that can improve the visual quality of a blurred image. The image enhancement process will be conducted by using the Wiener Filter. That filter can reduce the noise from an image with the absolute outcome.

a) *Wiener Filter:*

The Wiener filter is to work on noise reduction from the blurred image. This filter has improved the visual quality of an image by reducing the noise. This filter has estimated the value of a noisy process and apply some static value to improve the quality of noisy section from an image.

B. *Segmentation:*

Segmentation is a process that breaks a wider image into small blocks and each block can be assigned a pixel with a random value. The process of segmentation will be conducted through "Sliding Window".

a) *Sliding Window:*

Sliding window technique is usually applicable on left side vector, and help us moving our required segment of an image from the left side to right side and from the top side to bottom side. This technique is used because the segmentation proceeds linearly, and segment carried out a frame that should be tested for the existence of a required object in it.

C. *Feature Extraction:*

Feature extraction extracts distinctive features of an object to detect in an image such as geometric features and appearance features. Geometric features define size, shape, position of the required object in an image while the appearance features define an appearance of the required object in an image. However, for conducting a successful object detection experiment, there is a need for finding an appropriate feature vector.

Histogram Oriented Gradient (HOG) is a feature extraction method that is used for object detection. It is developed by Navneet Dalal and Bill Triggs [6]. In this method, the shape of the object is described by using intensity gradients or edge directions. This method divides the image into small blocks and features of individual cells are obtained as described in figure 2.

- Gradient computation
- Orientation binning
- Descriptor blocks
- Block normalization

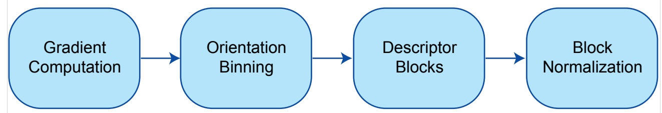

Fig. (2). HOG Implementation

a) *Gradient Computation:*

The first step of feature detection needs accurate information of the gradient values such as the colours and gamma values. To calculate an accurate gradient value, the famous techniques are canny, Sobel and Prewitt [13]. Most of these are computed by developing an image with a kernel filter that is widely used for blurring, sharpening, embossing, edge detection effects. In the HOG method, the gradient values of an image are computed by allocating x and y derivatives to a vertical and horizontal direction. The edges of the image segment (J) acquired by sliding window with horizontal (ymask) and vertical (xmask) with the approximate value of each pixel is assigned zero.

$$\text{xmask} = \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix} \text{ymask} = (1 \;\; 0 \; - 1)$$

$$\text{Gradient } |G| = \sqrt{J_y^2 + J_x^2}$$

$$\text{Orientation } ø = \text{atan}\left(\frac{J_y}{J_x}\right)$$

The value J_x and J_y are correlated with both horizontal and vertical edges. After the completion of both horizontal and vertical directions J_x and J_y the grandient G and Orientation 0 for complete pixels in an image J is considered by equations.

b) *Orientation Binning:*

As the process begins, the HOG labels the gird of each cell that helps to arrange each cell into a new block for proceeding as cell histogram. During this process, each cell carries few pixels, and every time at each pixel the gradient vector is to be counted to create an orientation based histogram channels. For this purpose, the angle of each vector is supposed to be central for the accurate voting of each cell. For instance, the orientation based histogram is supposed to spread over 0 to 15 degree or 0 to 360 degree, but it depends if the gradient is signed or unsigned.

c) Descriptor Blocks:

The third step is the normalization of the gradient by arranging the cells into larger and spatially related blocks. For this purpose, there are two types of descriptor blocks such as circular blocks (C-HOG), rectangular blocks (R-HOG). But, the rectangular blocks are widely used as compared to circular blocks because the rectangular blocks are easier to execute in the HOG method. Rectangular blocks are square grids and symbolized by three constraints; such as the cells, the pixels, and the channels. In rectangular blocks, the required size of each block starts from 2 x 2, 4 x 4, 8 x 8 while the size of the circular blocks contains a single, central point, and angular point for each cell in figure 3.

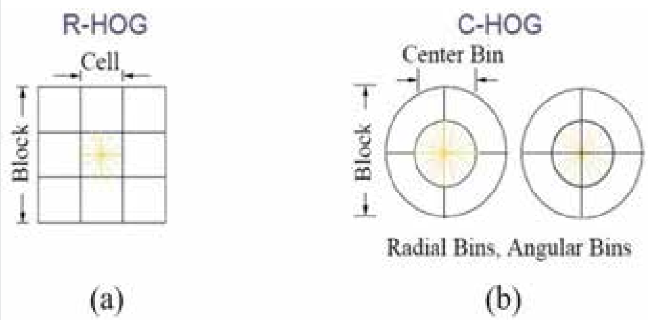

Fig. (3). Block Descriptor

d) Block Normalization:

Block normalization is done by overlapping a cell into each block. The block normalization proceeds in four different methods, but it works better rather than normalizing each channel individually, it assembles the cells into blocks and normalized them collectively.

$$L2-Norm: f = \frac{u}{\sqrt{||u|| \frac{2}{2} + e^2}}$$

$$L1-Norm: f = \frac{u}{||u||_1 + e}$$

$$L1-sqrt: f = \sqrt{\frac{u}{||u||_1 + e}}$$

The e is small random value in between 0 and 1, v is vector of non-normalized histogram bins in each small block of an image and $||u||_k$ is k for normalized of k.

D. Classification with Neural Networks:

Therefore, after the extraction of a feature vector, the machine starts the classification of the feature vector. Neural networks theory works just like the human neural network which performs complex computations in a short time. The human neural network organizes its components called neuron which performs pattern recognition and perception in less time as compared to a modern computer [14].

a) Multiple Feed Forward Network:

In multiple feed-forward neural network, connections between nodes do not form loops or cycles illustrated in figure 4. They transfer information in a linear way. Neural networks have three layers; an input layer, an output layer and a hidden layer. The neural network is called a multilayer neural network if the number of hidden layers in a neural network is more than one. It is called a deep neural network if the number of hidden layers is more than two

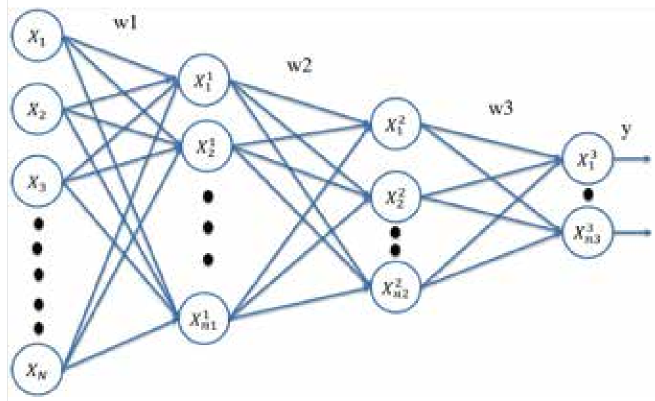

Fig. (4). Neural Networks

b) Back Propagation Algorithm:

Multiple complex functions can be learned as the number of the hidden layer's increases. The complexity is increased to calculate the correct combinations of weights. Back-propagation method is used to handle multilayer networks. For a back-propagation learning procedure, a vector input is randomly selected and given to the neural network as an input.

$$X_i = \sum J_I W_I$$

where Yj is the i^{th} layer output of the input

ji, J will be i - 1

- Activation Function

The two types of activated functions are based on propagation algorithm such as a function of unipolar sigmoid and function of bipolar sigmoid. The function of the unipolar sigmoid is given as:

$$X_j = \frac{1}{1 + e^{-Y_i w_j^T}}$$

The function of the bipolar sigmoid is given as:

$$X_j = \frac{1 - e^{-Y_i w_j^T}}{1 + e^{-Y_i w_j^T}}$$

- Neural Networks used Back Propagation Algorithms

The neural networks detect the weapon, the positive and images are considered for this purpose. The Positive images required weapons from an image and negative images required non-weapons. A neural network considered four layers to completion of this project, The N is a vector in four neural networks layers. The first layer is n1 of neurons, second layers is n2 of neurons, the third layer is n3 of neurons and four layers is weighted of w1, w2 and w3, the w1 is weight of N x n1, the w2 is weight of n1 x n2 and the w3 is weight of n2 x n3 in four neural networks layers.

$$w1 = \frac{rand(N, n1) - 0.5}{N}$$

$$w1 = \frac{rand(n1, n2) - 0.5}{n1}$$

$$w1 = \frac{rand(n2, n3) - 0.5}{n2},$$

The command of rand () has implemented in MATLAB as a vector in between the range of (0 to 1)

After the execution of weights, the input pair is executed randomly by neural networks and output x is executed. After the execution of output x, error e in between t and output is executed by an equation.

$e = t - x$

To accurate the weights using back-propagation, error δ_j is executed with layer j. δ_j for output of layer are executed with the given equation.

$$\delta_3 = diag(e).\frac{\vartheta x}{\vartheta w3}$$

The diag (e) is the matrix of diagonal are signifying of vector error. The function of the bipolar sigmoid is executed with the given equation and also a function of activation with the neural networks by using the given equation

$$\delta_3 = diag(e).(1 - \tanh(x)^2)$$

$$\Delta v3 = \alpha.\delta_3.O_2$$

The α is the rate of O_2 and also output vector of second neural networks layer δ_2 *and* $\nabla v2$ are execute by this given equation

$$\delta_2 = ((v3)^T.\delta_3)(1 - \tanh(O_2)^2)$$

$$\Delta v2 = \alpha.\delta_2.O_1$$

The O_1 is the output of the first layer and δ_1 and $\Delta v1$ are given as:

$$\delta_1 = ((v3)^T.\delta_2)(1 - \tanh(O_1)^2)$$

$$\Delta v1 = \alpha.\delta_1.y$$

The y is the vector function of factors $\Delta w1.\Delta w2.\Delta w3$. The weight of this factor is executed by given this equation

$$w3 = w3 + \Delta w3$$

$$w2 = w2 + \Delta w2$$

$$w1 = w1 + \Delta w1$$

The error vector e is executed with another training example and the procedure of weight is constant of mean square error.

c) Ten Ford Stratified Cross Validation:

Ten ford stratified cross-validation is functioned to divide a sample into small subsets known as k subsets, later, the ten ford stratified cross-validation uses these k subsets in database for a training and testing purpose. For the purpose of cross-validation, the sample is subdivided into ten equal sizes of subsets in which nine subsets are specifically processed for training purpose while the tenth set is only processed for testing purpose.

d) Performance Evaluation of a Classifier:

The process helps to evaluate the performance of neural network which is reliant on many aspects such as the total estimation of iterations, neurons, learning rate, and training samples consumed in the process described in table 1. Hence, the neuron network is formed with 'back-propagation algorithms' but there is a requirement to generate diverse neural networks by plotting parameters and receiver operating characteristics graph. Receiver operating characteristics graph is a technique used for a selecting, organizing and visualizing of the classifier's performance based on the classification of the both positive and negative samples; and indicate the differentiation of neural network that generate high true positive and low false positives: for instance, the trained classifier usually verifies testing dataset, and generates four probable consequences:

Table 1. Confusion Matrix

The equation of weight given as

FP FP Total Images	TP TP Total Images	PPV 1-PPV
TN TN Total Images	FN FN Total Images	FOR 1-FOR
TNR 1-TNR	TPR 1-TPR	Accuracy 1-Accuracy

$$True\ Negative\ rate = \frac{True\ Negatives}{Total\ Negatives}$$

The negative samples are total of a true positive and false negative from all training examples.

$$True\ Positive\ Rate = \frac{True\ Positives}{Total\ Positives}$$

The positive samples are total of true negative and false positive from all training examples.

$$Positive\ Productive\ Value\ (PPV) = \frac{True\ positives}{True\ positives + False\ Positives}$$

$$False\ Omission\ Rate\ (FOR) = \frac{True\ Negatives}{True\ Negatives + False\ Negatives}$$

$$Recall\ (Sentivity) = \frac{True\ Positives}{Total\ Positives}$$

$$Accuracy = \frac{True\ positives + True\ Negatives}{Total\ Positives + Total\ Negatives}$$

$$Specificity = \frac{True\ Negatives}{False\ Positives + True\ Negatives}$$

e) Neural Networks for Classification of Single Class:

The neural networks are beneficial to identify a single class of object such as a knife. For the purpose and the classification of an image, the estimated value of a feature vector calculated through histogram of oriented gradients (HOG) is used as an input vector. To identify a single class of object in an image, the classification of neural networks begins with one neural in the output layer that creates value for both the presence and absence of an object: value 1 for the presence of the object, and value 0 for the absence.

IV. IMPLEMENTATION

For implementing our experiment, the lowest resolution of images of approximately 400 x 400, 600x400, 800x600 pixels is to be considered. Implementation of the experiment will be conducted on MATLAB software, and the testing of an algorithm will be done with google images of people holding a knife in low-resolution quality.

A. Enhancement of Image by using Wiener Filter:

The first objective of our experiment is enhancing low-quality images by involving a filter of noise reduction that can improve the visual quality of a blurred image. The image enhancement process will be conducted by applying the Wiener Filter that filter can reduce the noise from an image with absolute outcome [15].

B. Segmentation of Image by using Sliding Window:

For conducting the first segmentation within an image, the image will be divided into four horizons such as matrix: a plotting of an image on x and y derivatives i.e. for pixels, I choose to work on a sliding window of 100 x 100 pixels. Thus, for the knife and gun detection purpose in an image of 400x400 pixels, the sliding window will start working from the top left pixel and will get testing for classification of each segment for the possibility of knife and gun.

C. Histogram Oriented Gradient Feature Extraction:

After developing a classification of 100 x 100 pixels' segments from one after another through a sliding window, in response to classification, the histogram oriented gradient feature will be counting each segment from x and y derivatives for next phase of a knife and gun detection. Once the counting of x and y derivatives are done, the 100 x 100 pixels' segments will be divided into cells of 8 x 8 pixels' rectangular blocks by comprising 64 pixels into each cell with the use of unsigned orientation within a range of orientation from 0-180.

D. Neural Network for Classification of Single Class:

As the understood fact, the classifiers are formed by the variable of training samples and the total of neurons in the hidden layer to define the proficiency of knife and gun detection with a high percentage of accuracy. These arrangements are divided into four classifiers: Classifier A, Classifier B, Classifier C, and Classifier D as shown in figure 5. For each hidden layer, the higher quantity of neurons increases process and calculation phase for testing and training (table 3).

a) *Classifier* A

- 20 neurons of first layer
- 30 neurons of second layer
- Positive images 3000
- Negative images 2200

b) *Classifier B*

- 25 neurons of first layer
- 35 neurons of second layer
- Positive images 3000
- Negative images 2200

c) *Classifier C*

- 45 neurons of first layer
- 40 neurons of second layer
- Positive images 1400
- Negative images 1000

d) *Classifier D*

- 45 neurons of first layer
- 40 neurons of second layer
- Positive images 300
- Negative images 200

Table 2. Dataset of Knife and Gun

Type	Training	Test
Positives Images	2400	1600
Negative Images	1900	1200

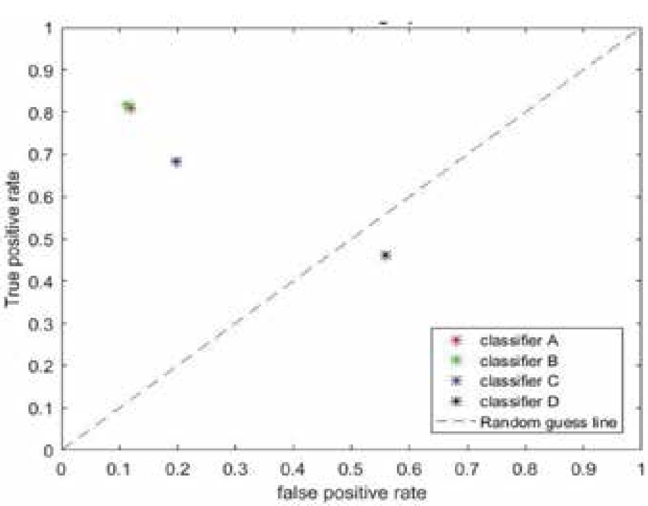

Fig. (5). ROC Graph

E. Detection of Knife and Gun

To detect the knife and gun from images and used the classifier B for knife and gun detection, the image taken from the google below mentioned figure 6 and table 2. Neural networks gave an output of "1" and identify the knife and gun from an image. The function of activation given the output of neuron with a threshold is 0.5. The function is identifying the knife and gun with the help of rectangle box in nearby the knife and gun in figure 7. The neural networks trained the value of 0.5 in between the value of “1”. The threshold is 0.7, the neural networks trained near to the value of “1”.

Fig. (6). Training Images

Fig. (7). Testing Images

F. Neural Networks Parameters

Table 3. Parameters of Guns & Knives

Parameters	Knife	Gun
Quantity of Layers	4	4
Quantity of Neurons in Layers	4100	2800
Quantity of Neurons in the First Layer	50	50
Quantity of Neurons in the Second Layer	60	60
Quantity of Neurons in Output Layer	1	1
Quantity of Iterations	180	160
Rate of Learning	0.05	0.05

V. RESULTS

For the results of this project, the first objective is image enhancement by using the Wiener filter to improve the quality of the image. The second objective is weapon detection such as knife and gun by using a sliding window for image segmentation than features extraction by using hog feature descriptor and classification of weapon detection by using neural networks.

A. Image Enhancement of Knife and Gun:

The first objective of our experiment is enhancing low-quality images by involving a filter of noise reduction that can improve the visual quality of a blurred image of a knife and gun in figure 8. The image enhancement process will be conducted by applying the Wiener Filter that filter can reduce the noise from an image with the absolute outcome.

Fig. (8). Image Enhancement of Knife and Gun

B. Detection of Knife and Gun

The 120x120 pixels sliding window are used to divide the segment from 640x480 pixels. The feature descriptor was considered the features of each divided segment by using histogram oriented gradient in figure 9. The image has shown the segment of hog feature value for knife and gun detection.

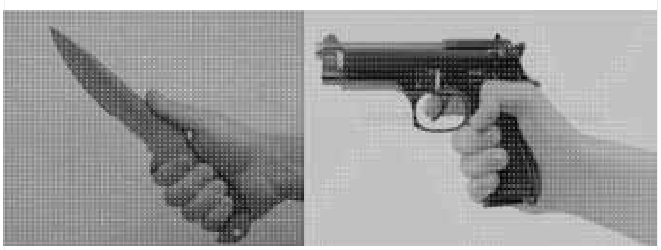

Fig. (9). HOG Descriptor of Knife and Gun

After the applied feature vector then it's considered for classifier C as an input of each segment of the image. The neural networks have trained (figure 10) the positive and negative images for knife and gun detection and each iteration for executing negative image for computing through the square mean error, and also each iteration for executing positive image for computing through a function of activation.

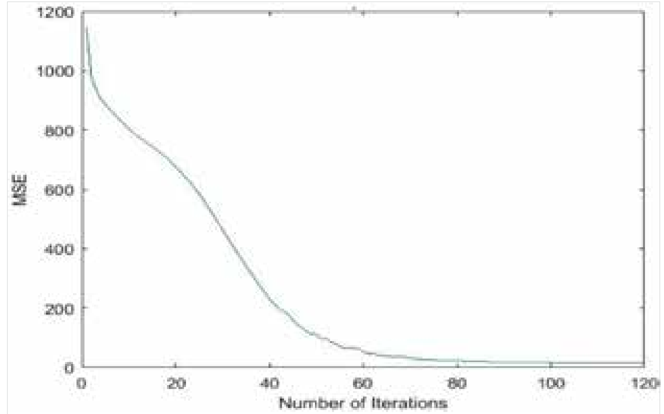

Fig. (10). Number of Iterations

Table 4. Confusion Matrix for Knife and Gun

Knife & Gun	Non-Knife and Gun	Total Percentage
2400	1900	71.25
42.94	25.56	85.45
760	720	66.65
60.25	66.25	55.26
89.21	65.29	75.60
56.56	21.98	35.71

The trained image of knife and gun is considered classifier C (table 4) for detection the knife and gun from an image with the help of rectangle box in surrounding the whole image (figure 11).

Fig. (11). Detection of Knife

VI. CONCLUSION

From the above results, I used the neural networks for making this project and it's more efficient than support vector machine. I also used some techniques such as image segmentation by using a sliding window, HOG feature extraction and Wiener filter of noise reduction for increasing the accuracy and performance of an artificial neural network.

Hence, the objection detection is a process that serves to detect an object within an image but influenced by different factors such as; enhancement, segmentation, features, and classification of the required object. It will take more time to train the algorithms and to Pre-process dataset. In the proposed approach for machine learning technique, the 60 - 40 split, 60 for training and 40 for testing have been applied.

VII. FUTURE WORK

In future, different classification algorithm for machine learning technique such as Support Vector Machine and Convolutional Neural Network can be used. Moreover, the object detection technique can be used for traffic signals to monitor the illegal activity and find their evidence against the forgeries for security reasons.

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