# Infrared Radiation Enabled Segmentation And Forensics

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***Abstract*—** This paper discusses the approach that discovers the suspiciousness of a suspected person and also perceives whether the suspicious person has concealed (hidden) firearm or not as well as evaluates its accuracy with the testimony of suspiciousness from IR image accurately and efficiently in order to save time in the confirmation of suspect while breaking down the barrier with the assurance by spotting the hidden weapon under suspected suspicious person's clothes with supervised machine learning, 2D convolutional neural network approach with a 3-by-3 layer for the intention of the detection of weapon and suspicious assessment measured under Digital Forensics.

**Keywords—**suspiciousness, weapon detection, digital forensics, neural networks, convolutional neural network (CNN**)**

## 1. INTRODUCTION

Artificial intelligence (AI)[1] is an extensive subdivision of computer science specifically focused on the development of intelligent technologies which are skillful to execute operations which usually involve human thinking and their intelligence. Generally, Infrared Enabled segmentation is the manner of segregating[2] a digital image into numerous subsections (pixels) and each of them have a label assigned, the same label pixel have the same colour appearance and it also implicates partition between foreground and background, centered on resemblances of colour and structures. To get somewhat significant as well as easiness in inspection is the main objective of Infrared Enabled segmentation through making simple modifications in the rending image. The newfound world of image data and its working is the blessing of Image segmentation which is constructed upon the extensive knowledge of object detection.

Traditionally, the investing carried followed the traditional forensics steps:

- Capture/Collection.
- Examine.
- Analysis/Investigation.
- Documentation.

These conventional steps of forensic[3] were a way to go for any investigation but a little drawback appears here as form capturing to documentation takes a lot of time in completion and hence results get a delay in the conformation of the suspect. So, to overcome this drawback the transformation of traditional forensics[4] take place which results in the birth of Digital Forensics which covers the following approaches:

- Capture/Collection.
- Examine.
- Analysis/Investigation.
- Preservation (Store and security)
- Documentation

## 2. PROBLEM STATEMENT

In today's environment of increment in crimes, the security is become more precious to everyone, as for which the investigation procedures are also transforming to advanced levels but some difficulties are still there. Here, we are addressing the difficulty of discovering the occurrence of weapons and suspiciousness in still pictures. The detection of suspiciousness of a person can be estimated through body posture but whether the suspected suspicious person is hiding a weapon under his clothes is still a barrier to security as for this the weapon detection under a person's cloth is yet to be assured. As for this, we are implying detection of weapons, specifically guns, covered under clothes through forensics[19] utilization in addition to segmentation entity

## 3. BACKGROUND STUDY

1 Using Infrared Imaging Technology for Concealed Weapons Detection and Visualization This proposed method shows that the image of mm-wave length optimizes superior data of covered weapons and this image was captured by the sensor and CV techniques. Some restrictions appeared concerning hardware and implementations.[5]

2 Computer Vision-Based Human Body Segmentation and Posture Estimation The algorithm which proposes the determination of threshold in pair of frames as well as dissimilarity in background.

The shadow in pictures and the composite scene in frames of static images impact the outcome [6].

3 An End-to-End Human Segmentation by Region Proposed Fully Convolutional Network The new methodology for segmentation through FCN is put forward which is put together with an end-to-end network with the extension of recognition of the person. The borderline of the segmented entity is uneven [7].

4 Multi sensor of thermal and Visual Images to Detect Concealed Weapon Using Harmony Search Image Fusion Approach Proposed method to discover covered weapons centered on fusion images of graphic as well as electromagnetic images for identification of weapons by K means SVM algorithm. Additional development and improvement are required [8].

5 A survey on instance segmentation: state of the art The indication of semantic segmentation technique which provides finer accuracy and efficient outcome. Recognition of objects through numerous scales is quite challenging [9].

6 Firearm Detection and Segmentation Using an Ensemble of Semantic Neural Networks Come up with a system of recognition of weapon along with its positioning through a Semantic Neural Network. Development needs to be done to train the system with further rifle's constituent dataset [10].

7 Identifications of a concealed weapon in a Human Body Newly proposed fusion algorithm of RGB with its corresponding Infrared image by capturing emitting radiation. With the loose clothes, the radiation tends to be extended which act as a barrier for capturing weapon in IR image [11].

8 Image Segmentation Based Privacy-Preserving Human Action Recognition for Anomaly Detection This method is constructed on RGB data and carries sufficient info to define top activities efficiently.

More development is necessary for a complete measure of AD-associated information [12].

9 Pose2Seg: Detection Free Human Instance Segmentation Newfound segmentation structure for humans which splits occurrences centered on human pose with improved accuracy and improved control over the blockage. Fewer components result in the fewer capability of learning, and additional components result in slight learning capability 13].

10 People Identification in Surveillance and Forensics The multidimensional categorization is introduced as a solution to the previous problem and resolves challenges of re-identification. More work needs to be done [14].

11 Image Segmentation Using Convolutional Neural Network The methodology for segmentation through CNN through 3-D images with the value of RGB intensity, helps to decrease computation time. Only colour images show the best result [15].

12 A Comparative Study of Background Segmentation Approaches in Detection of Person with Gun under Adverse Weather Conditions Different class valuation matrices is utilized for the assessment of the execution of state-of-the-art approaches. Flaws are still there to resolve along with the advancement of detection of gun lone [16].

13 Concealed Weapon Detection Using Millimeter Wave Technology and Image Fusion Algorithm Detecting weapons from luggage, as luggage has a high possibility for keeping the weapon under wraps from x-ray images by fuzzy KNN. More work needs to be done to improve for consumption outsized storage [17].

14 Pose2Body: Pose-Guided Human Parts Segmentation The methodology put forward for body portion segmentation centered on posture view outcomes. Future work to currently perform posture estimation in addition to semantic categorization [18].

## 4. OBJECTIVES

The main objective of this project is to assist the forensics as well as investigation[20] procedure to advance level by opening away to find out and be assured of whether the suspected person is suspicious as well as is armed (hiding a weapon)[24] or not specifically gun, simply through still pictures with the forensics utilization and machine learning technique.

The objective will be achieved through:

- Forensics inspection.
- Incident inspection.
- Spotting of the weapon through segmentation.
- Construct and deploy the neural network to identify weapons [25].

## 5. SIGNIFICANCE, SCOPE AND LIMITATIONS

Our project has great significance in Digital Forensics by making a new approach to finding suspiciousness for security purpose. As far as artificial intelligence and machine learning will evolve and emerge the scope of our project will also evolve and emerge as well as will adapt more and more advancement side by side with them. The limitation of our project is that:

- Doesn't support the video feature.
- Fails to imply live surveillance video.
- The new weapon won't be classified and recognized unless the model is re-trained with the new dataset.

## 6. METHODOLOGY

### *6.1 Proposed Architecture*

For our project, the methodology which we will acquire is a Convolutional Neural Network, the essential component of machine learning [23], shown in Figure 1. The important components in the architecture of Convolutional Neural Network are:

#### *6.1.1 CONVOLUTIONAL LAYER*

The core building block of a CNN is a convolutional layer which performs the most-heavy lifting process like feature extraction, and edges identification, using a 3-dimensional kernel also called a filter of a certain size, which is made up of a group of neurons. A convolutional layer makes sure that the image is of standard size. To perform a convolutional of the kernel with the image, we centre our kernel over the pixels of the image, take each corresponding pixel and kernel value, multiply them together, sum the whole thing up and then assign it to the corresponding pixel in the convoluted image.

#### *6.1.2 MAX POOLING LAYER*

Pooling layer act as the passage of connecting the Convolutional Layer and the Fully Connected layer. The pooling layer can either be Max or Average. For our project, we will acquire Max Pooling. The feature map from the previous layer is reduced in size in this layer in order to manage computing expenditures. Max pooling specifically focuses on the greatest bit in the feature map. The other use of pooling layers is to control overfitting. The most used pooling layer has filters of size 2 x 2 with a stride 2. This effectively reduces the input to a quarter of its original size.

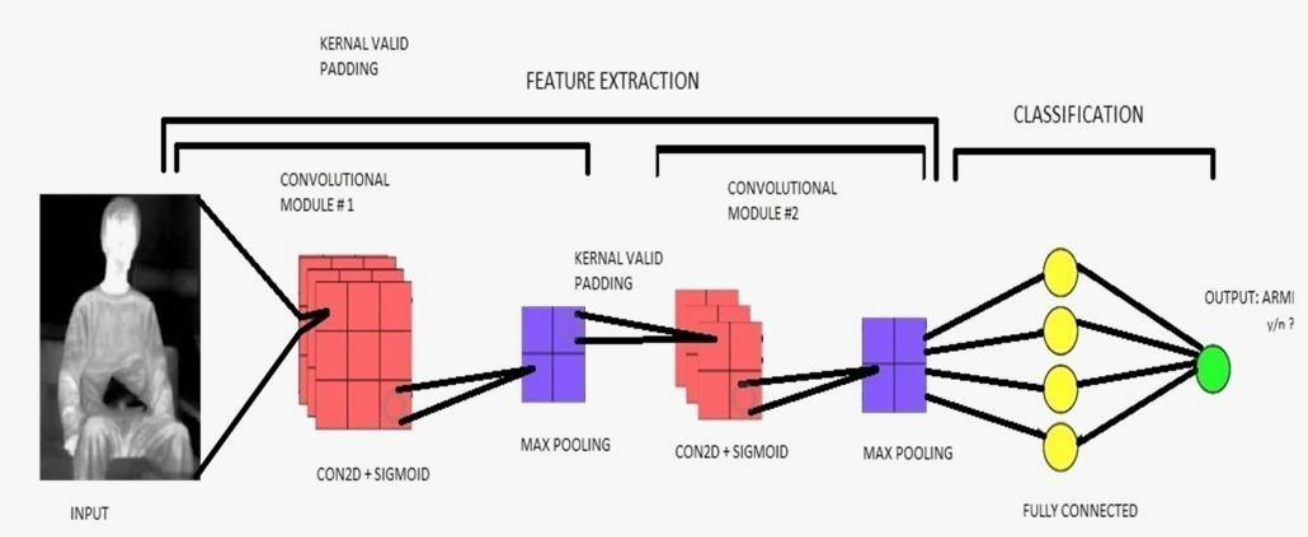


Fig.1. Architecture of proposed methodology

### *6.1.3 ACTIVATION FUNCTION*

Activation Function is a significant function in Convolutional Neural Network, activation function is responsible to decide which info should be forwarded in-network, and which one should not. For our project, we will acquire a sigmoid. The range of sigmoid function varies from 0.0 to 1.0. By standard 0 = off and 1 = on, whereas it can vary as per input. Sigmoid is mainly significant for probability prediction, as shown in Figure 2.

### *6.1.4 FULLY CONNECTED DENSE LAYER*

A fully connected Dese layer is said to be the output layer in which each neuron of one layer is linked with each neuron of the second layer. This layer is mainly concerned with the classification whereas the dense layer mainly concentrates on the accurateness of output with the help of enormous neurons present in the dense layer.

## 7. PROCESS MODEL

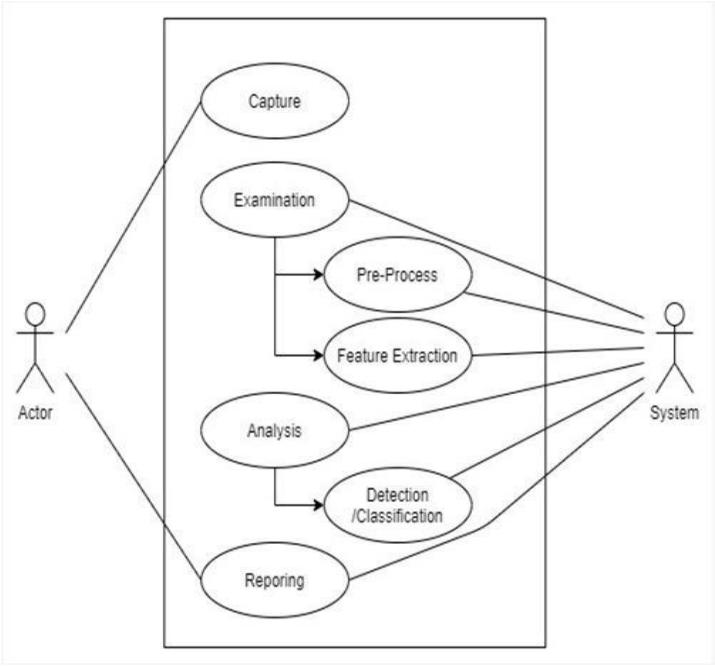


Fig.2. Flow control of proposed architecture

1. 2D Convolutional Neural Network with 3-by-3 layer.

2. Kernel/Filter is the range of weights which must be lesser than input picture data. In the Convolutional layer, dotproduct/scalar-product is carried out between input pictures and filter which results in a 2D array known as a Feature map, the output of the convolutional layer.

3. The range of sigmoid function varies from 0.0 to 1.0. By standard 0 = off and 1 = on, whereas it can vary as per input. Sigmoid is mainly significant for probability prediction.

## 8. CONCLUSION AND FUTURE WORK

This paper discusses the application of forensics along with the investigation procedure, we proposed an approach to assure that the suspected person is hiding a weapon (specifically a gun) or is an unarmed person. This approach will be achieved by the application of a Convolutional Neural Network, an exclusive part of Machine Learning. However, in future work, the proposed system will be extended to classify all different kinds of weapons and the integration of the proposed algorithm, and the system will also be deployed over video-based features for real-time environment investigation and forensics.

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