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Privacy Preservation and Monitoring System for AAL using Deep Learning via Bodypix.

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Abstract: **As the world is moving towards modernization, there are a plethora of threats regarding an individual's privacy. We have to move forward in every sector but with efficient security measures. Taking the health sector into account the factor of privacy cannot be neglected as there is persistent monitoring of patients through humans and hence there are chances of leakage of personal information. One of the most efficient ways to perform this action can de be done through continuous surveillance in a digitalized way through CCTV's. Mainly this project focuses on the elderly who cannot look after themselves and are kept at a secured place. This method will be cost- efficient because as a part of the hardware setup there will be a surveillance camera only with all the basic functionalities to monitor. This project aimsto keep the privacy of an individual unhampered and also letting the resource person know about any emergency caused during monitoring in the real-time environment. The task ofproviding the notification will be done through an intermediate module and necessary action will be taken. It intends to provide more options for the health organizations that take charge to look after people. The above methodology will be very much accurate and will be able to define real-time segmentation.**

Keywords: Ambient Assisted living, convolutional neural network, Surveillance, Segmentation.

I. INTRODUCTION

Ambient assisted living (AAL) can be well-defined as "the use of information and communication technologies (ICT) in a individual's daily living and working environment to allow them to stay active longer, remain communally associated and live independently into old stage"[1]. The Ambient Assisted Living is a sub-part of the Ambient Intelligence. Ambient assisted living is an emergent drift in which artificial intelligence allows the habit of new products, services, and processes that support to offer safe, high-quality, and autonomous survives for the delicate and elderly. Due to underlying health issues, features of everyday living can develop physically and mentally challenging for them. Technology can provision day-to-day communication and be combined in the health care of older citizens, which are both vital to ensure their health and happiness. Surveillance is the main factor when dealing with looking after people but privacy preservation must not be compromised with it. The capturing frames through CCTV will be in a stable format as the mobility factor does not come into account [2]. The primary focus will be to segment the specimen from the surrounding environment and notify in case of any emergency. The segmentation process can be done using the body pix module of Tensor flow.js which can locate the mobility of the object while running in real-time. The approach follows the flow of convolutional neural networks adding more info in each step in the process of segmentation. Getting into the workflow the optimization with the above algorithms can result in a better output. The segmented frames now can be modulated in a structured way having the values in the form of graphs and tabular format. As a result of this, an emergency alert will be provided and necessary steps for it can be taken. As per AAL system diagram mention. [11]

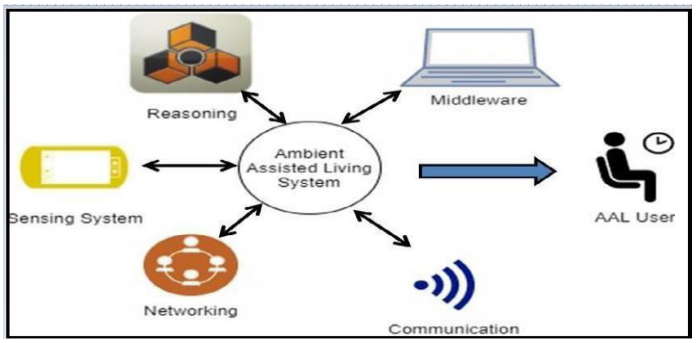


Figure 1.1 : AAL System.

II. RELATED WORK

A. *Stage -1*

Segmentation and blurring:Bodypix 2.0 an open-source machine learning module provided by TensorFlow.js deals with the real-time biomechanics of the entity and accurately provides the coordinates for various body parts with multiperson support . The main aim is to get computationally efficient segmentation without compromising the accuracy factor. For this purpose, a webcam app made using ReactJs is modulated in which BodyPix is loaded which does the task of differentiation of the person and background using the drawBokehEffect function.[10]. Different layers of processing include collecting the frames and disintegrating them and finally segment the person from the background. It also performs the task of replacing the pixels that do not depict the person by changing the pixel magnitude. This is based upon the convolutional neural network which helps in the classification of the pixels into person and non-person. The pixel value ranges from 0 to 1 for the entity and -1 for the rest of the background by using the estimate Part Segmentation API for an image as well as video. Also, they can be depicted using different colors. The architecture can vary according to the used devices it can be MobileNetV1 or ResNet50 based on the GPUs. Although Resnet gives better results. The model is trained to capture 24 different body parts so for each image position there are different channels in the TensorFlow model from which optimal body id is picked [10].

Generalized form:

body_id=max_probabliity(i)[(x,y)]

where i=[0 to 23] and x and y are the coordinates.

B. *Stage -2*

Notification:

The pace of the model can also be increased by using the mobileNetMultiplier which corresponds to the MobileNetArchitecture. The unwanted actions will then be detected and based on the confidence score using the {{ML model}} notification will be provided on the basis of the threat level.

III. SYSTEM ARCHITECTURE

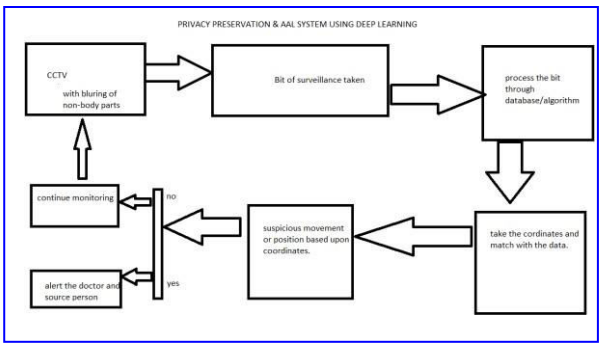


Figure 2.1: System Architecture.

A. *Use Case*

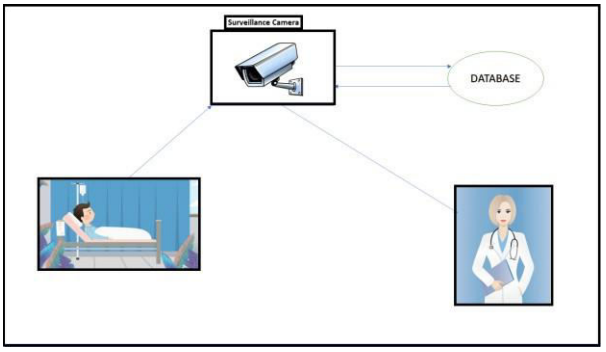
- Scenario for privacy :

If we consider a example like an patient who is isolated, old or a person who needs a medical attention is kept under CCTV surveillance at home. So CCTV captures everything around the patient and it reveals his/her privacy [2]. It is harmful because it gives many other unnecessary information to the doctor or third person. Now in this case our body pix model comes to use as it blurs the non-body parts and gives only proper footage of patient. It helps in privacy preservation and gives a focused view on patient.

- Scenario for alerting the care taker and doctor :

As we seen that surveillance helps on monitoring patient in previous section. So our next part is to alert doctor and care taker for unusual action of the patient. For this we have to train a model based on keypoints of body parts. Now, Keypoints Coordinates will be our input and it will determine the state of the patient. If the patient is having some trouble then the situation will be classified based upon the predetermined danger levels[10].

Danger levels will be categorized on the severity of the action. The levels will be as follows



- Level 0 : Healthy and normal behavioural state.
- Level 1 : Slight symptoms like headache, joint pain ,etc.
- Level 2 : Unusual actions from patient like having a heart pain or heart attack, etc.

Figure 2.2 : Purpose System

B. *ALGORITHM USED :*

a) Bodypix:
As specified earlier, the proposed model makes use of BodyPix model.

- In BodyPIx we use the ResNet50 neural network model.
- Residual Network (ResNet50) consist of 48 Convolution layers along with 1 MaxPool and 1 Average Pool layer. So the results are more accurate.
- It will help us to identify the coordinates of 24 body parts. so we could get more accurate results of body parts coordinates with highest confidence score[10].

b) CNN:

For alerting purpose, We need to classify the classes according to the threat levels. Here comes the use of CNN, Input will be given from the output of bodypix model.

- We will select parameters, apply filters with strides, padding if requires & do convolution on the input to apply on ReLU activation to the matrix.
- We will consider pooling to reduce dimensionality size in CNN.
- We will add classes layers until the results are satisfied.
- Flatten the output from the layers and feed into a fully connected layer
- Output will be in one of the given classes i.e. one of the threat level(0,1,2) [5].

IV. EXPECTED RESULT

In our proposed experiment, CCTV must properly give the surveillance. Our model should work smoothly with accuracy considering minimum time. BodyPix model should provide the body parts coordinates with higher confidence score. Our CNN model should classify the threat levels of the person who is isolated. So these are the results expected from our proposed experiment.

V. CONCLUSION

As per the current experiment, we will cover the privacy part of AAL patients. We will be also determining the threat level of the person. So that health care facilities will be provided to the customer as soon as possible.

VI. REFERENCE

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