

HUMAN ACTION RECOGNITION USING OPEN COMPUTER VISION CLASSIFIERS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in
Electronics and communication Engineering

by

YATHAPU MANOJ KUMAR REDDY (Register No. 37130452)



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **YATHAPU MANOJ KUMAR REDDY** (Reg. No. 37130452) who carried out the project entitled "**HUMAN ACTION RECOGNITION USING OPEN COMPUTER VISION CLASSIFIERS**" under our supervision from December 2020 to April 2021.

Dr.T.Vinod M.E. ,Ph,D., Internal Guide

Dr. RAVI M.E., Ph.D., Head of the Department

Submitted for Viva voce Examination held on_____

Name:

Signature:

Internal Examiner

External Examiner

DECLARATION

I **YATHAPU MANOJ KUMAR REDDY** (Reg. No. 37130452) hereby declare that the Project Report entitled “**HUMAN ACTION RECOGNITION USING OPEN COMPUTER VISION CLASSIFIERS**” done by me under the guidance of **DR.T.VINOD** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and communication Engineering.

Y.MANOJ KUMAR REDDY

DATE:

PLACE:

SIGNATURE OF THE CANDIDATES

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ABSTRACT

Human activity recognition (HAR) aims to recognize activities from a series of observations on the actions of subjects and the environmental conditions. The visionbased HAR research is the basis of many applications including video surveillance, health care, and human-computer interaction (HCI). This review highlights the advances of state-of-the-art activity recognition approaches, especially for the activity representation and classification methods. For the representation methods, we sort out a chronological research trajectory from global representations to local representations, and recent depthbased representations. For the classification methods, we conform to the categorization of template-based methods, discriminative models, and generative models and review several prevalent methods. Next, representative and available datasets are introduced. Aiming to provide an overview of those methods and a convenient way of comparing them, we classify existing literatures with a detailed taxonomy including representation and classification methods, as well as the datasets they used. Finally, we investigate the directions for future research.

TABLE OF CONTENT

	CHAPTER NO.	TITLE PAGE NO
1	INTRODUCTION	1
1.1	AIM OF THE PROJECT	3
1.2	EXISTING SYSTEM	3
1.3	PROPOSED SYSTEM	4
2	LITERATURE SURVEY	5
3	AIM AND SCOPE	7
3.1	BLOCK DIAGRAM	7
3.2	2D SILHOUSETTS AND SHAPES	9
3.3	OPTICAL FLOW	10
3.4	3D SPACE TIME VOLUMES	11
3.5	DESCRETE FOURIER TRANSFORM	12
3.6	LOCAL REPRESENTATION	13
3.7	LOCAL DESCRIPTOR	14
3.8	FUTURE ENCODING METHODS	14
3.9	DEPTH BASED REPRESENTATION	15
3.10	REPRESENTATION ON DEPTH MAPS	16
3.11	SKELETON BASED REPRESENTATION	17

4	MATERIALS AND METHODS USED	19
4.1	IMAGE PROCESSING	19
4.2	PRE PROCESSING	19
4.3	EDGE DETECTION	20
4.4	THRESHOLDING	20
4.5	SEGMENTATION	21
4.6	SEGMENTATION TECHNIQUES	21
4.7	OPEN CV	22
4.8	PYTHON	22
4.9	SNAP SHOT	23
5	CHALLENGES OF THE RECOGNITION SYSTEM	24
6	CONCLUSION AND RESULT AND	22
	FUTURE RESULT AND SCOPE	
	RESULT	26
	CONCLUSION	28
	FUTURE SCOPE AND DIRECTION	29
7	REFERENCES	32

LIST OF FIGURES

FIGURE NO	TITLE	PAGENO
3.1	BLOCK DIAGRAM OF THE PROJECT	8
3.2	IMAGE COLLECTION OF HUMAN ACTION RECOGNITION	8
3.9	CAMERAS AND THEIR COLOUR IMAGES DEPTH MAPS ,SKELETAL INFORMATION	18
3.11	NOISY SKELETAL PROBLEM CAUSED BY SELF CONCLUSION	18
4.9	SNAP CHAT IMAGE	23
5	5(a) UBUNTU SOFTWARE	27
	5(b) CODE FOR GMAIL ALERT	28
	5(c) CODE FOR FACE DSETECTION	28
	5(d) FACE DETECTION	28

CHAPTER 1

INTRODUCTION

Human activity recognition (HAR) may be a wide studied pc vision drawback. Applications of HAR embrace video police investigation, health care, and human- computer interaction. because the imaging technique advances and also the camera device upgrades, novel approaches for HAR perpetually emerge. This review aims to produce a comprehensive introduction to the video-based act recognition, giving an outline of assorted approaches likewise as their evolutions by covering each the representative classical literatures and also the progressive approaches.

Human activities have associate inherent hierarchical data structure that indicates the various levels of it, which might be thought-about as a three-level categorization. First, for very cheap level, there's associate atomic component and these action primitives represent additional advanced human activities. once the action primitive level, the action/activity comes because the second level. Finally, the advanced interactions type the highest level, that refers to the human activities that involve quite 2 persons and objects. during this paper, we tend to follow this three-level categorization particularly action primitives, actions/activities, and interactions. This three-level categorization varies a touch from previous surveys [1–4] and maintains a standardized theme. Action primitives ar those atomic actions at the limb level, like “stretching the left arm,” and “raising the proper leg.” Atomic actions ar performed by a selected a part of the bod, like the hands, arms, or higher part [4]. Actions and activities ar used interchangeably during this review,

touching on the whole-body movements composed of many action primitives in temporal successive order and performed by one person with no additional person or extra objects. Specifically, we tend to refer the word human activities as all movements of the 3 layers and also the activities/actions because the middle level of human activities. Human activities like walking, running, and waving hands are classified within the actions/activities level. Finally, almost like Aggarwal et al.'s review [2], interactions are human activities that involve 2 or additional persons and objects. the extra person or object is a crucial characteristic of interaction. Typical samples of interactions are preparation that involves one person and varied pots and pans and arousal that's performed by 2 persons.

This review highlights the advances of image illustration approaches and classification strategies in vision-based activity recognition. Generally, for illustration approaches, connected literatures follow a search flight of world representations, native representations, and up to date depth-based representations (Figure 1). Earlier studies tried to model the full pictures or silhouettes and represent human activities during a world manner. The approach in [5] is an example of world illustration within which reference system shapes are generated because the image descriptors. Then, the emergence of reference system interest points (STIPs) projected in [6] triggered vital attention to a replacement native illustration that focuses on the informative interest points. Meanwhile, native descriptors like bar graph of orientated gradients (HOG) and bar graph of optical flow (HOF) orientated from visual perception are widely used or extended to 3D in HAR space. With the upgrades of camera devices, particularly the launch of RGBD cameras within the year 2010, depth image-based

representations are a replacement analysis topic and have drawn growing concern in recent years.

1.1 AIM OF THE PROJECT

Identifying someone with a picture has been popularised through the mass media. However, it's less strong to fingerprint or tissue layer scanning. This report describes the face detection and recognition mini-project undertaken for the beholding and autonomy module at Plymouth University. It reports the technologies out there within the Open-Computer-Vision (OpenCV) library and methodology to implement them victimization Python. For face detection, Haar-Cascades were used and for Human recognition chemist faces, Fisher faces and native binary pattern histograms were used.

1.2 EXISTING SYSTEM

Thus, this work aims at coming up with and evaluating a sensible disk system for unmoved face recognition through a weightless artificial Neural Network (WNN) co-processor designed in High-Level Synthesis (HLS) and enforced within the system's FPGA.

- Although the co-processor is employed for face recognition functions, it are often utilized by any application that must use artificial neural networks. Extensive performance, circuit-area, energy consumption and network latency results shows that the coprocessor will with efficiency learn and acknowledge faces quicker than the system's

1.3 PROPOSED SYSTEM:

This paper describes the mini-project for perception and autonomy module. Next, it explains the technologies employed in the project and also the methodology used. Finally, it shows the results, discuss the challenges and the way they were resolved followed by a discussion. victimization Haarcascades for face detection worked very well even once subjects wore spectacles. Real time video speed was satisfactory likewise empty noticeable frame lag. Considering all factors, LBPH combined with Haarcascades may be enforced as a price effective face recognition platform. associate example could be a system to spot famed troublemakers in an exceedingly mall or a grocery to supply the owner a warning to stay him alert or for automatic attending taking in an exceedingly category.

CHAPTER 2

LITERATURE SURVEY

For many years human action recognition has been studied well. Most of the action recognition methods required to manually annotate the relevant portion of the action of interest in the video. In the recent years it has been studied that the relevant portion of action of interest can be found out automatically and recognize the action. We can review the action the recognition methods.

A. ACTION RECOGNITION

For representing video feature trajectories have shown efficiency .but the quality and quantity of these trajectories have not sufficient. As the use of dense sampling came popular for image classification wang et al.[1] proposed to use dense trajectories for representing videos. dense points for each frame are sampled and traced them based on displacement information. For improving the performance wang et al.[2] takes into account the camera motion. The camera motion is estimated by matching the feature points between the frames by using the SURF descriptors and dense optical flow. Another approach [3] aimed at modeling the code words derived from local patch trajectories and therefore does not require accurate foreground background separation and proposed another method for finding the informative reasons . They used Saliency mapping algorithms . As a new method this paper proposes using a joint learning framework from learning spatial and temporal extents of action of interest.

B.ACTION DETECTION

Recognition was performed using the mahalanobis distance between the moment description of the input and each of the known actions .Recent popular methods which employ machine learning technique such as SVMs and AdaBoost provide one possibility for incorporating the information contained in a set of training examples. [4] introduces the Action MACH filter ,a template based method for the action for action recognition which is capable of capturing intraclass variability by synthesizing a single action.

Another method is proposed in [5] multiple instance learning framework, named smile SVM (Simulated annealing Multiple Instance Learning Support Vector Machines), is presented for learning human action detector based on imprecise action location. Wang et al.[6] used a figure centric visual word representation in that localized is treated as latent variable so as to recognize the action. A spatio temporal model is learned .During the training seven model parameters is estimated and the relevant portion is identified [8] proposed on independent motion evidence for feature for distinguishing human actions from background motion .

Most of the methods require that the relevant portion of the video has to be annotated with bounding boxes .Human intervention was tedious and then a model was generated that identify the relevant sub group.

This paper introduce a method that learns both spatial and temporal extents for detection improvements .Dense trajectory here used as local feature to represent

human action.

CHAPTER 3

AIM AND SCOPE

3.1 BLOCK DIAGRAM:

Identifying an individual with a picture has been popularized through the mass media. However, it's less sturdy to fingerprint or tissue layer scanning.

This report describes the face detection and recognition project undertaken for the beholding and autonomy module at Plymouth University.

It reports the technologies offered within the Open-Computer-Vision (OpenCV) library and methodology to implement them exploitation Python.

For face detection, Har-Cascades were used and for Human recognition chemist faces, Fisher faces and native binary pattern

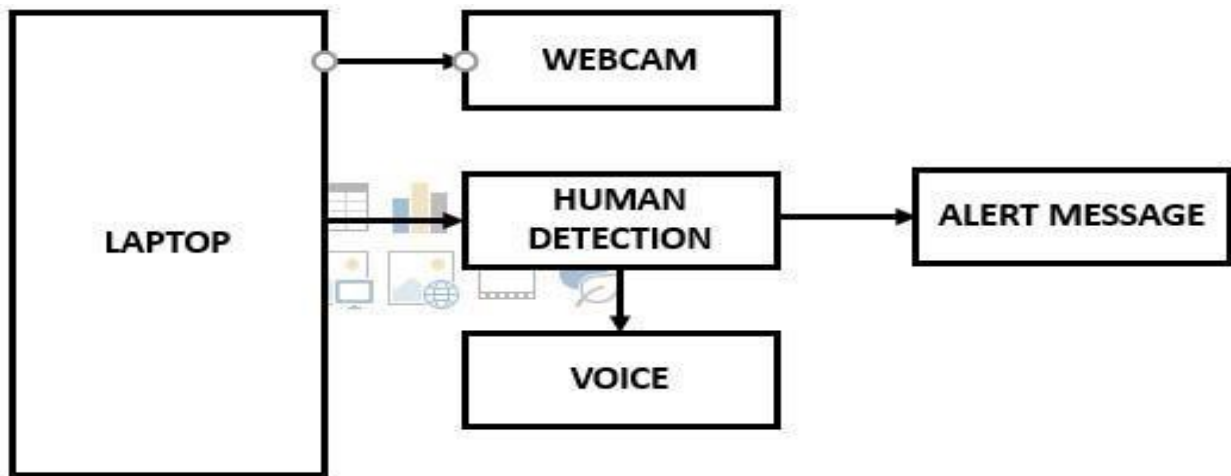


Fig 3.1 Block diagram of Human action recognition

HUMAN RECOGNITION:

IMAGE COLLECTION:

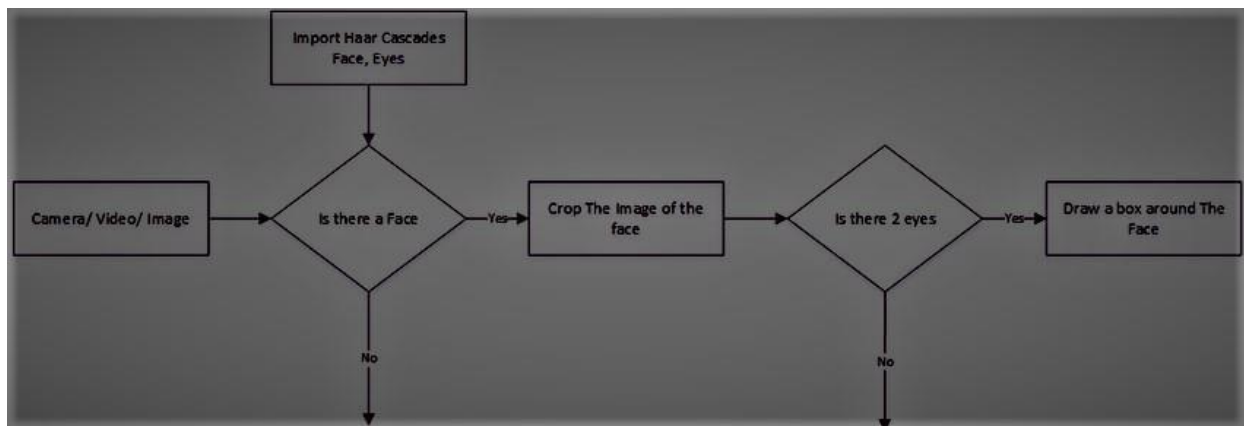


Fig 3.2 Image Collection of Human action recognition

Global representations extract world descriptors directly from original videos or pictures and write in code them as an entire feature. during this illustration, the human subject is localized and isolated exploitation background subtraction strategies forming the silhouettes or shapes (i.e., region of interest (ROI)). Some

world approaches write in code ROI from that they derive corners, edges, or optical flow as descriptors. different silhouettebased world illustration strategies stack the silhouette image on the time axis to make the 3D frame of reference volumes, then the volumes square measure utilised for illustration. Besides, separate Fourier rework (DFT) takes advantage of frequency domain data of ROI for recognition, conjointly being a world approach. world illustration approaches were principally projected in earlier works and step by step noncurrent thanks to the sensitiveness to noise, occlusions, and viewpoint changes.

3.2.2D SILHOUSTTESAND SHAPES

To recognize the human activities in videos, associate intuitive plan is to isolate the body from the background. This procedure is named background subtraction or foreground extraction. The extracted foreground within the HAR is named silhouette, that is that the region of interest and delineate as an entire object within the international illustration approach • Soil wetness device. scheming the background model is a crucial step before extracting silhouettes. Wren et al. [11] 1st planned to model the background scene with statistical distribution. Koller et al. [12] acknowledged that some foreground values update unduly and so they introduced the selective background update strategy. Stauffer and Grimson [13] planned to model the prices of a selected background component as a mix of Gaussians to interchange the strategy of exploitation just one Gaussian value within the previous approach. The Gaussian mixture model (GMM) has been applied wide however the introduction of expectation maximization (EM) formula will increase the process value. to cut back the value, k-means clump formula is employed to interchange the EM formula with associate insignificant loss of accuracy. it's value mentioning that current RGBD

cameras build it straightforward to get the

silhouette by exploitation the depth information provided by depth sensors.

- • Besides the silhouette illustration, the second form of the silhouette will be used as a feature likewise. Veeraraghavan et al. [14] emphasised the effectiveness of form options. In their experiments, form and mechanics that square measure being thought of as 2 necessary cues in human motion were evaluated. Tests on each the gait-based human identification and also the activity recognition indicate that form plays a a lot of necessary role.

Veeraraghavan et al. then used this form illustration in their following work [15]

3.3 OPTICAL COLUMN

The figure three.2 is associate aurdino board that is that the best user friendly board to urge started with physics likewise as committal to writing. If this is often your terribly initial expertise with this platforOptical flow is a good thanks to extract and describe silhouettes for a dynamic background. Lucas-KanadeTomasi (LKT) feature hunter [22, 23] will be accustomed acquire the optical flow. Lu et al.

[24] used a LKT feature hunter approach to trace joints in key frames and actual frames. every activity is delineated as a posture sequence, and every key posture is recorded in a very key frame. Specific posture in actual frames will be recognized by finding correspondence between the particular and key frame. The recognized posture from the particular frame is compared to the key posture frame by mapping body locations, and therefore the matched posture sequences area unit confirmed because the activity.

For recognizing human activities at a distance (i.e., the soccer broadcast

video), Efros et al. [10] introduced a descriptor supported computing the optical flow to

explain the “small” soccer players in person-centered pictures. Obviously, the background is dynamic because of the movement of players that makes it arduous to model for background subtraction.

Tran and Sorokin [25] combined silhouettes and optical flow options along. Normalized bounding box is scaled to capture the region of the chassis, and therefore the optical flow measurements among the box area unit split into horizontal and vertical channels, whereas the silhouette offers the third channel. Subwindows area unit additional divided to calculate histograms, and concatenating histograms of all three channels type the ultimate destructor.

In the figure 3.3 it shows that there are many types of Arduino boards in the world in which many of them were third party compatible versions. The most official versions available are the Arduino Nano V3 and An activity video can be seen as a series of images that contain activity sequences. Concatenating all frames along the time axis forms

3.4 3D SPACE TIME VOLUME(STV'S)

3D coordinate system volume (STV) that has 3 dimensions together with 2 abstraction dimensions X and Y and one temporal dimension T.

Representations supported STVs expect to capture the extra dynamic info that the abstraction illustration ways cannot acquire because of the absence of your time dimension. Constructing STVs for various activities may be a world illustration technique. However, the STV typically combines with native options to make the ultimate feature sets. Blank et al. [5] 1st

introduced the coordinate system form to

represent human activities. coordinate system form is obtained by solely stacking the silhouette regions inside pictures. However, because of the nonrigidity of the created 3D coordinate system shapes and inherent distinction between house and time dimensions, ancient 3D form analysis can not be applied to the coordinate system activity shapes. Thus, the answer of the Poisson equation is employed to derive native coordinate system strikingness and orientation options. Achard et al.

[26] generated semiglobal options named coordinate system small volumes from image sequence to traumatize performances of differentIn [28], the input videos square measure metameric into coordinate system volumes mistreatment mean shift agglomeration technique. These oversegmented regions, that square measure termed “supervoxels,” square measure then matched employing a projected shape-matching technique, that is compared to the standard silhouette matching ways. in contrast to the previous silhouette-based approaches, the projected shapebased illustration doesn't need background subtraction nor specific background models. To avoid the shortages of {the form|the form}-matching ways that square measure ignoring options within the shape, Shechtman and Irani’s flow- based options [27] square measure any incorporated. temporal durations. impelled by seeking the common underlying induced motion fields of sequences of an equivalent behaviors, Shechtman et al. [27] projected AN approach to check volumes in step with their patches.

3.5 DESCRETE FOURIER TRANSFORM (DFT)

The DFT of image frame is another world feature that contains the intensity data

of the foreground object (i.e., the region of the subject's body) on condition
that

the foreground object intensity is completely different from the background. Kumari and Mitra [29] took advantage of this hypothesis and planned a DFT-based approach, getting data concerning the geometric structure of the abstraction domain foreground object. Normalized image frame is split into tiny size blocks inside that the common of all the DFT values is calculated. Finally the K-nearest neighbor (KNN) is applied to classify the DFT options and generate the activity classification result. The extracted DFT feature is novel compared to the previous work; but, its performance is restricted to easy backgrounds. The background in their check video datasets is sort of blank.

3.6 LOCAL REPRESENTATION

Instead of extracting the silhouette or STV and coding them as an entire, native representations method activity video as a set of native descriptors. They specialize in specific native patches that square measure determined by interest purpose detectors or densely sampling [30]. Most existing native options square measure welltried to be sturdy against noise and partial occlusions comparison to world options. native options square measure then ordinarily combined with the bag-of- visual-words (BoVW) model and yield the final pipeline of current progressive native illustration approaches [31]. headed from bag-of-words (BoW), BoVW-based native illustration chiefly contains four steps: feature extraction, codebook generation, feature coding, and pooling and social control. we tend to follow [32] and state a conventional BoVW pipeline here: interest points and native patches square measure initial obtained by detectors or densely sampled. Then native options square measure extracted from those interest points or patches. Next, a visible lexicon (i.e., codebook) is learned in coaching set by k-means or Gaussian mixture model (GMM), the initial high-dimension descriptors square measure clustered, and also the center of every cluster is thought to be a visible codeword. After that, native options square measure encoded and pooled. Finally, the pooled vectors square measure

normalized as video illustration. Among these steps, the

event of additional intricately designed low-level options and additional subtle coding ways square measure the 2 chief reasons for the nice achievements

3.7 LOCAL DESCRIPTORS

Local descriptors ar designed to explain the patches that sampled either densely or at the interest points [1]. Effective descriptors ar thought-about to be discriminative for the target human action events in videos and sturdy to occlusion, rotation, and background signal. Laptev [41] portrayed their 3D Harris corner by computing native, spatiotemporal N-jets because the descriptor. The descriptor is scale-invariant since they estimate the spatiotemporal extents of detected events by maximising a normalized spatiotemporal Laplacian operator over abstraction and temporal scales. Moreover, the projected descriptors ar proven to be sturdy to occlusions and dynamic untidy backgrounds within the human motion analysis. Similar to works of extending 2nd interest purpose detector into spatiotemporal domain, like the Harris corner detector [34] and also the extended spatiotemporal one [41], several spatiotemporal descriptors were projected by extending mutual image descriptors yet. we tend to shortly review these works as well as each the initial abstraction descriptors and also the spatiotemporal version of them.

3.8 FUTURE ENCODING METHODS:

The STIP-based descriptors or alternative intricately designed descriptors ar all referred as native options. native options ar then encoded with feature encryption strategies to represent activities and also the encoded options ar later fed into pretrained classifiers

(e.g., SVM) [32]. encryption feature may be a key step for constructing BoVW illustration associate degreeed utilizing an acceptable encryption technique will considerably improve the popularity accuracy [56]. Here, we tend to summarize the common feature encryption strategies in recent

literatures in Table a pair of. the

amount of citations for every description paper is additionally provided to facilitate mensuration of their influence

3.9 DEPTH BASED REPRESENTATION

Previous analysis of HAR primarily concentrates on the video sequences captured by ancient RGB cameras. Depth cameras, however, are restricted because of their high value and quality of operation [74]. due to the event of low-priced depth sensors like Microsoft Kinect [75], a reasonable and easier thanks to access the depth maps is provided. what is more, Kinect SDK free the appliance that may directly acquire the skeletal joint positions in period of time (adopting algorithms in [75]). The accessible depth maps and also the skeletal info (see Figure 4) smartly contributed to the pc vision community. These 2 options and their by-product options additionally triggered a large interest to unravel HAR issues victimisation depth-based solutions, replacement standard RGB-based ways, or acting as supplements to boost the RGBbased ways. during this section, we tend to on an individual basis reviewed the recent advance of activity representations victimisation depth maps or skeletons.

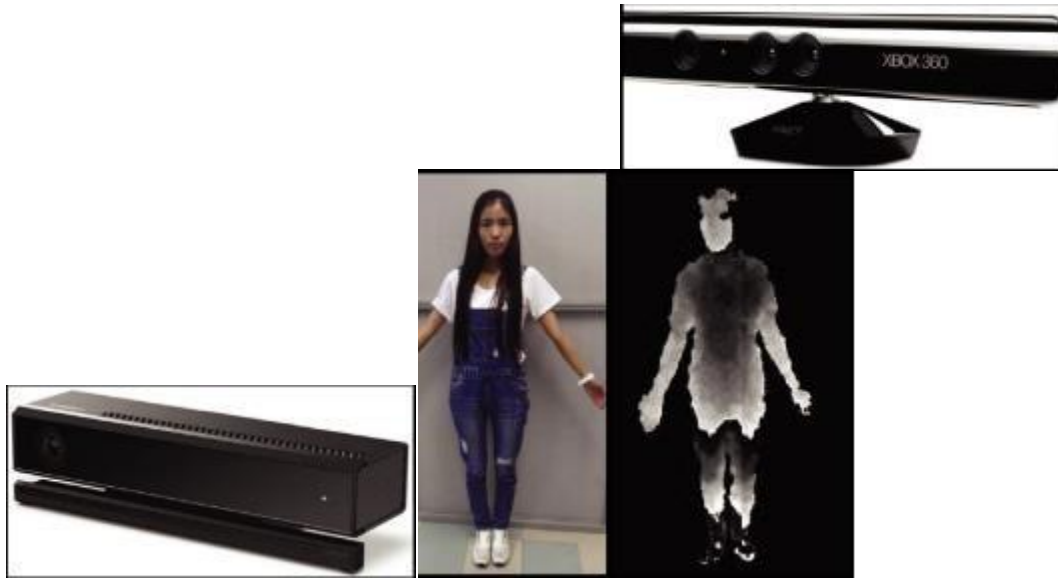


Fig 3.8: cameras and their color images, depth maps, skeletal information. (a) Kinect v1 (2011). (b) Kinect v2 (2014). (c) Skeleton captured by Kinect v1. (d) Skeleton captured by Kinect v2.

3.10 REPRESENTATION BASED ON MAPS

Depth maps contain further depth coordinates comparison to traditional color pictures and square measure additional informative. Approaches bestowed during this section regard depth maps as spatiotemporal signals and extract options directly from them. These options square measure either used severally or combined with RGB channel to make multimodal options. Li et al. [76] utilized the action graph model, that represents activities victimization many salient postures serving as nodes in action graph. All activities share same posture sets and every posture is characterised as a bag of 3D points from the depth maps. However, involving all the 3D points is computationally expensive; so, a straightforward and effective technique to sample the representative 3D points is projected, achieving

over ninetyeth recognition accuracy by sampling about 1 Chronicles points in keeping with their report.

3.11 Skeleton-Based Representations

Skeletons and joint positions square measure options generated from depth maps. Kinect device is widespread during this illustration because of its convenience of getting skeleton and joints. Application in Kinect v1 SDK generates twenty joints, whereas the later version (Kinect v2) generates twenty five joints, adding five joints round the hands and neck (see Figure 4). we have a tendency to reviewed recent papers on skeleton-based illustrations and summarize 3 aspects efforts on rising the performance of skeleton-based representation. First, skeleton model has associate degree inherent deficiency that it continually suffers the clattery skeleton drawback once handling occlusions (see Figure 5) [76]. options from inaccurate skeletons and joints could utterly be wrong. Current approaches typically solve it by combining alternative options that strong to occlusion or alleviate occlusion drawback by separating the full skeleton into completely different body components and handling them severally since not all body components square measure occluded.

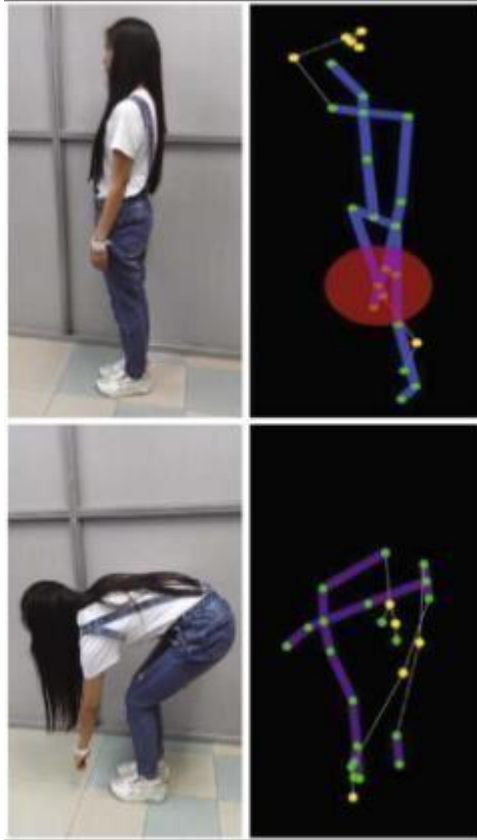


Figure 3.10: Noisy skeleton problem caused by self-conclusion.

CHAPTER 4

MATERIALS AND METHODS USED:

4.1 IMAGE PROCESSING

- Image process may be a technique to reinforce raw pictures received from cameras/sensors placed on satellites, area probes and aircrafts or photos taken in traditional day-today life for varied applications.
- Various techniques are developed in Image process throughout the last four to 5 decades. Most of the techniques square measure developed for enhancing pictures obtained from remote-controlled spacecraft's, area probes and military intelligence flights. Image process systems are getting common because of simple accessibility of powerful personnel.
- computers, giant size graphics software's etc. Image process is employed in varied Techniques.

4.2 PRE PROCESSING

. Pre-processing may be a common name for operations with pictures at very cheap level of abstraction of each input and output ar intensity pictures. The aim of pre-processing is associate degree improvement of the image information that suppresses unwanted distortion. • Some of the purpose process techniques include: distinction stretching, international thresholding, bar graph effort, log transformations and Stevens' law transformations. Some mask process techniques embrace averaging filters, sharpening filters, native thresholding... etc. • Different techniques: Data preprocessing may be a data processing technique that involves reworking information into an apparent format. information preprocessing may be a tried technique of breakdown such problems. information preprocessing

prepares information for more process. or enhances some image options vital for more process

4.3 EDGE DETECTION

Edge detection is a picture process technique for locating the boundaries of objects inside pictures. It works by detection discontinuities in brightness. Edge detection is employed for image segmentation and knowledge extraction in areas like image process, laptop vision, and machine vision.

4.4 THRESHOLDING

Automatic thresholding could be a good way to extract helpful info encoded into pixels whereas minimizing background signal. this can be accomplished by utilizing a feedback circuit to optimize the brink price before changing the initial grayscale image to binary. the concept is to separate the image into 2 parts; the background and foreground.

- Select initial threshold price, generally the mean 8-bit price of the initial image.
- Divide the initial image into 2 portions;
- Pixel values that ar but or capable the threshold; background
- Pixel values bigger than the threshold; foreground
- Find the common mean values of the 2 new pictures
- Calculate the new threshold by averaging the 2 suggests that.
- If the distinction between the previous threshold price and therefore the new threshold price ar below a given limit, you're finished. Otherwise apply the new threshold to the initial image keep attempting.

4.5 SEGMENTATION

network based mostly techniques etc.

- Analyzing pictures victimisation image thresholding techniques.
- Image thresholding the favored techniques used for image segmentation are: thresholding methodology, edge detection based mostly techniques, region based mostly techniques, bunch based mostly techniques, watershed based mostly techniques, partial equation based mostly and artificial neural could be a straightforward, however effective, method of partitioning a picture into a foreground and background. This image analysis technique could be a sort of image segmentation that isolates objects by changing grayscale pictures into binary pictures.

4.6 SEGMENTATION TECHNIQUES

There square measure many existing techniques that square measure used for image segmentation. These all techniques have their own importance. These all techniques will be approached from 2 basic approaches of segmentation i.e. region based mostly or edge based approaches.

- Every technique will be applied on totally different pictures to perform needed segmentation. These all techniques can also be classified into 3 classes.
- A. Structural Segmentation Techniques The structural techniques square measure those techniques of image segmentation that depends upon the data of the structure of needed portion of the image i.e. the desired region that is to be divided.
- B. random Segmentation Techniques The random techniques square measure those techniques of the image segmentation that works on the distinct picture element values of the image rather than the structural data of region.
- C. Hybrid Techniques The hybrid techniques square measure those techniques of the image segmentation that uses the ideas of each higher than techniques i.e. these uses distinct picture element and structural data along.
- In additional components of this paper the assorted techniques of segmentation square measure mentioned and compared. Mathematical description is avoided for simplicity so all the techniques square measure delineated on paper.

- The fashionable techniques used for image segmentation are: thresholding technique, edge detection based mostly techniques, region based mostly

techniques, bunch based mostly techniques, watershed based mostly techniques, partial equation based mostly} and artificial neural network based techniques etc.

- These all techniques square measure totally different from one another with relation to the tactic utilized by these for segmentation.

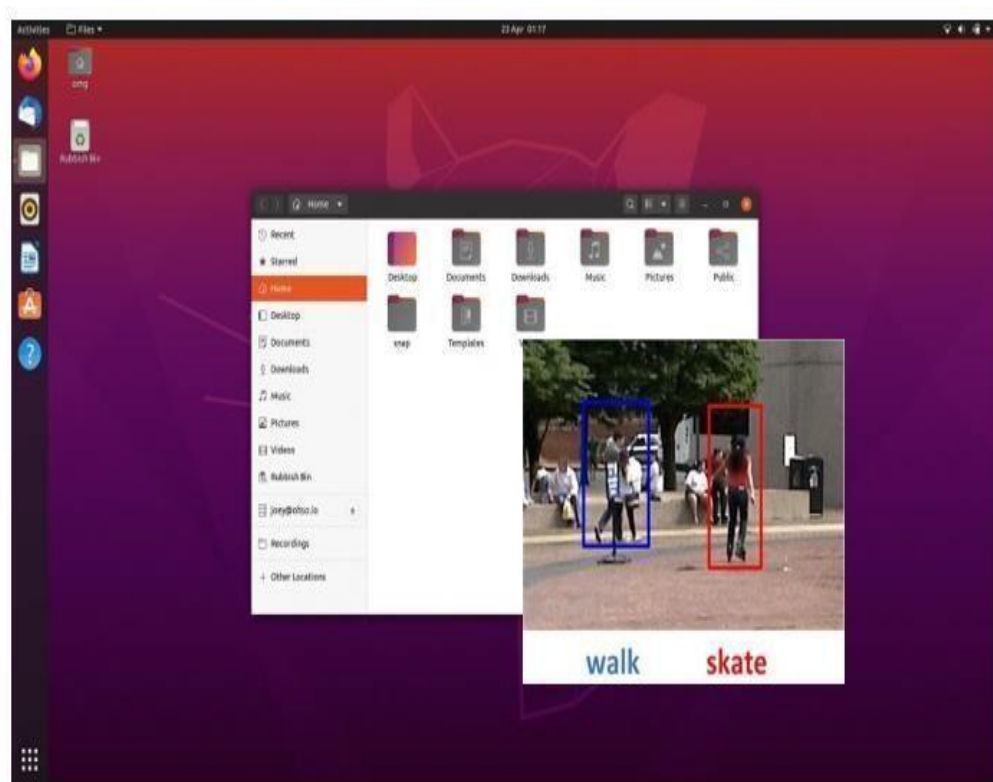
4.7 OPEN CV

OpenCV (Open supply pc vision) could be a library of programming functions chiefly aimed toward time period pc vision. Originally developed by Intel, it had been later supported by Willow Garage then Itseez (which was later noninheritable by Intel). The library is crossplatform and free to be used beneath the ASCII text file BSD license. • OpenCV supports the deep learning frameworks TensorFlow, Torch/PyTorch and Caffe

4.8 PHYTON

OpenCV-Python is a library of Python bindings designed to solve computer vision problems OpenCV-Python makes use of Numpy, which is a highly optimized library for numerical operations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays.

4.9 SNAPSHOT



CHAPTER 5

CHALLENGES OF THE RECOGNITION SYSTEM

The current HAR systems gift a giant range of challenges they need to address so as to produce the principal functions that they're developed. as an example, most HCI or video police investigation systems supported HAR should give continuous watching and generate reliable answers at the proper time so as to make sure the performance of the provided results. This challenge is mentioned in [118, 145, 223]. what is more, this becomes a significant issue once modelling AND analyzing interactions between individuals and objects with an applicable level of accuracy that remains difficult. this is able to be terribly helpful for police investigation and peace applications and should facilitate to observe many abnormality situations.

The use of those systems for the aim of police investigation, older help and patient watching along side the increasing implementation prices raise conjointly new social group challenges: acceptance by the society, privacy, facet effects of installation of those devices reception still as massive scale applications. as an example, authors in [27, 118] discuss the challenge of device integration reception for following, that is taken into account as violation of intimacy and privacy. to deal with this last downside, it's fascinating to explore the event of HAR systems on smartphones. this might contribute to beat the user's privacy constraint since the recorded information would be hold on on his own device and should scale back conjointly the procedure time associated with the transmission between the distant server and also the device. However, on-device implementation

could be a difficult issue still because of memory constraint, high range of parameters

required by the popularity model and also the battery lifetime of the device [127]. Another challenge is said to implicit dependency of such systems with the physical and physiological talents of the user.

Intuitively, HAR systems shouldn't rely upon the user's age, color, size or capability to use such systems. each toughened user and beginner ought to be ready to use these systems, and within the same approach. This challenge is raised in [118, 145]. The gestures independence and gestures recognizing from continuous information streams represent conjointly another style of challenge, since it's still troublesome to localize temporally the gesture in long continuous videos. Indeed, HAR systems don't seem to be however ready to observe and acknowledge varied gestures underneath totally different background conditions and don't seem to be tolerant with the measurability and growth of gestures. this is often the key challenge that is studied and regarded by several works such as: [4, 118, 145, 198, 223]. an additional space that require to be explored is that the ability of HAR systems to be context-aware. this might facilitate to create use of planned approaches and progress created in several application domains.

Understanding and detection of standard of living activities in long videos could be a difficult task. this is often because of the very fact that the long videos containing standard of living activities square measure composed of many complicated activities.

CHAPTER 6

RESULT AND CONCLUSION

RESULT

Given below diagrams is the result of our project based human action recognition using computer vision classifiers.

This can be identified by the three

ways. 1)Face detection

2)Gmail

Alert

3)Voice

Alert

The Software we used in this

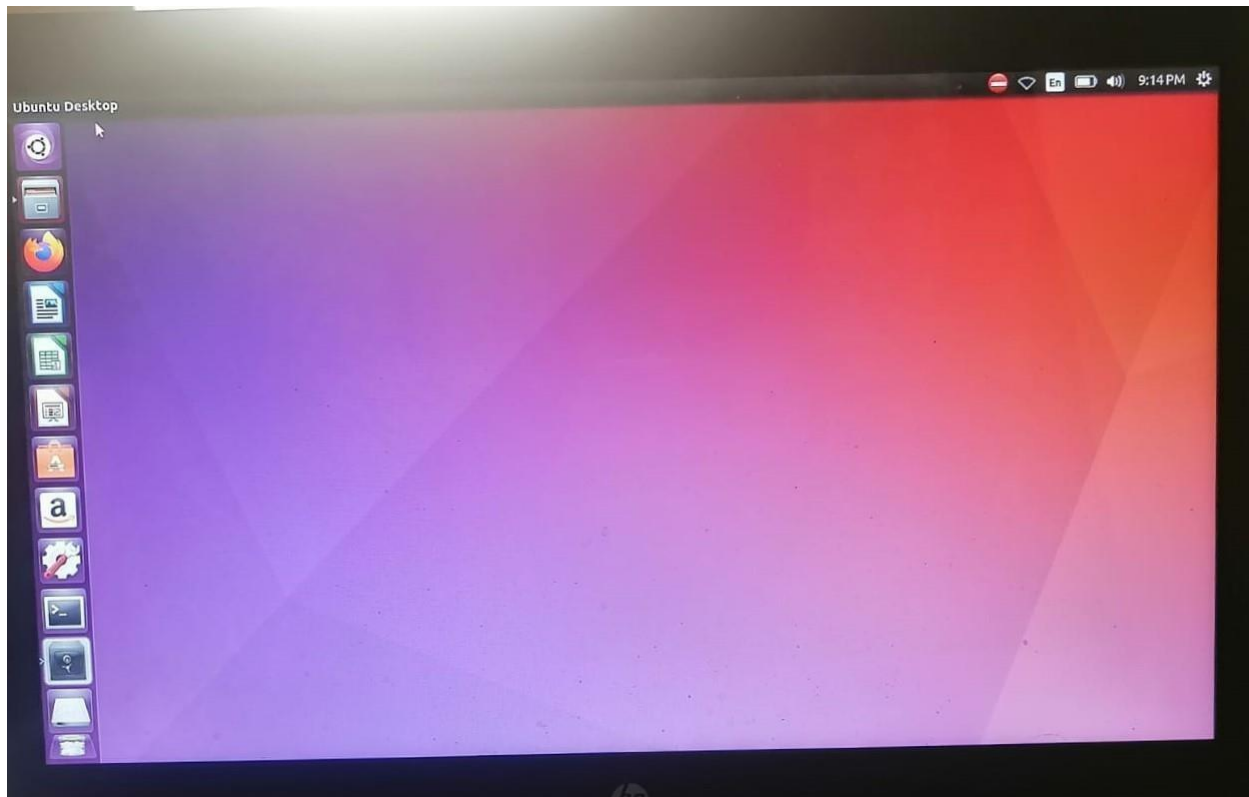


Fig 5 (a) Ubuntu Software

```

alert.py
import smtplib
from email.MIMEText import MIMEText
from email.MIMEText import MIMEText
from subprocess import call
fromaddr = "prakeshbhanu3@gmail.com"
toaddr = "prakeshbhanu3@gmail.com"

def mailt():
    msg = MIMEText('')
    msg['from'] = fromaddr
    msg['to'] = toaddr
    msg['Subject'] = 'human motion alert'
    body = 'Someone enter the gate'
    msg.attach(MIMEText(body, 'plain'))
    server = smtplib.SMTP('smtp.gmail.com', 587)
    server.starttls()
    server.login(fromaddr, 'aviaryofficer')
    text = msg.as_string()
    server.sendmail(fromaddr, toaddr, text)
    print('mail sent')
    server.quit()

mailt()

```

Fig 5(b) code for Gmail alert
detection c

```

Open - [A]
import cv2
import sys
import numpy as np
from subprocess import call
faceCascade = cv2.CascadeClassifier(cascPath)

cap = cv2.VideoCapture(0)
w = 640.0
h = 480.0

while True:
    # Capture frame-by-frame
    ret, frame = cap.read()
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    faces = faceCascade.detectMultiScale(
        gray,
        scaleFactor=1.1,
        minNeighbors=5,
        minSize=(30, 30),
        flags=cv2.CASCADE_SCALE_IMAGE
    )

    # Draw a rectangle around the faces
    for (x, y, w, h) in faces:
        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 255, 0), 2)
        print('human')
        call(['python', 'alert.py'])
        call(['python', 'alert1.py'])
        call(['python', 'speak.py'])
    #out.write(frame)
    # Display the resulting frame

```

fig 5(c) code for face
detection c

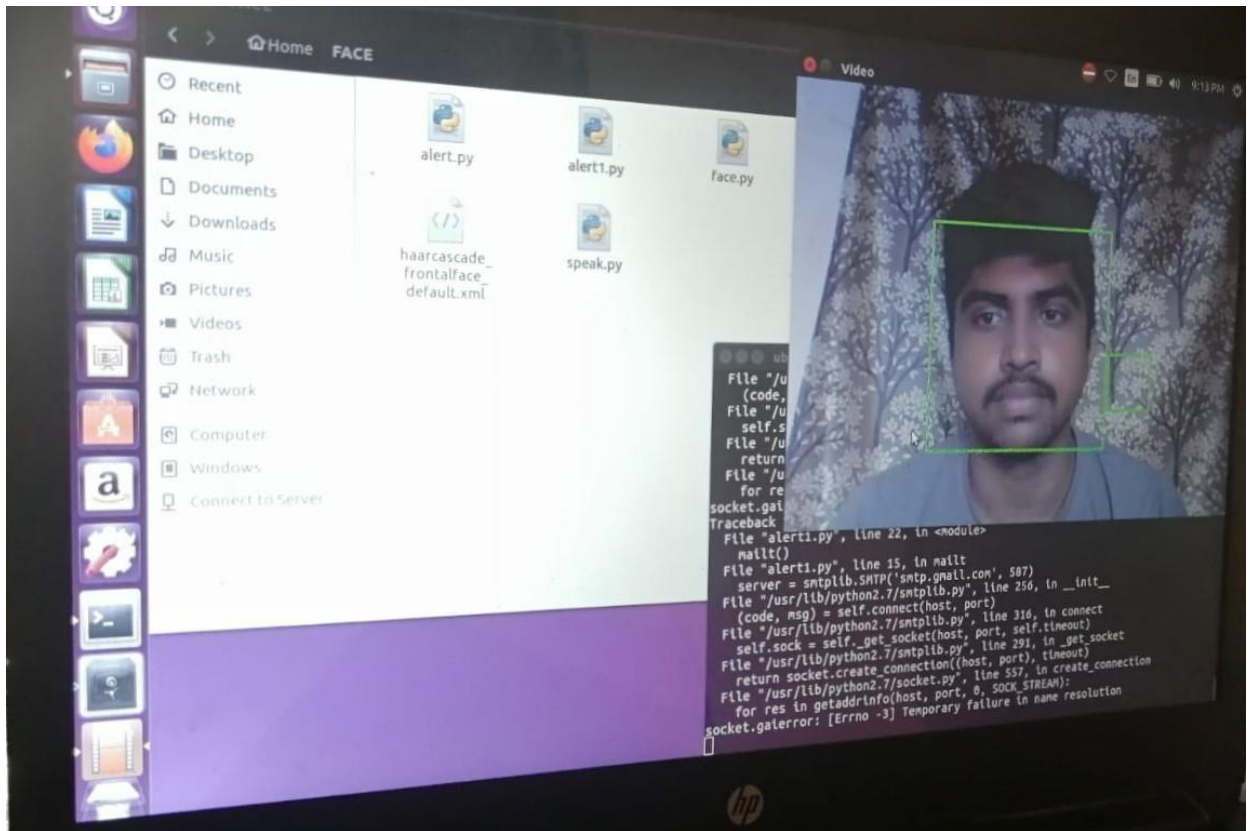


Fig 5(D) Face detection

CONCLUSION:

Human activity recognition remains to be a very important downside in laptop vision. HAR is that the basis for several applications like video police investigation, health care, and human-computer interaction.

Methodologies and technologies have created tremendous development within the past decades and have unbroken developing up so far. However, challenges still exist once facing realistic sceneries, additionally to the inherent intraclass variation and

interclass

similarity downside. In this review, we have a tendency to divided human activities

into 3 levels as well as action primitives, actions/activities, and interactions. we've summarized the classic and representative approaches to activity illustration and classification, furthermore as some benchmark datasets in several levels. For illustration approaches, we have a tendency to roughly sorted out the analysis mechanical phenomenon from international representations to native representations and up to date depth-based representations. The literatures were reviewed during this order. progressive approaches, particularly those depth-based representations, were mentioned, reaching to cowl the recent development in HAR domain. because the next step, classification ways play vital roles and prompt the advance of HAR. we have a tendency to categorised classification approaches into templatematching ways, discriminative models, and generative models. Totally, seven sorts of technique from the classic DTW to the latest deep learning were summarized. For human chase approaches, 2 classes area unit thought of particularly filter-based and kernel-based human chase. Finally, seven datasets were introduced, covering completely different levels from primitive level to interaction level, starting from classic datasets to recent benchmark for depth-based ways. Though recent HAR approaches have achieved nice success up to currently, applying current HAR approaches in real-world systems or applications remains nontrivial. 3 future directions area unit suggested to be thought of and any explored.

FUTURE SCOPE AND DIRECTION

First, current well-performed approaches square measure largely onerous to be enforced in real time or applied to wearable devices, as they're subject

to unnatural

computing power. it's tough for procedure unnatural systems to attain comparable

performances of these offline approaches. Existing work utilised further mechanical phenomenon sensors to help in recognizing, or developed microchips, for embedded devices. Besides these hardware-oriented solutions, from a pc vision perspective, additional economical descriptor extracting strategies and classification approaches square measure expected to coach recognition models quick, even in real time. Another potential method is to degrade quality of input image and strike a balance among input info, rule potency, and recognizing rate. for instance, utilizing depth maps as inputs and abandoning color info square measure ways in which of degrading quality. Second, several of the popularity tasks square measure resolved case by case, for each the benchmark datasets and also the recognition strategies. the longer term direction of analysis is clearly inspired to unite varied datasets as an outsized, complex, and complete one. although each dataset could act as benchmark in its specific domain, uniting all of them triggers simpler and general algorithms that square measure additional about to real-world occasions. for instance, recent deep learning is reportable to perform higher in a very four-dataset-combined larger datasets [114]. Another promising direction is to explore associate degree analysis criterion that allows comparisons among big variety of recognition strategies. Specifically, many very important activity indexes square measure outlined and weighted in line with specific task, evaluating strategies by activity indexes like recognition rate, efficiency, robustness, number, and level of recognizable activities. Third, thought recognition system remains in a very comparatively low level examination with those higher level behaviors. Ideally, the system ought to be able to tell the behavior “having a meeting” instead of innumerable folks sitting and talking, or perhaps harder, terminal that someone overhasty to catch a bus instead

of simply recognizing “running.” Activities square

measure analogous to the words consisting behavior languages. Analyzing logical and linguistics relations between behaviors and activities is a vital side, which might be learned by transferring from language process (NLP) techniques. Another conceivable direction is to derive further options from discourse info. although this direction has been for the most part exploited, current approaches typically introduce all the potential discourse variables while not screening. This follow not solely reduces the potency however additionally affects the accuracy. Thus, dynamically and fairly selecting discourse info may be a future smart topic to be mentioned.

Finally, tho' recent deep learning approaches reach outstanding performance, a conjoined ConvNets+LSTM design is anticipated for activity video analysis within the future. On the one hand, ConvNets area unit abstraction extension of typical neural networks and exhibit its advantage within the image classification tasks. This structure captures the abstraction correlation characteristics, however, ignores the temporal dependencies of the interframe content for activity dynamics modeling. On the opposite hand, LSTM as a representative reasonably RNN, is in a position to model the temporal or sequence info, that makes up the temporal shortage of ConvNets. LSTM is presently utilized in accelerometer-based recognition, skeleton- based activity recognition, or one-dimensional signal process, however has not been wide involved together with ConvNets for two-dimensional video activity recognition, that we tend to believe may be a promising direction within the future.

CHAPTER 7

REFERENCES:

1. R. Poppe, "A survey on vision-based human action recognition," *Image and Vision Computing*, vol. 28, pp. 976–990, 2010. View at: [Google Scholar](#)
2. J. K. Aggarwal and M. S. Ryoo, "Human activity analysis: a review," *ACM Computing Surveys*, vol. 43, p. 16, 2011. View at: [Google Scholar](#)
3. T. B. Moeslund, A. Hilton, and V. Krüger, "A survey of advances in visionbased human motion capture and analysis," *Computer Vision and Image Understanding*, vol. 104, pp. 90–126, 2006. View at: [Google Scholar](#)
4. J. M. Chaquet, E. J. Carmona, and A. Fernández-Caballero, "A survey of video datasets for human action and activity recognition," *Computer Vision and Image Understanding*, vol. 117, pp. 633–659, 2013. View at: [Google Scholar](#)
5. M. Blank, L. Gorelick, E. Shechtman, M. Irani, and R. Basri, "Actions as space- time shapes," in *Tenth IEEE International Conference on Computer Vision (ICCV'05) Volume 1*, pp. 1395–1402, Beijing, China, 2005. View at: [Google Scholar](#)
6. I. Laptev and T. Lindeberg, "Space-time interest points," in *Proceedings Ninth IEEE International Conference on Computer Vision*, vol. 1, pp. 432–439, Nice, France, 2003. View at: [Publisher Site](#) | [Google Scholar](#)
7. L. Rabiner and B. H. Juang, *Fundamentals of Speech Recognition*, 1993.
8. L. R. Rabiner and B. H. Juang, "An introduction to hidden Markov models," *IEEE ASSP Magazine*, Prentice Hall, Upper Saddle River, New Jersey, vol. 3, pp. 4–16, 1986. View at: [Google Scholar](#)
9. A. Krizhevsky, I. Sutskever, and G. E. Hinton, "Imagenet classification with deep convolutional neural networks," in *Advances in Neural*

Information Processing Systems, pp. 1097–1105, Lake Tahoe, Nevada, 2012. View at: [Google Scholar](#)

10. A. Efros, A. C. Berg, G. Mori, and J. Malik, "Recognizing action at a distance," in *Proceedings Ninth IEEE International Conference on Computer Vision*, pp. 726–733, Nice, France, 2003. View at: [Google Scholar](#)
11. C. R. Wren, A. Azarbayejani, T. Darrell, and A. P. Pentland, "Pfinder: real-time tracking of the human body," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 19, pp. 780–785, 1997. View at: [Google Scholar](#)
12. D. Koller, J. Weber, T. Huang et al., "Towards robust automatic traffic scene analysis in real-time, in: pattern recognition," in *Proceedings of 12th International Conference on Pattern Recognition*, vol. 1, pp. 126–131, Jerusalem, Israel, 1994. View at: [Google Scholar](#)
13. C. Stauffer and W. E. L. Grimson, "Adaptive background mixture models for real-time tracking," in *Proceedings. 1999 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (Cat. No PR00149)*, pp. 246–252, Fort Collins, CO, USA, 1999. View at: [Google Scholar](#)
14. A. Veeraraghavan, A. R. Chowdhury, and R. Chellappa, "Role of shape and kinematics in human movement analysis," in *Proceedings of the 2004 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2004. CVPR 2004*, pp. I–730, Washington, DC, USA, 2004. View at: [Google Scholar](#)
15. A. Veeraraghavan, R. Chellappa, and A. K. Roy-Chowdhury, "The function space of an activity," in *2006 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'06)*, pp. 959–968, New York, NY, USA, 2006. View at: [Google Scholar](#)
16. A. Bobick and J. Davis, "An appearance-based representation of action," in *Proceedings of 13th International Conference on Pattern Recognition*, pp. 307–312, Vienna, Austria, 1996. View at: [Google Scholar](#)
17. A. F. Bobick and J. W. Davis, "The recognition of human movement using temporal templates," *IEEE Transactions on Pattern Analysis*

and Machine Intelligence, vol. 23, pp. 257–267, 2001. View at: [Google Scholar](#)

- 18.N. Ikizler and P. Duygulu, "Human action recognition using distribution of oriented rectangular patches," in *Human Motion-Understanding Modelling Capture and Animation*, pp. 271–284, Springer, Rio de Janeiro, Brazil, 2007.View at: [Google Scholar](#)
- 19.G. Xu and F. Huang, "Viewpoint insensitive action recognition using envelop shape," in *Computer Vision--Asian Conference on Computer Vision 2007*, pp. 477–486, Springer, Tokyo, Japan, 2007.View at: [Google Scholar](#)
- 20.D. Weinland, R. Ronfard, and E. Boyer, "Free viewpoint action recognition using motion history volumes," *Computer Vision and Image Understanding*, vol. 104, pp. 249–257, 2006.View at: [Google Scholar](#)
- 21.S. Cherla, K. Kulkarni, A. Kale, and V. Ramasubramanian, "Towards fast, view- invariant human action recognition," in *2008 IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops*, pp. 1– 8, Anchorage, AK, USA, 2008.View at: [Google Scholar](#)



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CHAPTER 1 INTRODUCTION Human activity recognition (HAR) may be a wide studied pc vision drawback. Applications of HAR embrace video police investigation, health care, and human-computer interaction. because the imaging technique advances and also the camera device upgrades, novel approaches for HAR perpetually emerge. This review aims to produce a comprehensive introduction to the video-based act recognition, giving an outline of assorted approaches likewise as their evolutions by covering each the representative classical literatures and also the progressive approaches.

Human activities have associate inherent hierarchical data structure that indicates the various levels of it, which might be thought-about as a three-level categorization. First, for very cheap level, there's associate atomic component and these action primitives represent additional advanced human activities. once the action primitive level, the action/activity comes because the second level. Finally, the advanced interactions type the highest level, that refers to the human activities that involve quite 2 persons and objects.

during this paper, we tend to follow this three-level categorization particularly action primitives, actions/activities, and interactions. This three-level categorization varies a touch from previous surveys [1–4] and maintains a standardized theme. Action primitives ar those atomic actions at the limb level, like “stretching the left arm,” and “raising the proper leg.” Atomic actions ar performed by a selected a part of the bod, like the hands, arms, or higher part [4]. Actions and activities ar used interchangeably during this review, touching on the whole-body movements composed of many action primitives in temporal successive order and performed by one person with no additional person or extra objects.

Specifically, we tend to refer the word **human activities** as all movements of the 3 layers and also the activities/actions because the middle level of human activities. **Human activities like walking, running, and waving hands are classified within the actions/activities level.** Finally, almost like Aggarwal et al.'s review [2], interactions are human activities that involve 2 or additional persons and objects. the extra person or

object is a crucial characteristic of interaction. Typical samples of interactions are preparation that involves one person and varied pots and pans and arousal that's performed by 2 persons.

This review highlights the advances of image illustration approaches and classification strategies in vision-based activity recognition. Generally, for illustration approaches, connected literatures follow a search flight of world representations, native representations, and up to date depth-based representations (Figure 1). Earlier studies tried to model the full pictures or silhouettes and represent human activities during a world manner. The approach in [5] is an example of world illustration within which reference system shapes are generated because the image descriptors.

Then, the emergency of reference system interest points (STIPs) projected in [6] triggered vital attention to a replacement native illustration that focuses on the informative interest points. Meanwhile, native descriptors like bar graph of orientated gradients (HOG) and bar graph of optical flow (HOF) orientated from visual perception are widely used or extended to 3D in HAR space. With the upgrades of camera devices, particularly the launch of RGBD cameras within the year 2010, depth image-based representations are a replacement analysis topic and have drawn growing concern in recent years.

AIM OF THE PROJECT Identifying someone with a picture has been popularised through the mass media. However, it's less strong than fingerprint or tissue layer scanning. This report describes the face detection and recognition mini-project undertaken for the beholding and autonomy module at Plymouth University. It reports the technologies out there within the Open-Computer-Vision (OpenCV) library and methodology to implement them with Python.

For face detection, Haar-Cascades were used and for Human recognition, Eigen faces, Fisher faces and native binary pattern histograms were used.

EXISTING SYSTEM: Thus, this work aims at coming up with and evaluating a sensible disk system for unmoved face recognition through a weightless artificial Neural Network (WNN) co-processor designed in High-Level Synthesis (HLS) and enforced within the system's FPGA. Although the co-processor is employed for face recognition functions, it are often utilized by any application that must use artificial neural networks.

Extensive performance, circuit-area, energy consumption and network latency results shows that the coprocessor will with efficiency learn and acknowledge faces quicker than the system's **PROPOSED SYSTEM:** This paper describes the mini-project for perception and autonomy module. Next, it explains the technologies employed in the project and also the methodology used. Finally, it shows the results, discuss the challenges and the way they were resolved followed by a discussion. victimization Haar-cascades for face detection worked very well even once subjects wore spectacles. Real time video speed was satisfactory likewise empty noticeable frame lag.

Considering all factors, LBPH combined with Haar-cascades may be enforced as a price effective face recognition platform. associate example could be a system to spot famed troublemakers in an exceedingly mall or a grocery to supply the owner a warning to stay him alert or for automatic attending taking in an exceedingly category.

CHAPTER 2 LITERATURE SURVEY For many years human action recognition has been studied well. Most of the action recognition methods required to manually annotate the relevant portion of the action of interest in the video.

In the recent years it has been studied that the relevant portion of action of interest can be found out automatically and recognize the action. We can review the action recognition methods. **ACTION RECOGNITION** For representing video feature trajectories have shown efficiency .but the quality and quantity of these trajectories have not sufficient. As the use of dense sampling came popular for image classification wang et al.[1] proposed to use dense trajectories for representing videos. dense points for each frame are sampled and traced them based on displacement information. For improving the performance wang et al.[2] takes into account the camera motion. The camera motion is estimated by matching the future points between the frames by using the SURF descriptors and dense optical flow. Another approach [3] aimed at modeling the code words derived from local patch trajectories and therefore does not require accurate foreground background separation and proposed another method for finding the informative reasons. They used Saliency mapping algorithms. As a new method this paper proposes using a joint learning framework from learning spatial and temporal extents of action of interest.

Action Detection Recognition was performed using the Mahalanobis distance between the moment description of the input and each of the known actions. Recent popular methods which employ machine learning technique such as SVMs and AdaBoost provide one possibility for incorporating the information contained in a set of training examples. [4] introduces the Action MACH filter, a template based method for the action for action

recognition which is capable of capturing intraclass variability by synthesizing a single action.

Another method is proposed in [5] multiple instance learning framework, named smile SVM (Simulated annealing Multiple Instance Learning Support Vector Machines), is presented for learning human action detector based on imprecise action location. Wang et al. [6] used a figure centric visual word representation in that localized is treated as latent variable so as to recognize the action. A spatio temporal model is learned. During the training seven model parameters is estimated and the relevant portion is identified [8] proposed on independent motion evidence for feature for distinguishing human actions from background motion.

Most of the methods require that the relevant portion of the video has to be annotated with bounding boxes. Human intervention was tedious and then a model was generated that identify the relevant sub group. This paper introduce a method that learns both spatial and temporal extents for detection improvements. Dense trajectory here used as local feature to represent human action. CHAPTER 3

MATERIALS AND METHODS 3.1 BLOCK DIAGRAM: Identifying an individual with a picture has been popularized through the mass media. However, it's less sturdy to fingerprint or tissue layer scanning.

This report describes the face detection and recognition project undertaken for the beholding and autonomy module at Plymouth University. It reports the technologies offered within the Open-Computer-Vision (OpenCV) library and methodology to implement them exploitation Python. For face detection, Haar-Cascades were used and for Human recognition chemist faces, Fisher faces and native binary pattern

Fig 3.1 Block diagram of Human action recognition HUMAN RECOGNITION: IMAGE COLLECTION: Fig 3.2

Image Collection of Human action recognition Global representations extract world descriptors directly from original videos or pictures and write in code them as an entire feature. during this illustration, the human subject is localized and isolated exploitation background subtraction strategies forming the silhouettes or shapes (i.e., region of interest (ROI)). Some world approaches write in code ROI from that they derive corners, edges, or optical flow as descriptors.

different silhouette- based world illustration strategies stack the silhouette image on the time axis to make the 3D frame of reference volumes, then the volumes square measure utilised for illustration. Besides, separate Fourier rework (DFT) takes advantage of frequency domain data of ROI for recognition, conjointly being a world approach. world illustration approaches were principally projected in earlier works and step by step noncurrent thanks to the sensitiveness to noise, occlusions, and viewpoint changes.

3.2.2D SILHOUSTTESAND SHAPES

To recognize the human activities in videos, an intuitive plan is to isolate the body from the background. This procedure is named background subtraction or foreground extraction.

The extracted foreground within the HAR is named silhouette, that is that the region of interest and delineate as an entire object within the international illustration approach • Soil wetness device. Scheming the background model is a crucial step before extracting silhouettes. Wren et al. [11] 1st planned to model the background scene with statistical distribution. Koller et al. [12] acknowledged that some foreground values update unduly and so they introduced the selective background update strategy.

Stauffer and Grimson [13] planned to model the prices of a selected background component as a mix of Gaussians to interchange the strategy of exploitation just one Gaussian value within the previous approach. The Gaussian mixture model (GMM) has been applied wide however the introduction of expectation maximization (EM) formula will increase the process value. To cut back the value, k-means clump formula is employed to interchange the EM formula with associate insignificant loss of accuracy.

It's value mentioning that current RGBD cameras build it straightforward to get the silhouette by exploitation the depth information provided by depth sensors. • Besides the silhouette illustration, the second form of the silhouette will be used as a feature likewise. Veeraraghavan et al. [14] emphasised the effectiveness of form options. In their experiments, form and mechanics that square measure being thought of as 2 necessary cues in human motion were evaluated.

Tests on each the gait-based human identification and also the activity recognition indicate that form plays a lot of necessary role. Veeraraghavan et al. then used this form illustration in their following work [15]

OPTICAL COLUMN The figure three.2 is associate aurdino board that is that the best user friendly board to urge started with physics likewise as committal to writing. If this is often your terribly initial expertise with this platforOptical flow is a good thanks to extract and describe silhouettes for a dynamic background. Lucas-Kanade- Tomasi (LKT) feature hunter [22, 23] will be accustomed acquire the optical flow.

Lu et al. [24] used a LKT feature hunter approach to trace joints in key frames and actual frames. every activity is delineated as a posture sequence, and every key posture is recorded in a very key frame. Specific posture in actual frames will be recognized by finding correspondence between the particular and keyframe. The recognized posture from the particular frame is compared to the key posture frame by mapping body locations, and therefore the matched posture sequences area unit confirmed because the activity. For recognizing human activities at a distance (i.e.,

the soccer broadcast video), Efros et al. [10] introduced a descriptor supported computing the optical flow to explain the “small” soccer players in person-centered pictures. Obviously, the background is dynamic because of the movement of players that makes it arduousto model for background subtraction. Tran and Sorokin [25] combined silhouettes and optical flow options along. Normalized bounding box is scaled to capture the region of the chassis, and therefore the optical flow measurements among the box area unit split into horizontal and vertical channels, whereas the silhouette offers the third channel.

Subwindows area unit additional divided to calculate histograms, and concatenating histograms of all three channels type the ultimate destructor. In the figure 3.3 it shows that there are many types of Arduino boards in the world in which many of them were third party compatible versions. The most official versions available are the Arduino Nano V3 and An activity video can be seen as a series of images that contain activity sequences.

Concatenating all frames along the time axis forms the

3D SPACE TIME VOLUME (STV'S) 3D coordinate system volume (STV) that has 3 dimensions together with 2 abstraction **dimensions X and Y and one temporal dimension T**. Representations supported STVs expect to capture the extra dynamic info that the abstraction illustration ways cannot acquire because of the absence of your time dimension. Constructing STVs for various activities may be a world illustration technique. However, the STV typically combines with native options to make the ultimate feature sets. Blank et al. [5] 1st introduced the coordinate system form to represent human activities.

coordinate system form is obtained by solely stacking the silhouette regions inside pictures. However, because of the nonrigidity of the created 3D coordinate system shapes and inherent distinction between house and time dimensions, ancient 3D form analysis can not be applied to the coordinate system activity shapes. Thus, the answer **of the Poisson equation is** employed to derive native coordinate system strikingness and orientation options. Achard et al.

[26] generated semiglobal options named coordinate system small volumes from image sequence to traumatize performances of different In [28], the input videos square measure metameric into coordinate system volumes mistreatment mean shift agglomeration technique. These oversegmented regions, that square measure termed "super-voxels," square measure then matched employing a projected shape-matching technique, that **is compared to the** standard silhouette matching ways. in contrast to **the previous silhouette-based approaches, the** projected shape-based illustration doesn't need background subtraction nor specific background models.

To **avoid the shortages of {the form|the form}-matching ways** that square measure ignoring options within **the shape, Shechtman and Irani's flow-based options** [27] square measure any incorporated. temporal

durations. impelled by seeking the common underlying induced motion fields of sequences of an equivalent behaviors, Shechtman et al. [27] projected AN approach to check volumes in step with their patches. DESCRETE FOURIER TRANSFORM (DFT) The DFT of image frame is another world feature that contains the intensity data of the foreground object (i.e.,

the region of the subject's body) on condition that the foreground object intensity is completely different from the background. Kumari and Mitra [29] took advantage of this hypothesis and planned a DFT-based approach, getting data concerning the geometric structure of the abstraction domain foreground object. Normalized image frame is split into tiny size blocks inside that the common of all the DFT values is calculated. Finally the K-nearest neighbor (KNN) is applied to classify the DFT options and generate the activity classification result.

The extracted DFT feature is novel compared to the previous work; but, its performance is restricted to easy backgrounds. The background in their check video datasets is sort of blank.

LOCAL REPRESENTATION Instead of extracting the silhouette or STV and coding them as an entire, native representations method activity video as a set of native descriptors. They specialize in specific native patches that square measure determined by interest purpose detectors or densely sampling [30].

Most existing native options square measure well- tried to be sturdy against noise and partial occlusions comparison to world options. native options square measure then ordinarily combined with the bag-of-visual-words (BoVW) model and yield the final pipeline of current progressive native illustration approaches [31]. headed from bag-of-words (BoW), BoVW-based native illustration chiefly contains four steps: feature extraction, codebook generation, feature coding, and pooling and social control.

we tend to follow [32] and state a conventional BoVW pipeline here: interest points and native patches square measure initial obtained by detectors or densely sampled. Then native options square measure extracted from those interest points or patches. Next, a visible lexicon (i.e., codebook) is learned in coaching set by k-means or Gaussian mixture model (GMM), the initial high-dimension descriptors square measure clustered, and also the center of every cluster is thought to be a visible codeword. After that, native options square measure encoded and pooled. Finally, the pooled vectors square measure normalized as video illustration.

Among these steps, the event of additional intricately designed low-level options and additional subtle coding ways square measure the 2 chief reasons for the nice achievements **LOCAL DESCRIPTORS** Local descriptors ar designed to explain the patches that sampled either densely or at the interest points [1]. Effective

descriptors are thought-about to be discriminative for the target human action events in videos and sturdy to occlusion, rotation, and background signal. Laptev [41] portrayed their 3D Harris corner by computing native, spatiotemporal N-jets because the descriptor.

The descriptor is scale-invariant since they estimate the spatiotemporal extents of detected events by maximising a normalized spatiotemporal Laplacian operator over abstraction and temporal scales. Moreover, the projected descriptors are proven to be sturdy to occlusions and dynamic untidy backgrounds within the human motion analysis. Similar to works of extending 2nd interest purpose detector into spatiotemporal domain, like the Harris corner detector [34] and also the extended spatiotemporal one [41], several spatiotemporal descriptors were projected by extending mutual image descriptors yet. we tend to shortly review these works as well as each the initial abstraction descriptors and also the spatiotemporal version of them.

FUTURE ENCODING METHODS: The STIP-based descriptors or alternative intricately designed descriptors are all referred as native options. native options are then encoded with feature encryption strategies to represent activities and also the encoded options are later fed into pretrained classifiers (e.g., SVM) [32]. encryption feature may be a key step for constructing BoVW illustration associate degree utilizing an acceptable

encryption technique will considerably improve the popularity accuracy [56].

Here, **we tend to summarize the** common feature encryption strategies in recent literatures in Table a pair of. the amount of citations for every description paper is additionally provided to facilitate mensuration of their influence Depth-Based Representations Previous analysis of HAR primarily concentrates on the video sequences captured by ancient RGB cameras. Depth cameras, however, are restricted because of their high value and quality of operation [74]. due to the event of low-priced depth sensors like Microsoft Kinect [75], a reasonable and easier thanks to access the depth maps is provided.

what is more, Kinect SDK free the appliance that may directly acquire the skeletal joint positions in period of time (adopting algorithms in [75]). The accessible depth maps and also the skeletal info (see Figure 4) smartly contributed to the pc vision community. These 2 options and their by-product options additionally triggered a large interest to unravel HAR issues victimisation depth-based solutions, replacement standard RGB-based ways, or acting as supplements to boost the RGB- based ways.

during this section, we tend to on an individual basis reviewed the recent advance of activity representations victimisation depth maps or skeletons.

__ Fig 3.8: cameras and their color images, depth maps, skeletal information. (a) Kinect v1 (2011). (b) Kinect v2 (2014). (c) Skeleton captured by Kinect v1. (d) Skeleton captured by Kinect v2. Representations Based on Depth Maps Depth maps contain further depth coordinates comparison to traditional color pictures and square measure additional informative. Approaches bestowed during this section regard depth maps as spatiotemporal signals and extract options directly from them. These options square measure either used severally or combined with RGB channel to make multimodal options. Li et al.

[76] utilized the action graph model, that represents activities victimization many salient

postures serving as nodes in action graph. All activities share same posture sets and every posture is characterised as a bag of 3D points from the depth maps. However, involving all the 3D points is computationally expensive; so, a straightforward and effective technique to sample the representative 3D points is projected, achieving over ninetyeth recognition accuracy by sampling about 100 points in keeping with their report. Skeleton-Based Representations Skeletons and joint positions square measure options generated from depth maps. Kinect device is widespread during this illustration because of its convenience of getting skeleton and joints.

Application in Kinect v1 SDK generates twenty joints, whereas the later version (Kinect v2) generates twenty five joints, adding five joints round the hands and neck (see Figure 4). we **have a tendency to** reviewed recent papers on skeleton-based illustrations and summarize 3 aspects efforts on rising the performance of skeleton-based representation. First, skeleton model has associate degree inherent deficiency that it continually suffers the clattery skeleton drawback once handling occlusions (see Figure 5) [76]. options from inaccurate skeletons and joints could utterly be wrong.

Current approaches typically solve it by combining alternative options that strong to occlusion or alleviate occlusion drawback by separating the full skeleton into completely different body components and handling them severally since not all body components square measure occluded.

/ Figure 3.10: Noisy skeleton problem caused by self-conclusion. CHAPTER 4 MATERIALS AND METHODS USED: IMAGE PROCESSING Image process may be a technique to reinforce raw pictures received from cameras/sensors placed on satellites, area probes and aircrafts or photos taken in traditional day-to-day life for varied applications.

Various techniques are developed in Image process throughout the last four to five decades. Most of the techniques square measure

developed for enhancing pictures obtained from remote-controlled spacecraft's, area probes and military intelligence flights. Image process systems are getting common because of simple accessibility of powerful personnel. computers, giant size graphics software's etc. Image process is employed in varied Techniques. **PRE PROCESSING** . Pre-processing may be a **common name for operations with pictures at very cheap level of abstraction** of each **input and output as** intensity pictures.

The **aim of pre-processing is** associate degree **improvement of the image** information that suppresses unwanted distortion. • Some of the purpose process techniques include: distinction stretching, international thresholding, bar graph effort, log transformations and Stevens' law transformations. Some mask process techniques embrace averaging filters, sharpening filters, native thresholding... etc.

- Different techniques: Data preprocessing may be a data processing technique that involves reworking information into an apparent format information preprocessing may be a tried technique of breakdown such problems. information preprocessing prepares information for more process. **or enhances some image options** vital for more process

EDGE DETECTION Edge detection is a picture process technique for locating the boundaries of objects inside pictures. It works by detection **discontinuities in brightness.** **Edge detection is employed for image segmentation and knowledge extraction in areas like image process, laptop vision, and machine vision.**

THRESHOLDING Automatic thresholding could be a good way to extract helpful info encoded into pixels whereas minimizing background signal. this can be accomplished by utilizing a feedback circuit to optimize the brink price before changing the initial grayscale image to binary. the concept is to separate the image into 2 parts; the background and foreground. Select initial threshold price, generally the mean 8-bit price of the initial image.

Divide the initial image into 2 portions; Pixel values that are but or capable the threshold; background Pixel values bigger than the threshold; foreground Find the common mean values of the 2 new pictures Calculate the new threshold by averaging the 2 suggests that. If the distinction between the previous threshold price and therefore the new threshold price are below a given limit, you're finished. Otherwise apply the new threshold to the initial image keep attempting. **SEGMENTATION** network based mostly techniques etc. Analyzing pictures victimisation image thresholding techniques.

Image thresholding the favored techniques used for image segmentation are: thresholding methodology, edge detection based mostly techniques, region based mostly techniques, bunch based mostly techniques, watershed based mostly techniques, partial equation based mostly and artificial neural

could be a straightforward, however effective, **method of partitioning a picture into a foreground and background**. This image analysis technique could be a sort **of image segmentation that** isolates objects by changing grayscale pictures into binary pictures. **SEGMENTATION TECHNIQUES** There square measure many existing techniques that square measure used for image segmentation.

These all **techniques have their own importance. These all techniques will be approached from 2 basic approaches of segmentation i.e. region based mostly} or edge based approaches. Every technique will be applied on totally different pictures to perform needed segmentation. These all techniques can also be classified into 3 classes.** **A. Structural Segmentation Techniques** The structural techniques square measure those techniques of image segmentation that depends upon the data of the structure of needed **portion of the image i.e. the** desired region that is to be divided. **B.**

random Segmentation Techniques The random techniques square measure those techniques of the image segmentation that works on the distinct picture element values of the image rather than the structural data of region. **C. Hybrid Techniques** The hybrid techniques square measure those techniques of the image segmentation that uses the ideas of each higher than techniques i.e. these uses distinct picture element and structural data along. In additional components of this paper the assorted techniques of segmentation square measure mentioned and compared. Mathematical description is avoided for simplicity so all the techniques square measure delineated on paper.

The fashionable techniques used for image segmentation are: thresholding technique, edge detection based mostly techniques, region based mostly techniques, bunch based mostly techniques, watershed

based mostly techniques, partial equation based mostly} and artificial neural network based techniques etc. These all techniques square measure totally different from one another with relation to the tactic utilized by these for segmentation. **OPEN CV** OpenCV (Open supply pc vision) could be a library of programming functions chiefly aimed toward time period pc vision. Originally developed by Intel, it had been later supported by Willow Garage then Itseez (which was later noninheritable by Intel).

The library is cross- platform and free to be used beneath the ASCII text file BSD license.

- OpenCV supports the deep learning frameworks TensorFlow, Torch/PyTorch and Caffe

PHYTON OpenCV-Python is a library of Python bindings designed to solve computer vision problems OpenCV-Python makes use of Numpy, which is a highly optimized library for numerical operations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays. **SNAPSHOT**

/ .

CHAPTER 5 CHALLENGES OF THE RECOGNITION SYSTEM The current HAR systems gift a gianrange of challenges theyneed to address so as to produce the principal functions that they're developed. as an example, most HCI or video police investigation

systems supported HAR should give continuous watching and generate reliable answers at the proper time so as to make sure the performance of the provided results. This challenge is mentioned in [118, 145, 223]. what is more, this becomes a significant issue once modelling AND analyzing interactions between individuals and objects with an applicable level of accuracy that remains difficult.

this is able to be terribly helpful for police investigation and peace applications and should facilitate to observe many abnormality situations. The use of those systems for the aim of police investigation, older help and patient watching along side the increasing implementation prices raise conjointly new social group challenges: acceptance by the society, privacy, facet effects of installation of those devices reception still as massive scale applications. as an example, authors in [27, 118] discuss the challenge of device integration reception for following, that is taken into account as violation of intimacy and privacy.

to deal with this last downside, it's fascinating to explore the event of HAR systems on smartphones. this might contribute to beat the user's privacy constraint since the recorded information would be hold on on his own device and should scale back conjointly the procedure time associated with the transmission between the distant server and also the device. However, on-device implementation could be a difficult issue still

because of memory constraint, high range of parameters required by the popularity model and also the battery **lifetime of the device** [127].

Another challenge is said to implicit dependency of such systems with the physical and physiological talents of the user. Intuitively, HAR systems shouldn't rely upon the user's age, color, size or capability to use such systems. each toughened user and beginner ought to be ready to use these systems, and within the same approach. This challenge is raised in [118, 145]. The gestures independence and gestures recognizing from continuous information streams represent conjointly another style of challenge, since it's still troublesome to localize temporally the gesture in long continuous videos.

Indeed, HAR systems don't seem to be however ready to observe and acknowledge varied gestures underneath totally different background conditions and don't seem to be tolerant with the measurability and growth of gestures. this is often the key challenge that is studied and regarded by several works such as: [4, 118, 145, 198, 223]. an additional space that require to be explored is that the ability of HAR systems to be context-aware. this might facilitate to create use of planned approaches and progress created in several application domains. Understanding and detection of standard of living activities in long videos could be a difficult task.

this is often because of the very fact

that the long videos containing standard of living activities square measure composed of many complicated activities.

/ Fig 5 (a) Ubuntu Software Fig 5(b) code for Gmail alert fig 5(c) code for face detection

c Fig 5(D) Face detection CONCLUSION: Human activity recognition remains to be a very important downside in laptop vision. HAR is that the basis for several applications like video police investigation, health care, and human-computer interaction.

Methodologies and technologies have created tremendous development within the past decades and have unbroken developing up so far. However, challenges still exist once facing realistic sceneries, additionally to the inherent intraclass

variation and interclass similarity downside. In this review, we have a tendency to divided human activities into 3 levels as well as action primitives, actions/activities, and interactions.

we've summarized the classic and representative approaches to activity illustration and classification, furthermore as some benchmark datasets in several levels. For illustration approaches, we have a tendency to roughly sorted out the analysis mechanical phenomenon from international representations to native representations and up to date depth-based representations. The literatures were reviewed during this order. progressive approaches, particularly those depth-based representations, were mentioned, reaching to cowl the recent development in HAR domain.

because the next step, classification ways play vital roles and prompt the advance of HAR. we have a tendency to categorised classification approaches into template-matching ways, discriminative models, and generative models. Totally, seven sorts of technique from the classic DTW to the latest deep learning were summarized. For human chase approaches, 2 classes area unit thought of particularly filter-based and kernel-based human chase. Finally, seven datasets were introduced, covering completely different levels from primitive level to interaction level, starting from classic datasets to recent benchmark for depth-based ways.

Though recent HAR approaches have achieved nice success up to currently, applying current HAR approaches in real-world systems

or applications remains nontrivial. 3 future directions are unit suggested to be thought of and any explored. **FUTURE SCOPE AND DIRECTION** First, current well-performed approaches square measure largely onerous to be enforced in real time or applied to wearable devices, as they're subject to unnatural computing power. it's tough for procedure unnatural systems to attain comparable performances of these offline approaches. Existing work utilised further mechanical phenomenon sensors to help in recognizing, or developed microchips, for embedded devices.

Besides these hardware-oriented solutions, from a pc vision perspective, additional economical descriptor extracting strategies and classification approaches square measure expected to coach recognition models quick, even in real time. Another potential method is to degrade quality of input image and strike a balance among input info, rule potency, and recognizing rate. for instance, utilizing depth maps as inputs and abandoning color info square measure ways in which of degrading quality. Second, several of the popularity tasks square measure resolved case by case, for each the benchmark datasets and also the recognition strategies.

the longer term direction of analysis is clearly inspired to

unite varied datasets as an outsized, complex, and complete one. although each dataset could **act as benchmark in its specific domain, uniting all of them triggers** simpler and general algorithms that square measure additional about **to real-world occasions.** for instance, **recent deep learning is** reportable to perform higher in a very four-dataset-combined larger datasets [114].

Another **promising direction is to explore** associate degree analysis criterion that allows comparisons among big variety of recognition strategies. Specifically, many very important activity indexes square measure outlined and weighted in line with specific task, evaluating strategies by activity indexes like recognition rate, efficiency, robustness, number, and level of recognizable activities. Third, thought recognition system remains in a very comparatively low level examination with those higher level behaviors.

Ideally, the system ought to be able to tell the behavior “having a meeting” instead of innumerable folks sitting and talking, or perhaps harder, terminal that someone overhasty to catch a bus instead of simply recognizing “running.” Activities square measure analogous to the words consisting behavior languages. Analyzing logical and linguistics relations between behaviors and activities is a vital side, which might be learned by transferring from language process (NLP) techniques. Another conceivable direction is to derive further options from discourse info. although this direction has been for the most part

exploited, current approaches typically introduce all the potential discourse variables while not screening.

This follows not solely reduces the potency however additionally affects the accuracy. Thus, dynamically and fairly selecting discourse info may be a future smart topic to be mentioned. Finally, tho' recent deep learning approaches reach outstanding performance, a conjoined ConvNets + LSTM design is anticipated for activity video analysis within the future. On the one hand, ConvNets are a unit abstraction extension of typical neural networks and exhibit its advantage within the image classification tasks.

This structure captures the abstraction correlation characteristics, however, ignores the temporal dependencies of the interframe content for activity dynamics modeling. On the opposite hand, LSTM as a representative reasonably RNN, is in a position to model the temporal or sequence info, that makes up the temporal shortage of ConvNets. LSTM is presently utilized in accelerometer-based recognition, skeleton-based activity recognition, or one-dimensional signal process, however has not been wide involved together with ConvNets for two-dimensional video activity recognition, that we tend to believe may be a promising direction within the future.s

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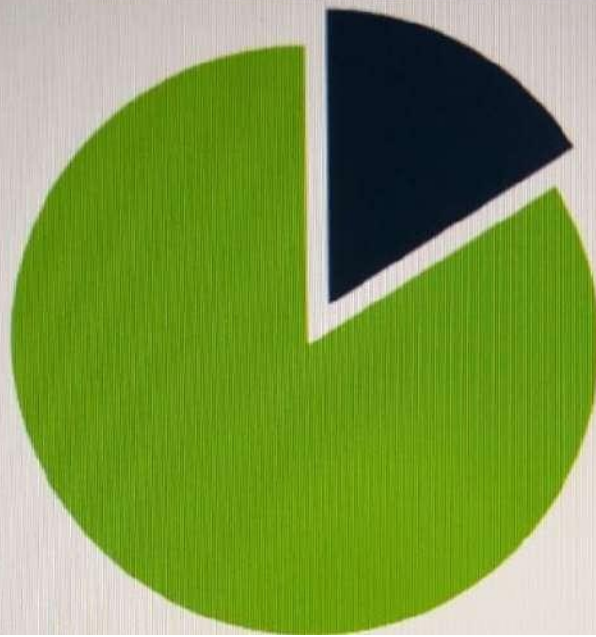
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