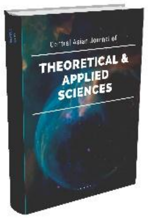

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 03 Issue: 07 | Jul 2022 ISSN: 2660-5317
https://cajotas.centralasianstudies.org

An Overview of Object Tracing Techniques in Videos and Images

Sahila Fareed
Student, Sat Kabir Institute of Technology and Management, Haryana, India
Sahilas3@gmail.com

Kirti Bhatia, Shalini Bhadola
Assistant Professor, Sat Kabir Institute of Technology and Management, Haryana, India
bhatia.kirti.it@gmail.com, shalini77info@gmail.com

Rohini Sharma
Assistatnt Professor and corresponding Author, GPGCW, Rohtak, India
rohinisharmaohlan@gmail.com

Received 26th May 2022, Accepted 18th Jun 2022, online 20th July 2022

Abstract: *The object Tracing is a growing area of image processing research with numerous important applications. Using object tracking, it is possible to accurately and automatically identify objects in films. This is accomplished by creating models for each individual object and tracking its motion as it moves around the screen or through various camera angles. For tracing objects, various techniques have been suggested. These largely differ from one another. This article aims to categorize Tracing techniques into useful groups and offers thorough justifications for distinctive approaches in each group. This paper reviews different research work done in the field of object tracking. In this article, we have examined the object tracing system and related work. The summary includes several approaches, strategies, types of photos, and outcomes. an overview of the papers that have been reviewed and the best findings are then given.*

Keywords: *Computer Vision.*

Introduction:

Simply identifying objects is the essence of object detection. This method has some issues that make it challenging to utilise for video analysis, such as multiple detections from a single image or the inability to connect objects across frames because they vanished from the camera's field of vision while moving around the screen. Using ground truth derived from visually matched poses observed in the training data set together with manually located candidate locations based on their closeness and form may be one method. The fact that object detection uses a lot of processing power is another issue. Tracking systems use orientation and acceleration clues from neighbouring pixels to assist decrease search space, making them easier on devices equipped with limited resources like those found in edge computing environments. Because the methods have no knowledge of what they're looking at, all pictures must be searched in an attempt to discover objects. Fig. 1 shows multiple objects present in an image.

Related Work:

Object tracking has a wide range of uses in computer vision, including surveillance cameras that can keep an eye on passing vehicles or individuals crossing the street [1]. Object tracking is related to image processing [2-5] and computer vision fields [6-8]. Object Tracing must be employed to computerize the course of bestowing info regarding a definite object exhibited in a video rather than physically having to examine the object in a catalog.

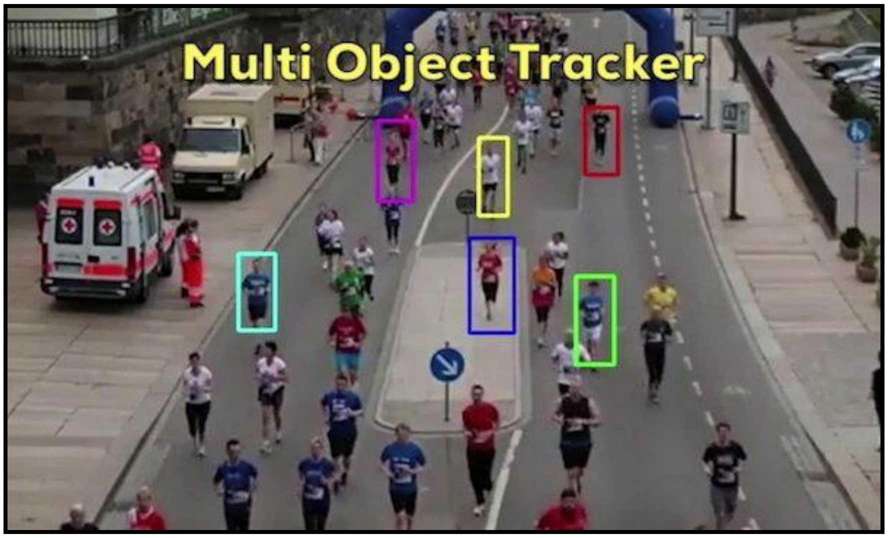

Fig 1: Multiple Objects Tracking in a Picture

Object Tracing Procedures

The writers of [9] have studied tracing techniques in-depth, classifying them into several groups and placing emphasis on both necessary and helpful tracing methods. They have given a succinct summary of tracing techniques such zone-based and dynamic contour-centered, as well as their benefits and drawbacks. With extensive explanations, they have mentioned many tracing techniques. They looked at common ways in literature studies on various processes before confirming the look at potential research recommendations.

In the field of picture handling, object tracing is a well-known problem. Even though the capacity to trace objects has greatly improved over the past few years, this issue is still thought to be challenging to fix. The importance of object tracing is demonstrated in a variety of applications, including video monitoring, human-computer interaction, and robot direction-finding. The authors' major objective is to research, evaluate, and create a concise summary of the most effective object tracing techniques [10]. The writers have researched object representation, object attributes, and object detection techniques.

In a video inquiry, there are three basic phases: object recognition and tracing, and track analysis-based discovery of object behaviours [11]. There are many distinct methods that can be grouped into different types or groups when considering the tracing procedure. The three main classifications of point tracing, kernel tracing, and silhouette tracing can be used as a broad technique to categorise the operations. Zone-centered tracing is another approach to categorise the algorithm.

According to authors in [12], a lot of study has been done in the field of object identification and tracing in many current applications. For this goal, a number of excellent techniques, including colour segmentation and edge tracing, have been developed. However, these techniques are not very effective when used in the real world and are also constrained by limitations like the scene's background having to be white or simple. In real-world video cassettes or with just one camera, the authors' approach can find and follow an object even against a complex background. The suggested process has undergone extensive analysis to function in complex, real-world atmospheric conditions, non-simple light modulation, and shifting context.

According to authors in [13], object detection and tracing play a particularly central role in a variety of image processing applications. The features tally methods have a few problems with extremely complex computations and brittle sturdiness in various environments. Through better characteristics compared to the real atmosphere, the authors propose a less intricate and active item identification and chasing method. The method uses constant attributes to identify objects and reduces the size of the attribute descriptor to address various problems. The experiments show that their system can trace objects precisely in a variety of settings and is more rapid and powerful than traditional ways.

Authors in [14] used a simple way to demonstrate how visual object tracing and semi-managed video object reduction are carried out in real-world scenarios. Their technique, known as SiamMask, improves the offline training process of popular Siamese complete involution object tracing methods by amplifying their harm through a binary segmentation procedure. SiamMask solely uses a single bordering box for initialization following training, and it performs online generation of class-based uncertain object segmentation covers and switched bordering boxes at a rate of a few frames per second. Despite its simplicity, adaptability, and quick speed, their enables the creation of a new condition amongst real-time trackers on VOT-2018 while also displaying the best speediness and similar time reasonable execution for the semi-supervised video object segmentation procedure on DAVIS.

According to writers in [15], the most popular study areas in computer vision nowadays are object recognition, detection, and tracing. The authors have planned for an actual scenario objects tracing structure. They have concentrated on improving CamShift so that it can track moving objects very precisely. This paper proposes a flexible Gaussian contextual prototype. The system changes the background on its own and figures out how to reposition things. The essay identifies the techniques to support the enactment through analysis of several approaches. The CamShift method is used for fixed background video series and thoroughly identifies motion as well as performing object tracing.

CUSTOMARY OBJECT TRACING SYSTEMS

As illustrated in Fig. 2.1, the three primary ways of object tracing can be further divided into more specialised approaches.

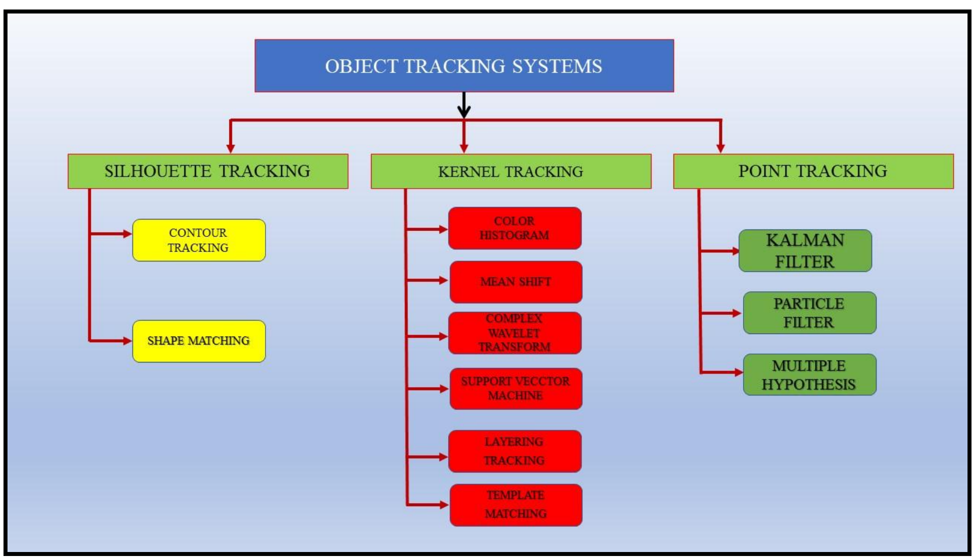

Fig 2: Classification of Object Tracking System

Kernel-based Tracing

A similar system is expanded repeatedly in this localization technique. The algorithm is also known by the name mean shift [16]. Calculating an object's mobility has an impact on the kernel tracing technique. It is possible to predict an object's future location by computing the movement of the object from one frame to the next. When the thing is described by simple geometric patterns, such as circles or triangles.If the object first appears in the field of vision, it is just required. Due to fundamental regular figure illustration, objects' fragments may stay outside of the definite form while context's fragments may stay inside it. Both rigid and flexible items may experience this problem. occlusion is typically not managed clearly.

Mean Shift Tracing

In order to do visual tracing, a confidence map is created in the new image based on the colour histogram of the item in the prior image. Mean shift is then used to find the largest confidence map closest to the object's previous location. The map for the new image is a probability density function that gives each dot in the image a probability. It is the likelihood that a given pixel colour will appear in an image's object.

Complex wavelet transforms (CWT)

Candidate regions in computer vision can be quickly concentrated by utilising the concept of visual frameworks. Objects of interest can be found in this area, and the CWT can then be used to determine additional attributes just for those areas. These additional traits are useful for exact object detection and identification. Additionally, the temporal independent component analysis (TICA) can be used to mine the basic autonomous resources. The CWT can also be used to identify the beginning voxels of cortex [17].

Support vector Machine (SVM)

Images are classified using the SVM. The outcomes of the simulation show that SVMs greatly outperform traditional query modification techniques in terms of discovery precision. Image segmentation can also be carried out using a modified SVM [18]. The operation of SVM for object tracing is shown in Fig. 3.

Layered Based Tracing

The film observation structures make heavy use of computerised object identification and tracking. The study of human mobility and the development of automobiles are where they are most frequently used. In order to draw attention to background information about the objects, the authors have created object identification in figure graphs. The author's layered method looks like this: Figures and drawings provide a clear measure to characterise the general state of the fascinating things at the top layer. The native characteristic provides guidance for overcoming arbitrary object division and abstraction [19]. Laid-based tracing is depicted in Fig. 4.

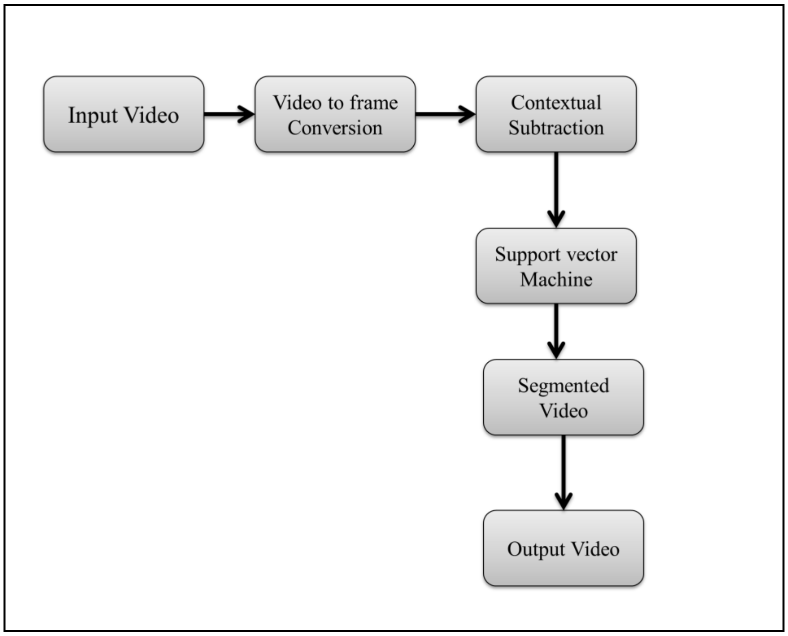

Fig 3: Object Tracing using SVM

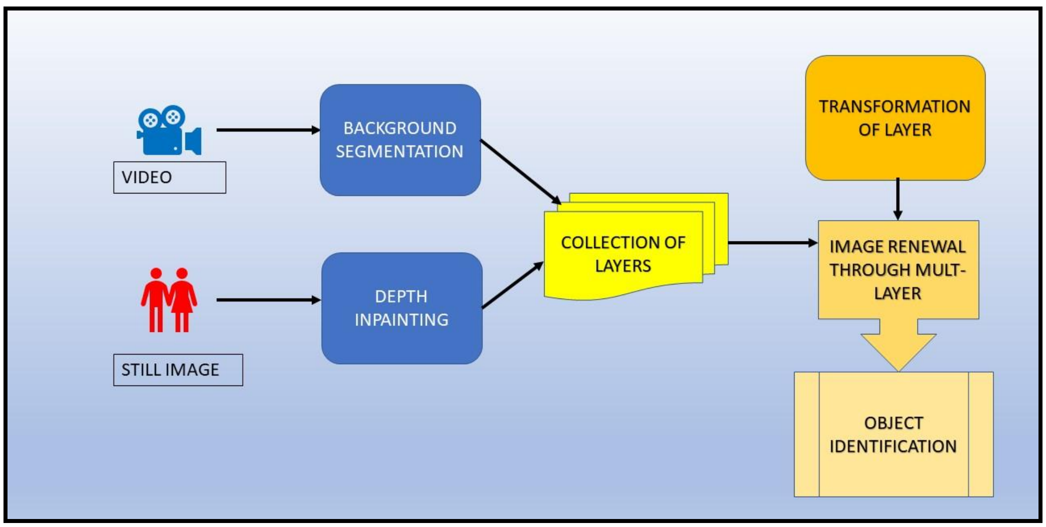

Fig 4: Layered Based Tracing

Template Based matching

It is a method of digital image processing used to find little details in a photograph and compare it to a template image. It might be used to create a quality control, a way to determine a mobile robot's path, or a way to locate edges in a picture [20]. The main issues with template matching, however, include obstruction, recognising non-rigid conversions, differences in lighting and context, disorder and size, and obstruction. Fig 5 depicts the template matching procedure for a picture.

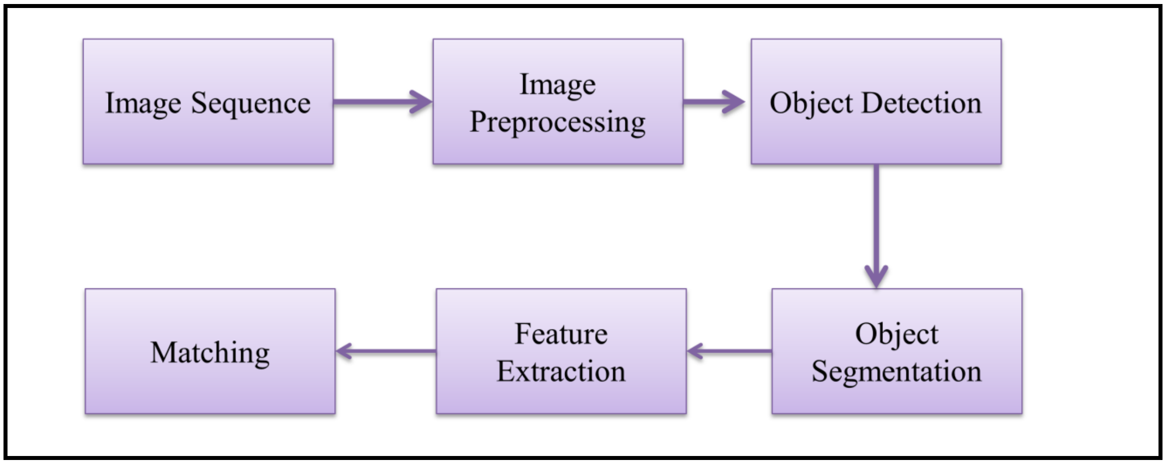

Fig 5: Template Based Matching

Point Tracing numerous traits or patterns can be observed in an image. Depending on how much data is needed and how exact of a result is desired, we can monitor one, two, or more features. There are 4 categories of point Tracing:

- One-point Tracing – Track the x and y axes of one feature point with little to no image change. We can do the reverse to steady the image or use this data to transfer other components in the composite.
- Two-point Tracing – Keep track of the two facial appearances' horizontal and vertical positions. The closely spaced feature locations indicate whether the image is rotating clockwise or counterclockwise. Only occasionally are two tracing points sufficient to calculate the scale of facial features.
- Three-point Tracing – Keep track of the three face appearances' horizontal and vertical positions. By adding a second collection of tracing data for increased accuracy in z-rotation and scaling, it provides all the benefits of two-point tracing.

The point Tracing method has been employed in context when identified objects are signified as points. Tracing is done by assessing the conditions of the object in the context of location and movement and by connecting points through frames.

Benefits: Insensitive to brilliance variations.

Drawbacks: Needs exterior methodology to discover the object in each frame. Problematic context in managing of occlusion, miss-identification, entrances and exits of objects. Difficult to differentiate between many objects a background.

Kalman Filters

In terms of Gaussian noise, it is the best filter for linear operations. It is a technique that uses a series of measurements that are perceived over time and include noise and other errors to approximate anonymous variables that are expected to be more precise than those associated with a single dimension [21] Fig. 6 shows the working of Kalman filter.

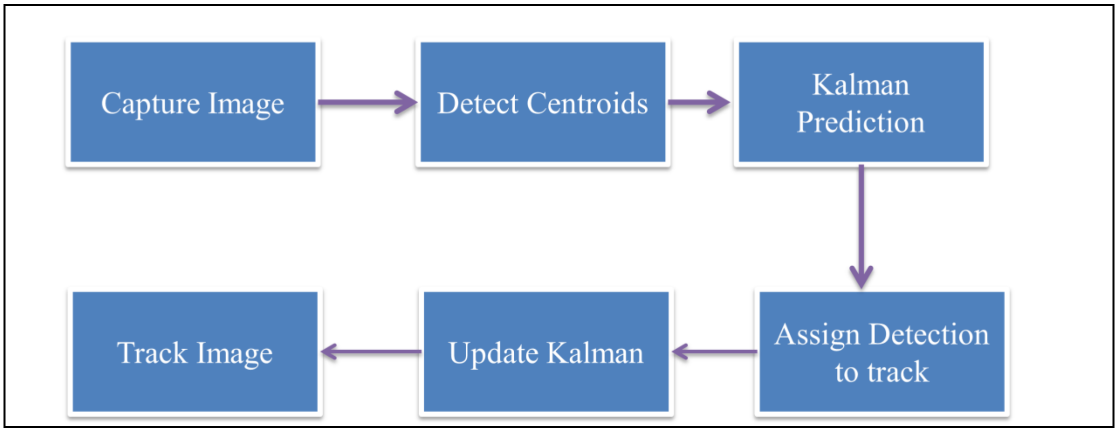

Fig 6: Kalman Filter Based object Tracking

Particle Filter

It can constantly track one or more things. It is a hypothesis tracker that calculates a particle group's stretched posterior allocation. It transmits these particles in accordance with a movement prototype after weighing them based on likelihood scores. The probability function is employed to reduce the quantity of particles that are present close to the item. While particles far from the object have no RGB values, particles above it have few RGB values. Extra-heavy particles create new particles nearby and push the lighter particles away from the item. The object-state and progression over time using the existence of the fittest are illustrated by a distinct collection of particles. It is able to show random densities in [22]. Tracing is done using temporal values. Nonetheless, its implementation is computationally challenging [23].

Multiple hypothesis Tracing (MHT)

The previous N scans are decided by this tracing process. It improves consistency on tracks. In the hope that later information may clarify the ambiguity, the hypotheses are projected into the future. The key need of the MHT method is that difficult data alliance decisions are delayed until more information is gathered. Fig. 7 shows how MHT is processed.

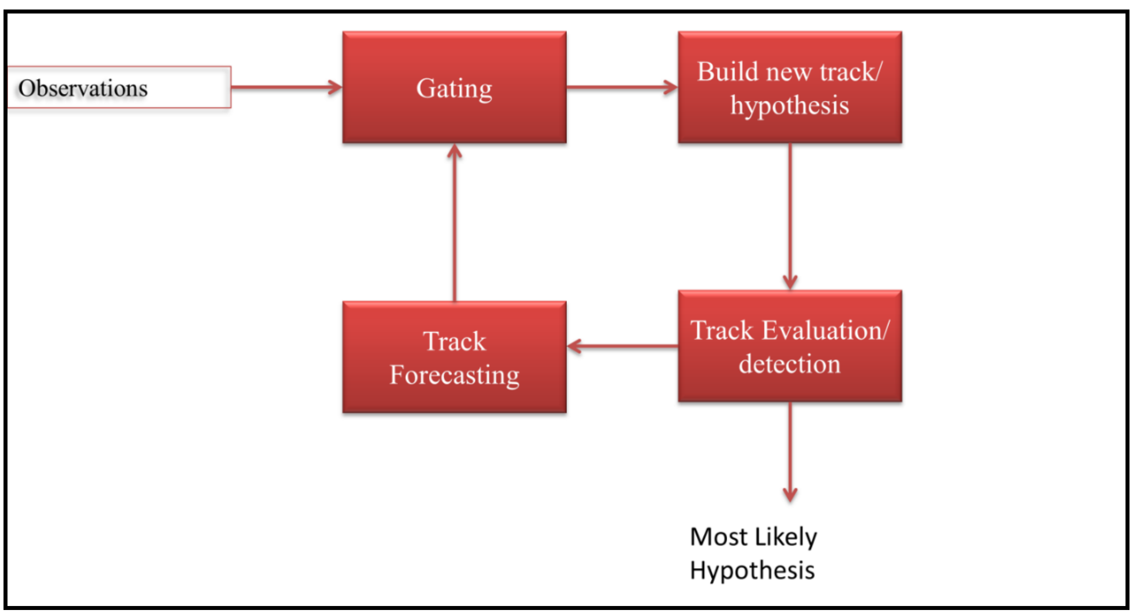

Fig 7: Multiple Hypothesis Tracing

Silhouette Tracing: It is the least expensive way to document someone's appearance [24]. Finding the motions and processing object tracing from silhouette photos, especially from a video, is fairly difficult. A group of various micro action series carried out by one or more body parts of the humans have been proposed by researchers as a new way for detecting human action.

The three key components of a typical human silhouette identification technique are foreground mining, categorization, facet drawing out, and mobility grouping. By removing the video's backdrop, the foreground is mined, which helps to reduce the searching area of the current frame. Whether a person is present in the foreground zone depends on the foreground layout. To determine the human movement in subsequent frames, the analysis of the motion of the human figure components is finished for each frame. Human motion detection from the silhouette is shown in Fig. 8.

- ✓ **Appropriateness:** Composite formed and flexible objects.
- ✓ **Benefits:** Malleable in object demonstration. It is capable of handling a huge diversity of object forms, containing composite flexible figures. Object identification is only required when the object seems in the sight.
- ✓ **Drawbacks:** Frequently does not manage obstruction intentionally.

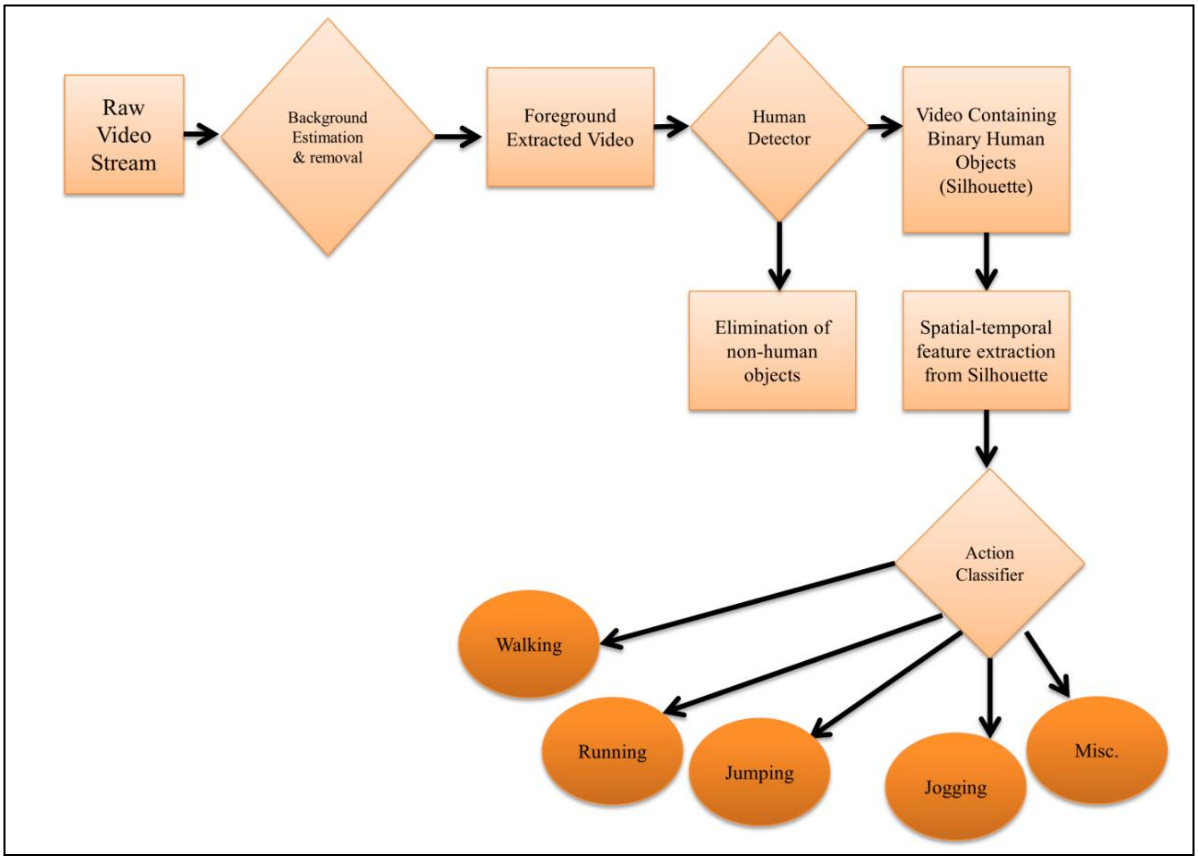

Fig 8: Human Motion Detection from Silhouette

Object edge recognition (dynamic contours or Compression procedure). Contour tracing techniques repeatedly move an initialised original contour from the previous frame to its new place in the current frame. Hand Tracing through contour has been shown in [24].

Shape Matching

The procedures below are used to use this method to track an object:

- ✓ Choose at random one set of points that are located on the edges of a known shape and another set of points that are located on the edges of an unknown shape.
- ✓ Determine the viewpoint of each point identified in the previous step's shape.
- ✓ Relate every point on the recognised shape to a point on the unknown shape. Choose an initial transformation (affine or spline) that encloses the edges of the identified shape to the unidentified shape in order to lower the cost of matching. Select a point on the unknown shape that is fairly near each warped point on the known shape.
- ✓ Calculate the separation between each pair of points on the two forms. Utilize a weighted sum of the shape framework's distance.
- ✓ Benefits Unresponsive to lighting variations and vigorous. Quicker than shape corresponding as it does not employ the entire object area.
- ➢ **Drawbacks:** Does not perform if objects are totally blocked.

Conclusion

This study presents a comprehensive assessment of object recognition and tracking techniques. The advantages and disadvantages of the various techniques for object recognition, classification, and tracking have been thoroughly addressed. Deep learning has become a very prominent branch of machine learning that has outperformed conventional methods in various image processing areas. The capacity of deep learning algorithms to acquire attributes from the unpure data reduces the need for manually created feature detectors and descriptors, which is a very desirable trait. A well-liked unsupervised model for recognising human action is the DBN. In comparison to its more conventional handmade rivals, this model has already demonstrated strong performance on difficult datasets.

References

1. Li, H. and Wang, Y. (2015). Object of interest tracking based on visual saliency and feature points matching, In Proc. 6th International Conference on Wireless, Mobile and Multi-Media (ICWMMN 2015),2015, pp. 201–205
2. Jasdeep Singh, Kirti Bhatia, Shalini Bhadola, Rohini Sharma, An Analytical Survey on Dimension Reduction Based Face Recognition Systems, International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM), Volume 9, Issue 7, July 2022, pp.1493-1498.
3. Akash Dagar, Princy, Kirti Bhatia, Rohini Sharma, Demosaicing Techniques Thorough Analysis, International Journal of Innovative Research in Science, Engineering, and Technology (IJIRSET), Volume 11, Issue 7, July 2022, pp.9902-9907.
4. Jyoti, Kirti Bhatia, Shalini Bhadola, Rohini Sharma, An Analysis of Facsimile Demosaicing Procedures, International journal of Innovative Research in computer and communication engineering, Vol-08, Issue-07, July 2020.
5. Deepak Dahiya, Kirti Bhatia, Rohini Sharma, Shalini Bhadola, A Deep Overview on Image Denoising Approaches, International Journal of Innovative Research in Computer and Communication Engineering, Volume 9, Issue 7, July 2021.

6. Nakul Nalwa, Shalini Bhadola, Kirti Bhatia, Rohini Sharma, A Detailed Study on People Tracking Methodologies in Different Scenarios, International Journal of Innovative Research in Computer and Communication Engineering, Volume 10, Issue 6, June 2022.
7. Mahesh Kumar Attri, Kirti Bhatia, Shalini Bhadola, Rohini Sharma, An Image Sharpening and Smoothing Approaches Analysis, International Journal of Innovative Research in Computer and Communication Engineering, Volume 10, Issue 6, June 2022, pp 5573-5580.
8. Yogita, Shalini Bhadola, Kirti Bhatia, Rohini Sharma, A Deep Overview of Image Inpainting Approaches, International Journal of Innovative Research in Science, Engineering and Technology, Volume 11, Issue 6, June 2022, pp. 8744-8749.
9. Ojha, S. and Sakhare, S. (2015). Image processing techniques for object tracking in video surveillance- A survey, In Proc. 2015 International Conference on Pervasive Computing (ICPC), Pune, India.
10. Agren, S. () 2015. Object tracking methods and their areas of application: A meta-analysis, Master Thesis in Computing Science.
11. Athanesious, J. and Suresh, P. (2012). Systematic survey on object tracking methods in video. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), 242–247.
12. Prasad, S. and Sinha, S. (2011). Real-time Object Detection and Tracking in an Unknown Environment, In Proc. of 2011 World Congress on Information and Communication Technologies, 11-14 Dec. 2011, pp. 1056-1061.
13. Ahn, H. and Rhee, S.-B. (2015). Research of Object Recognition and Tracking Based on Feature Matching, Computer Science and its Applications, 2015, pp. 1071-1076.
14. Wang, Q., Zhang, Li., Bertinetto, L., Hu, W. and Philip H.S. Fast Online Object Tracking and Segmentation: A Unifying Approach, arXiv: 1812.05050 [cs.CV].
15. Zhu, Li. and Hu, T. (2013). Research of CamShift Algorithm to Track Motion Objects, TELKOMNIKA, 11(8), August 2013, pp. 4372-4378.
16. Comaniciu, D. Ramesh, V. and Meer, P. (2000). Real-time Tracking of Non-rigid Objects Using Mean Shift, In Proc. IEEE Conf. on Computer Vision and Pattern Recognition, 2, pp. 142-149.
17. Kingsbury, N. G. (2001). Complex wavelets for shift invariant analysis and filtering of signals. Journal of Applied and Computational Harmonic Analysis, 10 (3), 234–253.
18. Haritaoglu, I., Harwood, D. and Davis, L.S. (2000). W4: real-time surveillance of people and their activities. IEEE Trans. on Pattern Analysis and Machine Intelligence, 22(8), 809-830.
19. He, Q. and Chu, C.H. (2011). Layer-based object detection and tracking with graph matching, In Proc. Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications VIII; 80200N.
20. Talmi, I. and Roey, Z.-M. (2016). Template Matching with Deformable Diversity Similarity.
21. Arulampalam, M., Maskell, S., Gordon, N. and Clapp, T. (2010). A Tutorial on Particle Filters for Online Nonlinear/Non-Gaussian Bayesian Tracking. IEEE Transactions on Signal Processing, 50 (2), 174-180.
22. Maggio, E. and Cavallaro, A. (2010). Video Tracking: Theory and Practice. 1. Video Tracking provides a comprehensive treatment of the fundamental aspects of algorithm and application development for the task of estimating, over time.

23. Chandrasekaran, K. (2010). Parametric & Non-parametric Background Subtraction Model with Object Tracking for VENUS. 1. Background subtraction is the process by which we segment moving regions in image sequences.

24. http://visagetechnologies.com/silhouette.

25. Yilmaz, A., Shafique, K. and Shah, M.(2002). Estimation of rigid and nonrigid motion using anatomical face model, In Proc. Int. Conf. of Pattern Recognition, 1, pp.377-380.

