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Object Tracking

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Abstract –

Object tracking *is one of the best applications of artificial intelligence and data science with the help of data and computers and cameras we can track the objects and there motions, speed and details.*

To do so we need trackers, sensors, cameras and AI to complete the desired work.

In this deep learning of computer also plays important role. Basically this research paper will guide and tell the importance of the deep learning and AI, object detection in day to day lives.

Key Words: Deep Learning, AI, Object tracking.

INTRODUCTION

Object tracking is a popular and challenging area of computer vision that involves detecting and tracking objects of interest in a sequence of video frames. The goal is to create a trajectory that accurately reflects the movement of the object over time. The use of object tracking is relevant for the following tasks: - motion-based detection, i.e. H. detection of people using the H. corridor., automatic object detection, etc. - Video indexing, which automatically annotates videos and searches them in media databases - Human-computer interaction such as traffic flow - Car navigation such as B. Video route planning and obstacle avoidance. At a high level of abstraction, there are mainly two levels of object tracking.

• Single Object Tracking (SOT)
• Multiple Object Tracking (MOT)

1.1 ***Background:***

Object tracking can also be categorized into two types: online and offline tracking. Online tracking refers to tracking objects in real-time, where the system processes each frame as soon as it arrives. In contrast, offline tracking involves processing a pre-recorded video sequence without real-time constraints. Online tracking is generally more challenging since it has to process frames in real-time, whereas offline tracking can take more time and use more resources.

Object tracking methods:

There are several object tracking methods, including:

1.Template-based tracking: This method involves creating a template of the object in the first frame and then tracking it throughout the video sequence by searching for a match of the template in each subsequent frame. However, this method is sensitive to changes in appearance due to occlusions, illumination, and scale variations.

2.Optical flow-based tracking: This method estimates the motion of pixels between frames to track objects. However, it suffers from errors due to noise and occlusions.

3.Feature-based tracking: This method involves identifying and tracking feature points such as corners, edges, and blobs, which are distinctive and invariant to changes in illumination and scale. However, feature-based tracking can fail when the features are not distinct enough.

4. Deep learning-based tracking: This method uses deep neural networks to learn the appearance and motion of objects, which can handle variations in illumination, scale, and occlusions. Deep learning-based tracking methods, such as Siamese networks, correlation filters, and region proposal networks, have achieved state-of-the-art performance on several tracking benchmarks.

SELECTING THE FUNCTIONS TO BE FOLLOWED:

Choosing the right features plays a key role in tracking. In general, the most desirable property of a visual element is its uniqueness, which allows objects within the element's space to be easily distinguished. The selection of features is closely related to the representation of the object. In general, many tracking algorithms use a combination of these features. The details of the common visual features are as follows. - color - borders - Optical Flow. - textures Of all the functions, color is one of the most commonly used tracking functions. Comaniciu et al. [2003] use a color histogram to represent the appearance of an object. Despite their popularity, most colored stripes are sensitive to changes in light. Therefore, in scenarios where this effect is unavoidable, other features are taken into account in the object model appearance. Cremer et al. [2003] use optical flow as a contour tracking function. Jephson et al.[2003] use controllable filter responses for tracking. Alternatively, a combination of these features is used to improve tracking performance.

OBJECT DETECTED:

Any tracking method requires an object detection mechanism at each frame or when an object first appears in the video. A common approach to object detection is to use the information in a single image. However, some object detection methods use timing information calculated from a sequence of frames to reduce false detections. This timing information is usually in the form of frame differencing, which highlights the areas that change in successive frames. Given the ranges of objects in the image, the tracker's role is to perform object matches from one image to another to create tracks.

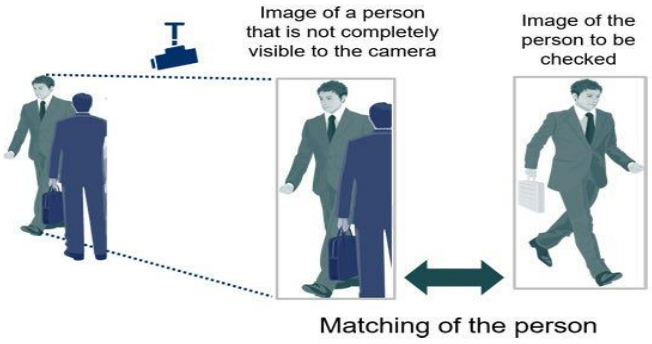
Table -1: Object Detection methods

Methods	Working	Features
Generating an image	This method is used to generate the image with the help of data given by the data base	It can change the image as data give to it changes.
Detection of height	With the help of formulae and deep learning we can check the height of person or an object	It shows the accurate height of object.it can also show various heights of object simultaneously
Detection of speed of a vehicles	It uses the AI and data base it detects the object of the vehicle	It is very fast and detects the speed of object very fast

Challenges:

When troubleshooting the object tracking issue, there are a number of issues that can result in a negative result. Algorithms have tried to solve these problems over the years, but so far we haven't found a fully proven solution, making it an open area of research.

• Variations due to geometric changes Example: - Pose, articulation, scale of objects



• Difference due to photometric factors. For example.:- Lighting, I'm waiting

• Non-linear movement • Limited resolution Ex: - Video captured by a low-end phone

• Similar objects in the scene Example: - Same color of clothes, accessories, etc.

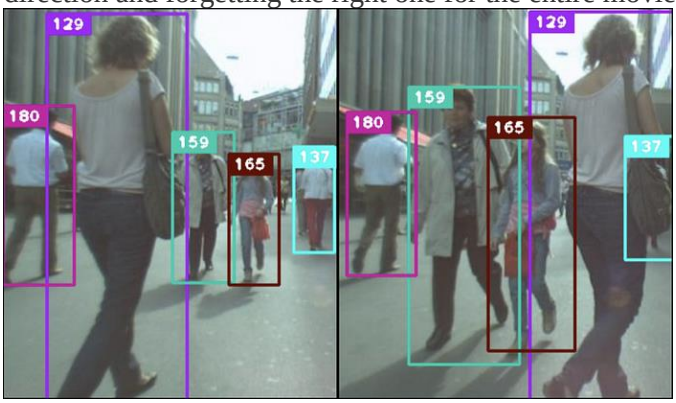
• High traffic scenarios such as streets, concerts, stadiums, markets.

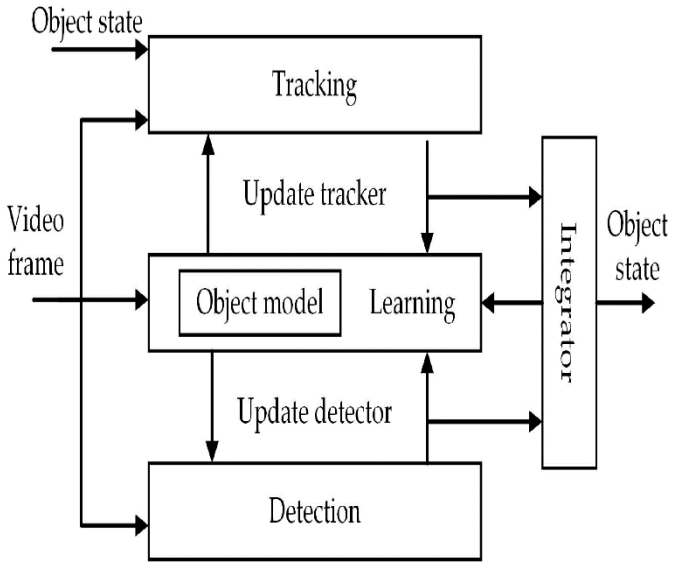
• Beginning and end of the journey. Before starting a tracking algorithm, information about the object you want to track is needed. It may not always be possible to initialize the algorithm with the target.

• Tracks may be merged/swapped due to sudden motion changes, sudden camera quality changes, etc.

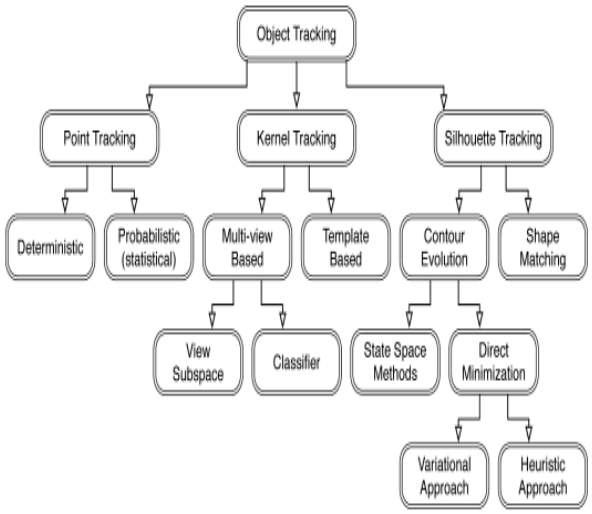
• Target IDs were swapped due to similar characteristics such as similar clothing, facial structure, glasses, skin color, height, etc.

• Drift due to incorrect update of the target model. A bad update can result in constantly updating in the wrong direction and forgetting the right one for the entire movie.





OBJECT TRACKING FLOWCHART



Taxonomy of tracking methods

A qualitative comparison of core tracers is possible a - followed by one or more objects, - ability to deal with occlusion, - training needs, - Motion model type i - Manual initialization is required.

FUTURE DIRECTIONS:

Significant progress has been made in object tracking in recent years. Several reliable trackers have been developed to track objects in real-time in simple scenarios. However, it is clear from the articles reviewed in this research that the assumptions used to solve the tracking problem, such as limits the tracker's usefulness in applications such as self-tracking, human-computer interaction, video download, traffic monitoring, and vehicle navigation on. Therefore, tracking and the related problems of feature selection, object representation, dynamic shape and motion estimation are very active research areas and new solutions are constantly being proposed. In general, we believe that additional sources of information, particularly historical and contextual information, should be used wherever possible to tailor the tracker to the specific scenario in which it is being used. A principled approach to integrating these different information sources will result in a generic tracker that can be used successfully in a variety of applications**. CONCLUSIONS**

Object tracking is an important research area in computer vision with many applications in a variety of fields. Pattern-based tracking methods, optical streams, functions, and deep learning have all been developed, each with their own advantages and disadvantages. Deep learning-based tracking methods have achieved top performances in several tracking benchmarks. However, challenges such as occlusions, lighting changes, and scale changes remain, and future research should aim to address these challenges in order to improve the accuracy and reliability of object tracking methods.

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