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# PEOPLE COUNTING AND TRACKING USING MACHINE LEARNING

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## ABSTRACT

The demand for people counting and tracking systems for surveillance applications is rapidly increasing, necessitating the development of more precise, efficient, and dependable systems. The major goal of this project is to create an accurate, long-lasting, and efficient system for counting and tracking people in public spaces. The main goal of this study is to create a system that can work in a variety of environments, including varying orientations, densities, and backdrops. AI calculations make a model in light of preparing information, which is a sample of data. The primary goal of this project is to keep track of and count people and determine the number of things. [11] This hybrid approach has the advantage of being able to count persons in a crowd with great precision utilizing a high definition camera. [13]. The HOG (Histogram of Oriented Gradients) technique is utilized to identify detecting, tracking, whereas the CNN algorithm is utilized to count objects and recognize faces [4], [5], [6]. This research is used to develop object tracking technologies that are less computationally intensive. In a single algorithm, the concepts of object detection and object tracking are combined. An ROIs based pedestrian detection system for single images [7].

**Keywords:** OpenCV, Detecting, People Counting, Tracking, Surveillance based spotting, Centroid Tracker, High Definition Camera, CNN, HOG algorithm.

## 1. INTRODUCTION

People counting and tracking are done using deep learning mechanisms, and thanks to advances in image processing algorithms and computer technology, the utilization of camcorders to track and count individuals has expanded significantly in recent years. There are a variety of techniques and technologies available to do this task, and due to its importance in a wide range of public space applications, commercial goods offer a variety of options. A Bayesian computer vision system for modeling human interactions is done by using these algorithms. [15] The functional distinctions between these goods can be visualised as a pyramid. In terms of functionality, systems that count the number of individuals are the most basic. A traffic flow detection system combining optical flow and shadow removal is done by the HOG and CNN algorithms. [9] Another option is to utilise video cameras to count persons entering or exiting a building through a door. Video cameras are commonly used as sensors in systems that track individuals. A method of counting the passing people by using the stereo images is implemented by using

the HOG and CNN algorithms. [16] It can be tracked while they are in the field of vision of the camera, resulting in a more accurate representation of their actions.

## **2. LITERATURE SURVEY**

**Title:**Image Motion Analysis **Year:** 2020**Author:**NanangCahyadi**Abstract:**Individuals counting frameworks can give factual pattern data used to human conduct investigation. Instinctively individuals counting framework works in view of succession discovery. In any case, with dynamic exploration exercises in Artificial Intelligence in Computer Vision, there are numerous choices accessible for carrying out a group counting framework.

## **3. METHODOLOGIES**

The methods used are profound sort, centroid tracker, CSRT, etc, which track the distinguished objects. The steps and methodologies followed are:

- Draw an ideal reference line on the information outline.
- Recognize individuals utilizing the item identification.
- Note the centroid on the recognized individual.
- Track the development of that obvious centroid.
- Compute the centroid development Count the quantity of individuals coming in or leaving a reference line.
- In light of the counting, increase the up or down counter.

## **4. RELATED WORK**

Object tracking and counting were not first offered as machine learning approaches. The present system detects, tracks, and counts objects using a deep learning method in machine learning. The main goal of this project is object detection and determining whether there are any instances of things from defined categories (such as humans, vehicles, bicycles, dogs, or cats) in a picture and, if present, returning the spatial location and human behavior extent of each object instance.[10] The advantage of this hybrid technique is that it can count people even in a crowd with great accuracy utilizing a high definition camera. The HOG (Histogram of Oriented Gradients) technique is utilized to identify tracking, while the CNN algorithm is utilized to count objects and recognize faces. [1], [12]

## **5. PROPOSEDSYSTEM**

The main purpose of this project is to tracking and counting of people and detect the number of the objects. The advantage of this half breed approach is that can apply exceptionally accuracy using high definition camera and count the people even in the crowd. HOG (Histogram of Oriented Gradients) algorithm is used for detecting, tracking and counting of objects such as body parts and face recognition. [14] This project is used for object tracking techniques without as a large part of the computational weight.

## **5.1 System Setup**

An above camera connected via USB link will be mounted pointing downwards or marginally inclined. The camera's height has a direct impact on the likelihood of detection. The higher the camera stature, the broader the camera's field of vision and, as a result, the larger the monitoring area.

## **5.2 Camera choice**

There are two kinds of cameras: fixed cameras and PTZ cameras. They can then be partitioned into two sorts: shading and non-shading. Notwithstanding, any type of camera might give information to a PC or control unit. A 25 business minimal expense camera was used for this venture. The nearest centering distance of the camera used is 4.8mm. It has a top notch sensor, high edge rate video playback, and a base responsiveness of 2.0V/Sec. It additionally upholds great AVI, as well as picture stockpiling in BMP and JPG designs. Its result outline has a goal of 640x480, which is great for the recognizing framework.

## **5.3 Image Processing Library**

The people counting system in this project is built utilizing Microsoft Visual Studio and the Open Source Computer Vision Library for identifying social and behavioral sciences. [3] Because of technological advancements, OpenCV is sufficient to support the whole detection process. [2] There are several functions in OpenCV's default library that may be used to handle video feeds from various sources.

## **5.4 Object Detecting**

We run our computationally more costly article tracker during the detection phase to determine if new items have entered our vision and to check in the event that we can find protests that were "lost" during the following stage. We construct or then again update an article tracker with the updated bounding box coordinates for each identified object. We only perform this step once every N frames since our item indicator is all the more computationally intensive.

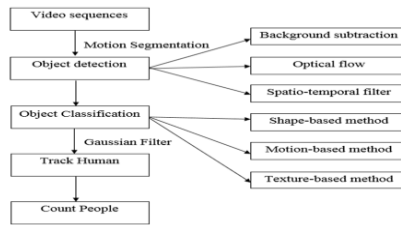
## **5.5 Object Counting**

We establish an object tracker for each of our identified objects to monitor the object as it travels across the edge. Our article tracker ought to be more efficient and quicker than the item identifier. We'll continue to follow until we reach the N-th frame, at which point we'll re-run our item indicator. The whole procedure is then repeated. We plan to use such a global positioning framework to improve our people and object counting.

## **6. IMPLEMENTATION**

To execute our people counter. We'll utilize both OpenCV and dlib to assemble our people counter. For standard PC vision/picture handling capacities, we'll utilize OpenCV, and for individuals counting, we'll

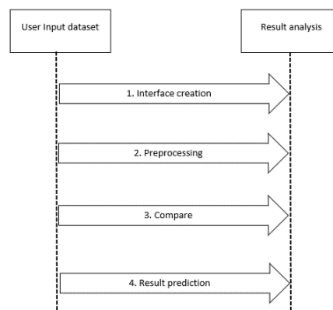
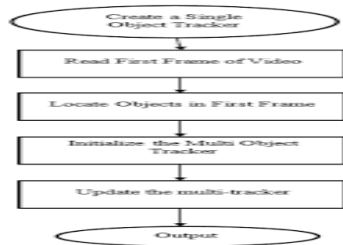
utilize the profound learning object indicator. Then, at that point, we'll utilize dlib to carry out connection channels. We might have utilized OpenCV all things considered, yet the dlib object following execution. Initially the video sequences of the object is detected based on motion segmentation and the object is classified with Gaussian filter and then track the human and count the people as shown in the fig.6.1.



**Fig 6.1 Flow chart of Tracking and Counting People**

### 6.1 UseCaseDiagram

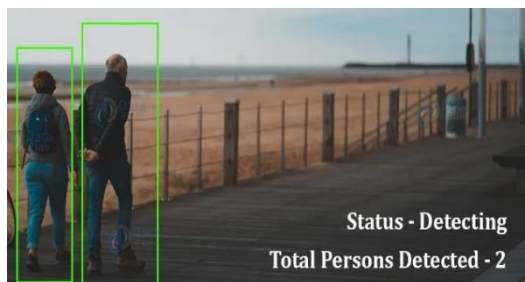
A use case diagram depicts a framework's dynamic way of behaving. The object is initially detected by the people counting and tracking system. By following the input dataset it tracks and counts the number of projects with high accuracy and determines whether the object is moving or static as shown in the fig.6.1.1. It is accomplished by employing a high-definition camera that focuses with pinpoint accuracy. The advantage of this hybrid approach is that it can count people even in a crowd with high accuracy using a high definition camera. [8], The HOG (Histogram of Oriented Gradients) algorithm is used for object tracking and the CNN algorithm for object counting and face recognition as shown in the fig.6.1.2. A single algorithm employs the concepts of object detection and object tracking



**Fig.6.1.1 Sequence Diagram of people Counting and Tracking**

**Fig. 6.1.2 UML Diagram of People Counting and Tracking Result Analysis**

## 7. RESULT AND DISCUSSION



It was successful in developing a counting system that could detect and count people. This project made use of a low-cost commercialised upward camera, open source programming, and a control unit like a CPU.

## 8. CONCLUSION

This research led in the creation of a counting system that can identify and count individuals. This project makes use of a low-cost commercialized overhead camera, open source programming, and a control device such as a CPU. The construction of the passerby counting framework might be based on the HOG and R-CNN algorithms, which are utilized in object detection and counting.

## 9. FUTURE SCOPE

In future, effective research is required to remove the complexities by shadows. Counting and tracking of people even in very much crowded area with high definition of image with very high accuracy can be implemented by using additional algorithms like Single Shot Detector (SSD), Faster RCNN, YOLO in future and it can be used to implement real time tracking and counting of people and objects.

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