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# REAL-TIME PEOPLE TRACKING AND COUNTING SYSTEM USING KALMAN FILTER

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**Abstract**— A Framework for track human movement in an enclosed environment from arrangements of monocular dark scale pictures that is acquired from mounted cameras. The recognition of articles that are moving utilizations foundation subtraction calculation which is working taking into account Gaussian blends model. Variable Gaussian models square apportion connected to look for the similar matches of human motions between progressive edges taken by cameras mounted in differed areas. The altered Kalman channels is utilized for identifying articles as a part of every edge, and decide the likelihood of every discovery is being doled out to every track. A critical part of this undertaking is Track upkeep. Hadoop Distributed File System is used to maintain large volume of counting datasets.

**Keywords**— Tracking, Counting, Segmentation, Background reduction, Hadoop Distributed File System

## I. INTRODUCTION

People tracking and counting is needed in many situations such as safety control in surveillance at event sites<sup>[1]</sup>. Pattern recognition defines the features and characteristics of object, while recognizing compares the texture of foreground and background images. Thus example illustrates the information on the number of passengers in a place or an airport is helpful to give an appropriate reaction in the case of emergency or distraction of services. In addition, information on the number of people in an office location or a public facility can be used for safety management of buildings. This information can be obtained by monitoring the number of pedestrians fleeting through specific areas such as doors, passage-ways, and so on. People counting are usually conducted manually or mechanically using sensors or live video cameras. Manual process of counting requires labor costs and is complex to relate in crowded scenes due to human errors. Therefore, automatic counting has concerned that has a lot of attention. Among automatic pedestrian tracking and counting methods, video processing-based counting methods have been commonly considered. Although the presentation of video

proceeding-based counting that is affected by surrounding environments such as the changes in light illumination and the climate, it has some advantages. For example, camera placement is flexible because video sequence can be recovered remotely. In addition, the preamble cost can be reduced by using existing surveillance cameras for some situations<sup>[3]</sup>. Therefore, there have been many researches for tracking and counting pedestrians in video sequences. The input which obtained from the surveillance camera and it processed through the recognition techniques. This task demonstrates that individuals' checking and following are key exercises in numerous applications, including movement acknowledgment, activity observing, car insurance, and perception. Subsequent human movement in an enclosed environment is of enthusiasm for uses of observation. In particular, we are adding to a procedure to follow individuals at, for example, hall, airplane terminal, fringe, and secured fabricating. This requires the observing framework have the capacity to duplicate the followed subject amid an expansive space over a broadened measure of following time. The track maintenance is important to update the exact count into the database.

The work has developed from learning human strolling utilizing an affixed camera to taking after non-foundation objects amid a solitary moving camera<sup>[4]</sup>. The studies in using so as to follow mounted single camera are constrained to a truly limit space attributable to the confined review point of the framework. A moving camera with an impressive level of move flexibility will expand the survey point to bound degree; notwithstanding, it entangles the execution by including the movement estimation of each the review framework furthermore the subject of hobby, and keeps on being confined in the measure of survey space. And this work, we tend to choose to utilize various affixed cameras mounted inside of the space of enthusiasm to track and screen the movement of individuals in successions of monocular grayscale pictures. As long on the grounds that the subject is inside of the domain checked by the attached cameras, the picture of this subject are contained inside of the read of at least one following human movement in an inside air is of enthusiasm for utilizations of police examination. In particular, we are adding to a procedure



to follow individuals at locales, for example, halls, airplane terminals, fringes, and secured structures. This requires the review framework prepared to picture the followed subject amid an expansive space over a developed measure of your time. In quest for this objective, our work has developed from learning human strolling utilizing an attached camera to interest camera. Bolstered this circumstance, the matter of perception a subject turns into that of interest the point of interest one camera read and coordinating that subject crosswise over totally distinctive camera sees, wherever the cameras inherent parameters and relative positions territory unit thought to be recognized from the earlier. To build up correspondence between back to back edges from totally diverse cameras, run of the mill interest courses taking into account the likeness of the thing structure, similar to cross relationship and line-edge matching, don't appear to be pertinent as a consequence of the type of Associate in Nursing object picture fluctuates definitely from perspective to take a gander at of different cameras, furthermore the entire body of a moving human commonly experiences refined changes amid movement. What's more, the congruity of the movement stream doesn't hold in the perspectives of various cameras.

Optical flow ways, which range unit wide utilized for plain movement interest, request minor and wash movement between edges, a limitation that conjointly doesn't grasp for our circumstances. Amid this paper was propose to track a moving human in a few camera sees upheld low level acknowledgment of human movement. A less demanding sort of human model is connected to discover moving human subjects. Interest between back to back edges is particularly in view of the consistency of the position, speed, and normal power of highlight focuses created by variable Gaussian models, considered inside of the perspectives of shifted cameras<sup>[5][6]</sup>. The arranged algorithmic guideline is computationally prudent and can be immediately used progressively applications. Consequently the following and including of individuals continuous applications that can achieved through the pre-preparing systems.

## II. PROPOSED WORK

The execution of human tracking in the real-time video processing that has been executed by implementing various methodology using Gaussian vectors. Video has been sequenced and converted into frames by frame conversion methods. The converted frames has been processed and thus executed with background subtraction, segmentation, frame conversion, particle filtering, object classification, detection of human using edge based mechanism for identifying human in the frames by comparing with edge of reference frames with the frame sequences obtained<sup>[13]</sup>. Tracking of humans from the frame sequence movements thus configured with kalman filters and then tracked humans interaction then counted with the movements of human. The video sequence is converted

into frames then segmentation takes place to locate the datasets.

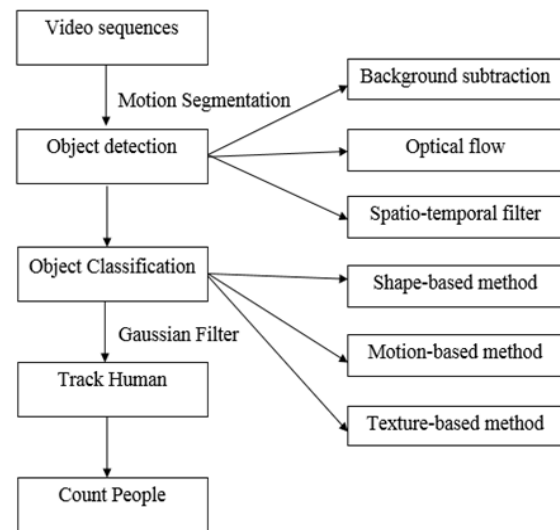


Fig. 1. People Counting Block Diagram

Here the algorithm which uses for people counting is kalman Filter and Gabor Filter. Those filters performs the identification followed by counting has been done. Gabor filter defines edge based detection and clusters the related texture based on the sample datasets. Modified kalman filter has the state and covariance estimation which defines the prediction of data is to be incremented and updation of data stores the results of people count. Every updates describes there is no repetition of people in the counting.

### A. Segmentation

The arranged division technique takes advantage of the assets of time-ward data. Since we tend to region unit abuse altered cameras, the foundation picture from indistinguishable camera view remains nearly unaltered. Once the foundation picture is recouped, photos of the non-foundation articles are regularly isolated from the foundation picture by variety and edge. Subsequent step is to get pictures of non-foundation objects at interims very surprising bouncing boxes. The segmentation has the preprocessing techniques to extract to the foreground object in the surveillance camera. The window cutting technique to the thresholded parallel picture in a coarse to unrivaled way. The paired picture is essential pressed by a five mean channel before we tend to compute its relating parallel and opposite profiles. At that point valleys of the smoothed profiles region unit considered to be the confinements of the rectangle boxes that containing non-foundation objects.

In the motion segmentation is processed for object detection and this can be done in three ways, as Background Subtraction, Optical flow and spatio-temporal filter<sup>[15]</sup>. The object classification is done by Shape-based method, motion-based method and texture-based method. Then Gaussian Filter is used for human tracking by filtering the background images and using foreground object the process is carried out.

### B. Human Detection

Different strategies for demonstrating the physical bodies have been created by analysts and describes about the occlusion. This used to analyze the occluded part of the human. The human body is envisioned either as a drawing or as a volumetrically show. Amid this work, proposed to utilize an unpleasant second model different channel mechanisms. Bolstered the perception that the people head and trunks doesn't alteration as radically in light of the fact that the hands and legs all through the movement, our strategy makes an endeavor to discover the zenith and trunk utilizing a coarse second model of the physical body<sup>[2]</sup>. The human head is models que as Associate in nursing shroud with a stature to broadness section of balanced. The human trunk is visualized as a parallelogram with a stature to broadness extent connection somewhere around one and three mulling over the unique points of body projection to the survey camera. Figure.1 demonstrates every one of the proportions is study from trial of picture of people from totally distinctive purposes of read. To begin with, we look for the arrangement of the apex considering the territory of a blob that is with regards to is the tomahawks of the eclipse. On the off chance that the universe of any high sub-district inside of each bouncing box is similarly steady with the higher than relationship, to proclaim this might well be a head. Else, we have a tendency to avoid it from extra thought.

### Steps involved in kalman filter

1. Read the input image.( affected image)
2. Create free hand ROI for affected region. (Segmentation)
3. Create a mask from ROI object. (Feature Extraction)
4. The affected region is re-validated by original face. (Removal of affected region)
5. Display the affected region removed image and popularize to count the human face. (New affected region removed image)

The removal of affected region is done by the kalman filter and updates the count by exact region<sup>[14]</sup>. The tracks obtained in every process which can be analyzed through the preprocessing techniques.

### C. Extraction of Feature and background Reduction

We pick directs satisfaction toward the average pivot of the predominant body in light of the fact that the element for pursue. Exploitation various component purposes rather than one point makes the coordinating of an equal subject between back to back casings extra reliable. Based on this presumption, we tend to constantly treat the measurement of a jumping box as genuine information and adjust the top therefore subsequently that all the bouncing boxes for correlation as appeared in figure.2, have a comparable width to stature quantitative connection.

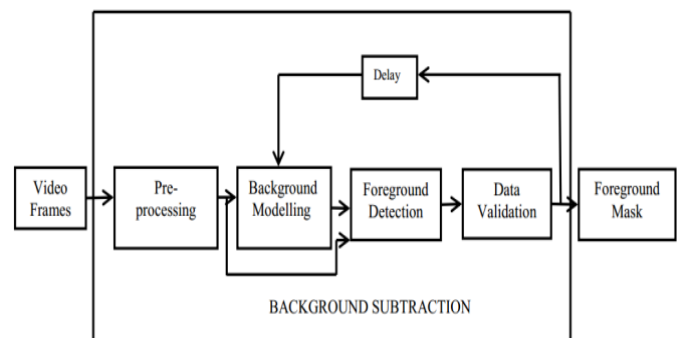


Fig. 2. Background Subtraction

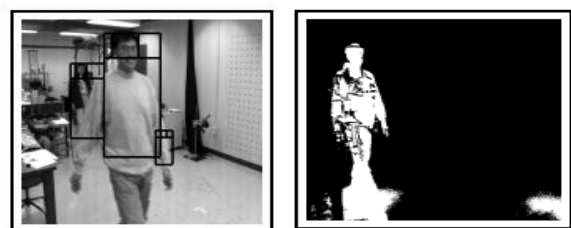


Fig. 3. Feature extraction on images to reduce background

### D. Maintain datasets using Hadoop Distributed File System

Hadoop Distributed File System(HDFS) is used for accumulate huge capacity of datasets and it is distributed java-based file system. In Big data HDFS plays vital role by providing scalability, fault-tolerant, cost-effective storage. HDFS maintains two major nodes as master and slave to store the large volume of datasets. The big data concept is proposed for to handle large volume datasets.

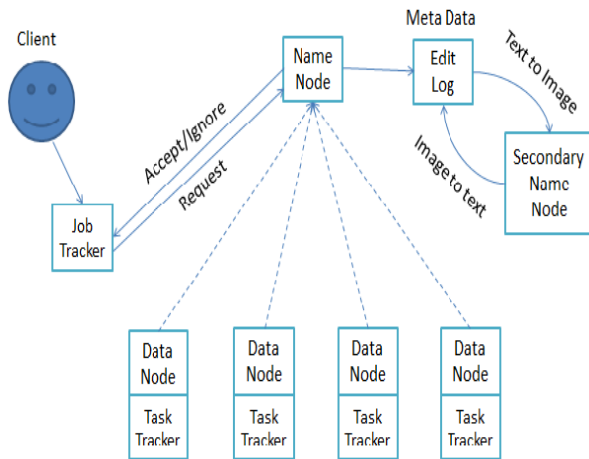


Fig. 4. HDFS Architecture



Fig. 5. Tracking on human action in surveillance

All datasets including the image can also store in any format. And also the fetching of datasets from the database which stored using the HDFS is easy and efficient.

### III. EXPERIMENT AND RESULT

Thus the experimentation in results shows that the efficiency and easy maintenance of people counting system. The process can be done in two ways as, tracking and counting. The counting occurs in client side while the tracking occurs. Although the frames are stored in the database for future reference and is to obtaining the count from the datasets<sup>[8]</sup>. The feasible connection between the tracking and counting has been processed by the modified kalman filter and Gabor filter.

#### a) TRACKING

In any case, we tend to screen the objective at interims the read of one mounted camera. At that point the framework takes after the subject moving over the review limit of 1 camera to an alternate. As long in light of the fact that the objective is at interims the part of read of the framework cameras, it will unendingly is half-track over various video streams caught from the cameras. Along these lines, the accompanying undertaking amid this setup comprises of 2 noteworthy parts: 1) taking after a human inside of the read of 1 mounted camera, and 2) taking after a human crosswise over totally distinctive camera sees as in figure 5.

Track support turns into a primary part of this venture. Human detection in the surveillance is achieved through the recognition techniques.

#### b) Counting

Including of individuals entering the observation are should be possible by numerous people enter, stroll around, and exit the workspace. The edge furthermore the genuine tally are plotted. The edge was frightfully high and isn't arranged. The edge coordinates the specific check fine. As clarified before, the edge is more tightly than the higher bound as a consequence of the character of the LBC requirement. Moreover, the UBC imperative is significantly weaker here as an aftereffect of the genuine item size is obscure and totally diverse for each individual.

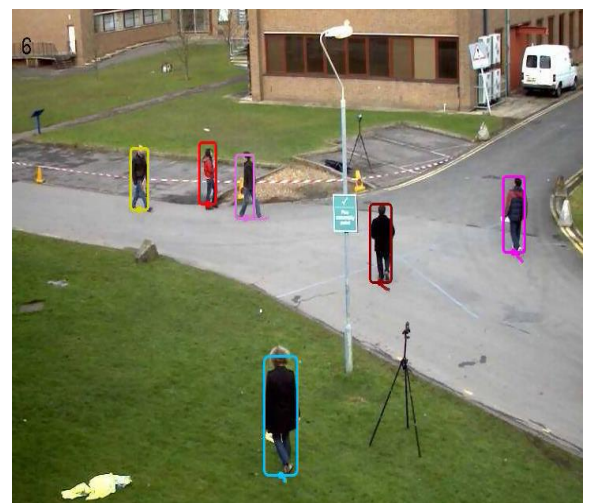


Fig. 6. Counting of people

The littlest least protest size ought to be utilized, making the edge much bigger. Additionally, allowing people to enter and leave debilitates the limits for polygons near the sting to encourage a much better lower headed for these edge polygons, once a polygonal shape inside of the workspace moves to the sting, the edge isn't progressively set to zero. Rather, the lower bound is prepared to zero once the polygonal shape vanishes from the sting. The exchange off is that once people stroll on the edge, the edge is more tightly, however once people exit, there will be a slack inside of the edge before it makes up for lost time to the genuine tally.

That is regularly why inside of the figures the edge lingers behind the specific tally once people exit. The counting of people from each frame can be estimated by the kalman filter and clusters of same datasets are updated to the database. The input from the surveillance camera is processed by image processing techniques such as segmentation and classification. In the analytical results shows the tracking of human in any location and updates its count while human is detected [13]. In some cases that an imaginary lines are drawn in a surface, if the human crosses the lines then the count is incremented to next count [14]. By this way both forward and reverse direction human pedestrians are monitored using surveillance camera and the counting process is made. Even though many sensors based device is available for human counting but that requires more cost for manufacture. So that we propose a people counting system based on image processing and stores data sets in the HDFS which less cost and effective.

```

---- JUMP MOVES ROUND 9 ----
merging.....done
merging does no good!
Target:   1  2  3  4  5  6  7  8 Tars Frms
grow bck: -  -  -  -  -  -  -  -  -  0  0
grow frw: -  -  -  -  -  -  -  -  -  0  0...done
growing does no good!
Target:   1  2  3  4  5  6  7  8 Tars Frms
shrk pst: -  -  -  -  -  -  -  -  -  0  0
shrk ftr: -  -  -  -  -  -  -  -  -  0  0...done
shrinking does no good!
splitting.....done
split does no good!
creating targets.....done
adding does no good!
removing targets.....done
purge does no good!
No jumps were executed. Optimization has converged after 9 epochs.
All done (0.29 min = 0.00h = 0.16 sec per frame)

Evaluation 2D:
Rc1l  Prcn  FAR| GT  MT  PT  ML| FP  FN  IDs  FM| MOTA  MOTP  MOTAL
98.2  99.8  0.01| 7  7  0  0| 1  9  1  0| 97.9  75.4  98.0

Evaluation 3D:
Rc1l  Prcn  FAR| GT  MT  PT  ML| FP  FN  IDs  FM| MOTA  MOTP  MOTAL
98.2  99.8  0.01| 7  7  0  0| 1  9  1  0| 97.9  86.1  98.0
    
```

Fig. 7. Execution results

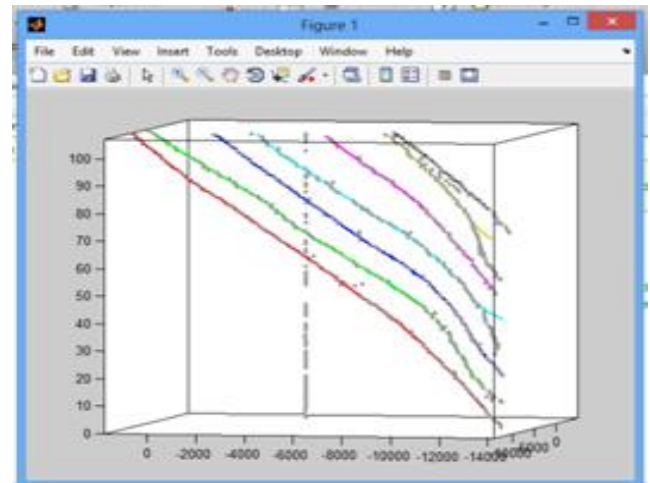


Fig. 8. Graph analysis

The graph analysis shows in fig. 8 about the rounds taken place in counting and frame rates which has been processed in the emulator. The different colors indicates the accuracy in counts and there is no repetition in human by bounding the rectangle box around the human movement. The target frame denotes the foreground objects which is extracts from the input source. And also the proposed algorithm initiate the graph by calibration based method.

#### IV. CONCLUSION

This venture demonstrates that individuals' numbering and following are key exercises in numerous PC vision applications. The utilization of the Kalman channel for following questions and spotlights on three essential components specifically; First stage is Prediction of article's future area, then Reduction of commotion presented by incorrect discoveries. Last stage is encouraging the procedure of relationship of numerous items to their tracks. This modified Kalman Filter is to distinguish and tallying the people groups can be utilized to break down in any stages. Location is additionally an initial step to performing more troublesome assignments, for example, following or characterization of individuals' by their sort. At last, the people groups are assessed utilizing following based discovery system is acknowledged and that can finish constant productivity. The altered Kalman channels is utilized for identifying articles as a part of every edge, and decide the likelihood of every discovery is being doled out to every track. A critical part of this undertaking is Track upkeep. Finally, propose a people counting system based on image processing and stores data sets in the HDFS which less cost and effective.



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