Topic: Foreground-Background Segmentation for Human tracking in Real-Time video

Project Presentation - Group 2

Deep Parekh 1401001
Jeet Parekh 1401011
Krima Doshi 1401035
Maharshi Bhavsar 1401061

May 9, 2017

Introduction

Motion is one of the major challenge faced by the researchers in the field of Computer Vision. For background-foreground segmentation, we mainly tried 3 approaches-

- Foreground-background segmentation is required when motion of objects need to be detected. The moving objects can be considered as foreground and the stationary objects can be considered as background.
- Next, we used MOG filter for the initial separation. Then we took a reference frame and subtracted current frame from the reference frame. This approach works for the stable camera and a stable background and only a moving foreground. For the moving background-foreground segmentation we used a complex algorithm called Optical Flow.
- Optical Flow is one of the tool at rescue to solve many problems such as object recognition, scene understanding, 3D shape acquisition, etc . Our problem statement is concerned with real time video sequence in which objects(Human) or the camera maybe moving according to 3D path. Optical flow provides visual perception. It takes a set of points in a frame and find those same points in another frame, and then find the vectors for each point and those vectors represents the direction and the magnitude of the change of that particular point with reference to the previous frame.

About Optical Flow

- Optical flow is implemented by studying the velocity of objects. The velocity is related to the space-time image derivatives at one image location using an equation often called the gradient constraint equation. n. If one has access to only two frames, or cannot estimate It, it is straightforward to derive a closely related gradient constraint, in which It(x, t) in (1.5) is replaced by I(x, t) I(x, t + 1) I(x, t).

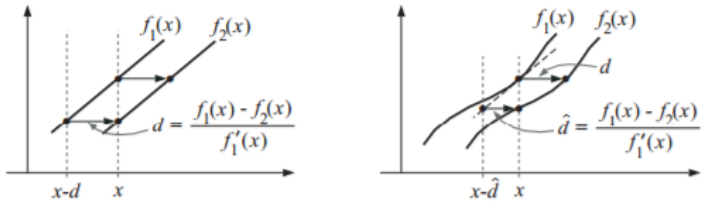


Figure: gradient constraint

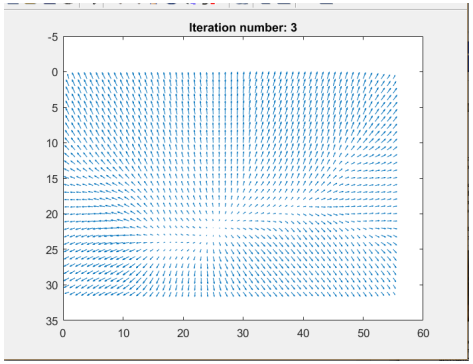
- The gradient constraint relates the displacement of the signal to its temporal difference and spatial derivatives (slope). For a displacement of a linear signal (left), the difference in signal values at a point divided by the slope gives the displacement. For nonlinear signals (right), the difference divided by the slope gives an approximation to the displacement.

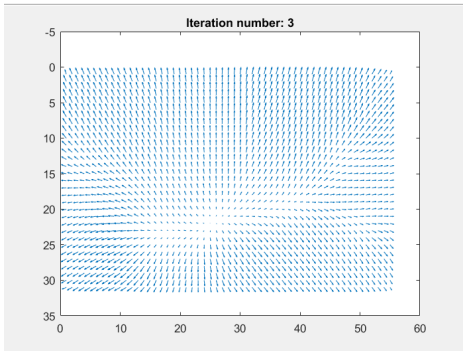
The Optical Flow Algorithm

Optical flow can be implemented by following the below mentioned steps:

1. Compute the intensity of each pixel
2. For each pixel position compute the gradient matrix and store an eigenvalue of matrix
3. Separate the high scoring pixels by flag matrix F and region size k and flag region size f
4. Take the top n eigen values and use those for the trackable features
5. The Gaussian random distribution is applied for speed base
6. Next, warp one image, take derivatives of the other so you dont need to re-compute the gradient after each iteration
7. Repeat until complete

Results





- These images above are snapshots taken from a real time surveillance video. The human figure detected is enclosed inside a box.

Conclusion

- First, we tried the method of background foreground subtraction, where we subtracted a reference image from the current image.
- In our next approach, after each specific no. of iteration, the reference frame got updated. And we are detecting the motion by differentiating the current frame and that reference frame. So once the object comes into the picture with some motion, it will get detected. But when it stops moving, the reference frame will be updated and eventually the current frame and the reference frame will be the same. So no motion will be detected. These methods are not capable of handling multiple backgrounds like moving water in a fountain.
- Currently, we have implemented the concept of optical flow.It refers to the pattern of apparent motion of objects, surfaces, and edges in a visual scene caused by the relative motion between an observer and a scene. Motion vectors, represents flow of a moving object, are obtained using Lucas - kanade optical flow algorithm for moving object detection with complex background. These flow vectors are quantized using a predefined threshold to decide whether a pixel is a part of an object or a background.We are successful in our attempt to improve the results obtained from the previous approaches.