Heaven's Light is Our Guide

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Human Segregation from Detected Moving Objects Using Histogram of Oriented Gradients

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Outlines

- Objective
- Related Works
- Proposed Methodology
- Implementation
- Experimental Result
- Limitation
- Further Works
- Conclusion
- References

Objective

- Video surveillance
- Distinguish human from other moving objects
- Develop an advance and intelligent security system

Existing Works

- Human detection approach
  - Histogram of Oriented Gradients for Human Detection(HOG) [1]
  - Overview of this Method:

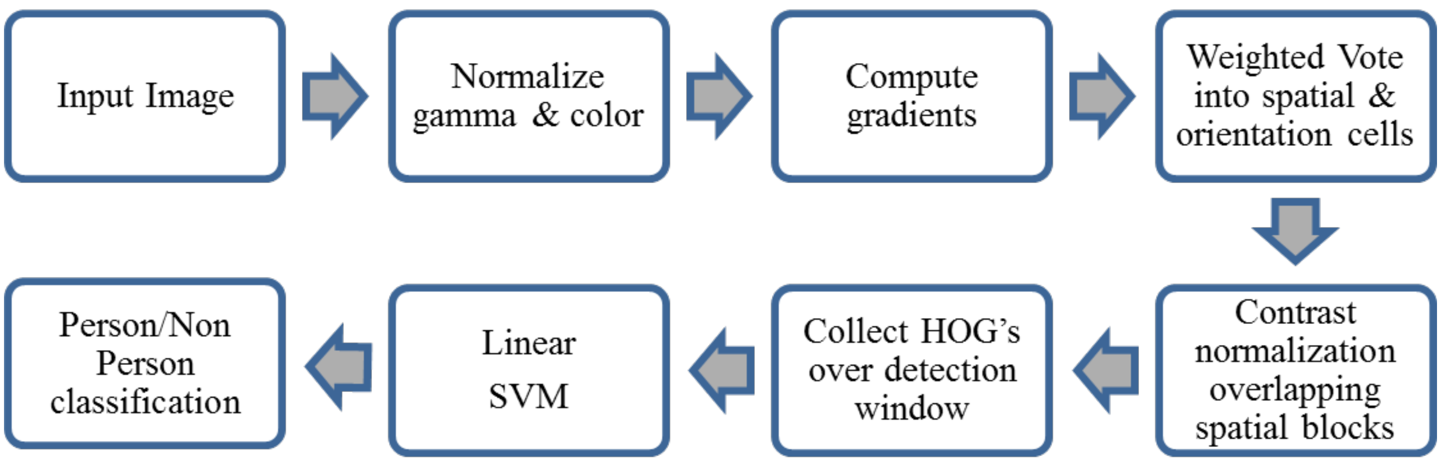


Fig.1. Original work [1]

Existing Works (Cont’d)

- Human detection approach
  - Pedestrian detector using infrared images and histogram of oriented gradients.[4]
  - Pedestrian detector using histograms of oriented gradients and SVM classifier.[5]

Existing Works (Cont'd)

- Moving object detection approach
  - Improved adaptive Gaussian mixture model for background subtraction.[2]
  - Adaptive Background Mixture model for Real-time tracking with shadow detection. using Mixture of Gaussian. [3]

Proposed Methodology

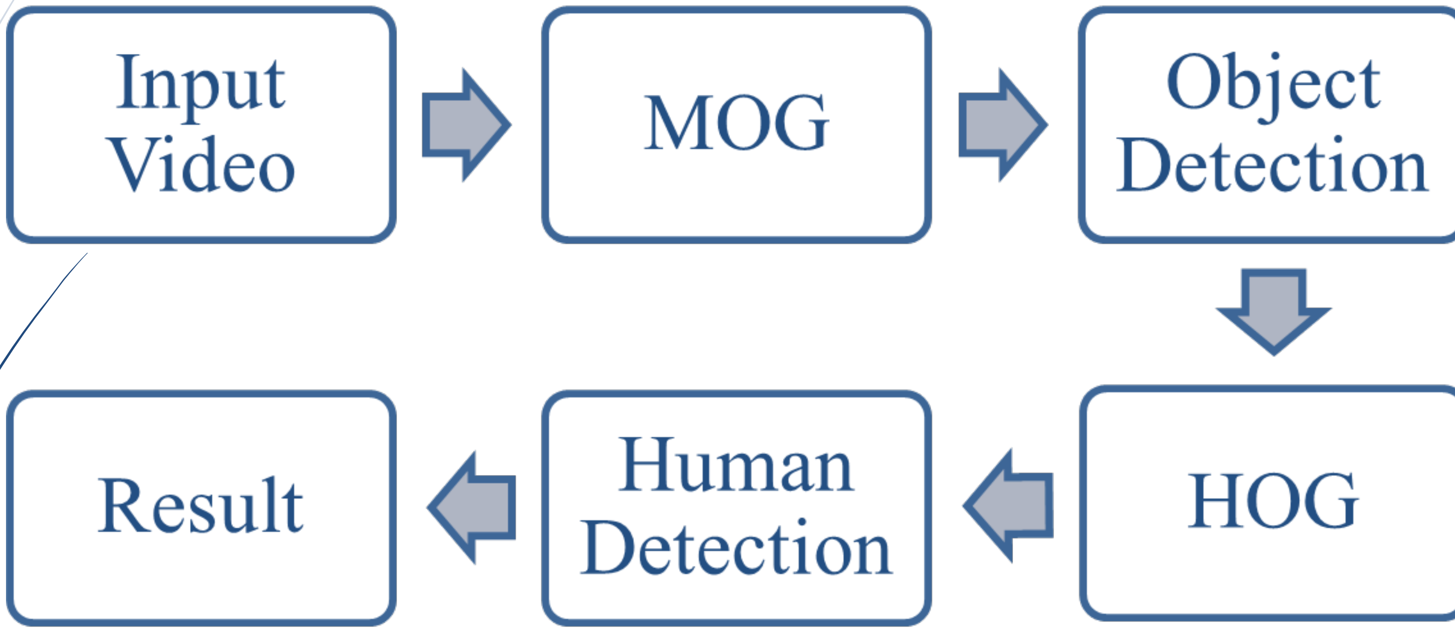


Fig. 2. Procedure of propose method

Implementation

Proposed methodology indicates two decent algorithm.

- Mixture of Gaussian (MOG) for Background Subtraction.
- Histogram of Oriented Gradients (HOG).

Mixture of Gaussian (MOG)

- MOG is common technique ,that has been used for background subtraction.
- Every pixel's intensity values in the video can be modeled using a Gaussian mixture model.

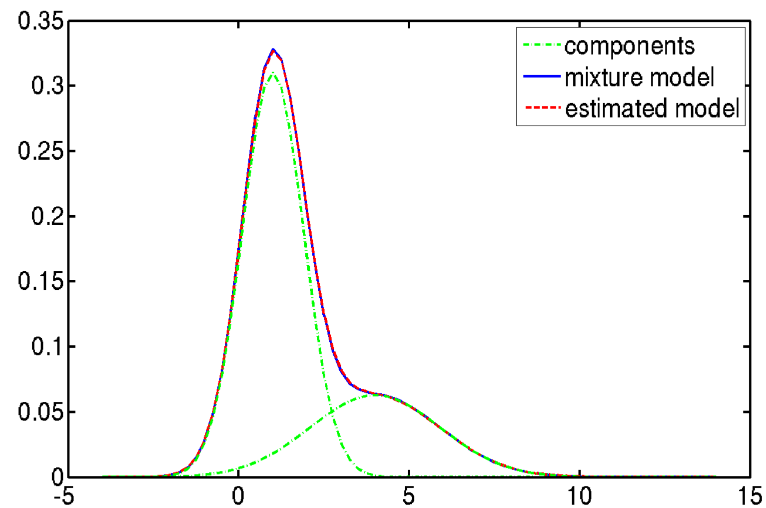


Fig. 2. Sum of two Gaussian distribution [6]

Mixture of Gaussian (Cont'd)

- Background model creation

Original frame

Background Model

Fig. 3. Background model creation [8]

Histogram of Oriented Gradients

- HOG is a type of feature descriptor.
- It uses global feature to describe a person.
- The whole person is used as a feature vector.

Histogram of Oriented Gradients (Cont’

- **How HOG descriptor works?**
  - HOG uses 64 x 128 detection window

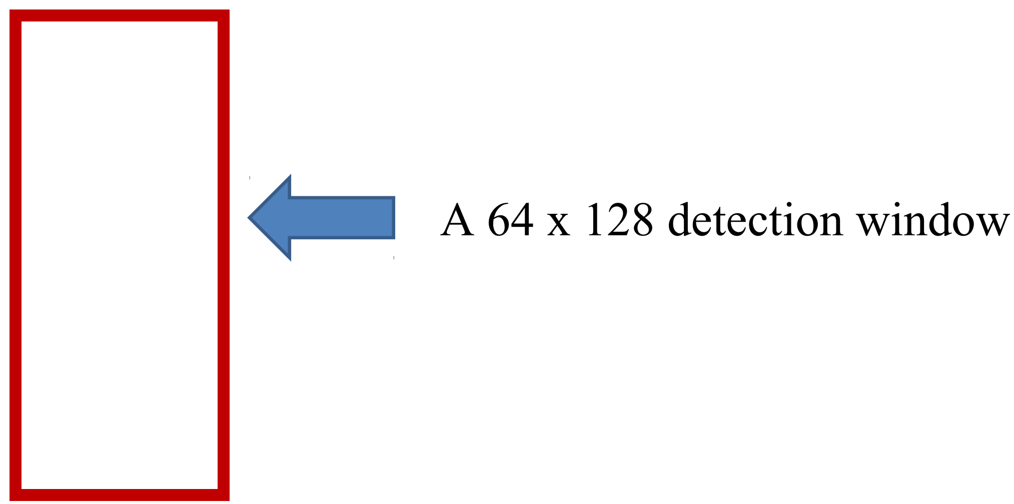


Fig. 5. 64 x 128 detection window

Steps of HOG

❖ Feature extraction:

For a 64 x 128 window,

- Compute gradient orientation and magnitude.
- Divide image into 16 x 16 ,50% overlap block.
- Each block consists 2x2 cells with size.
- Quantize the gradient orientation in 9 bin histogram.
- Concatenate histogram.

Steps of HOG (Cont'd)

Blocks and Cells:

- Total 7 x 15=105 blocks
- Two adjacent block overlaps each other by 50%.
- Each block has 2x2 cells with size 8x8 pixel.

Fig 6-Blocks and cells[7]

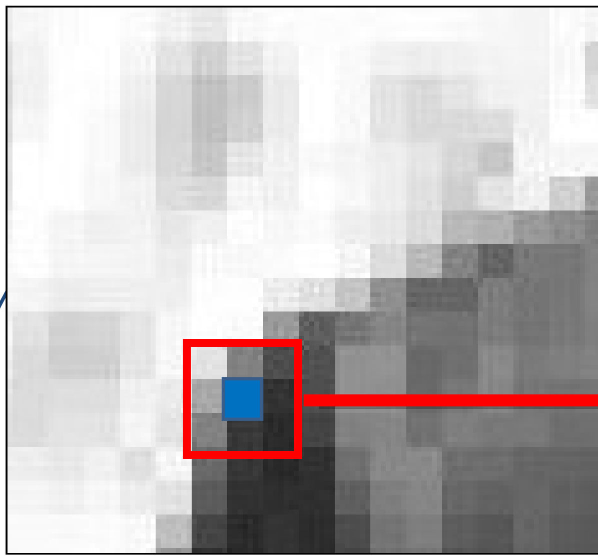
Steps of HOG (Cont'd)

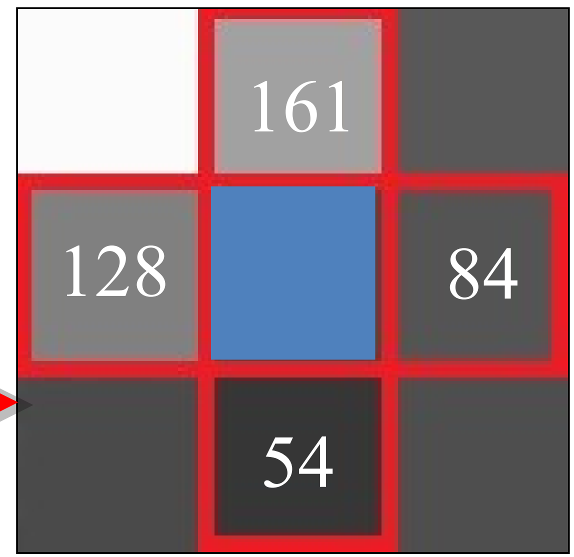
Calculating Gradient Vector

- Gradient vector is calculated for each pixels in 8x8 cells.
- Every pixel provides gradient magnitude and orientation.
- So we will have 64 gradients in one cell (8x8 size).

Calculating Gradient Vector

Notice the gray scale value of $N_4(P)$ of the desired (colored in **"Blue"**) pixel.


(a)

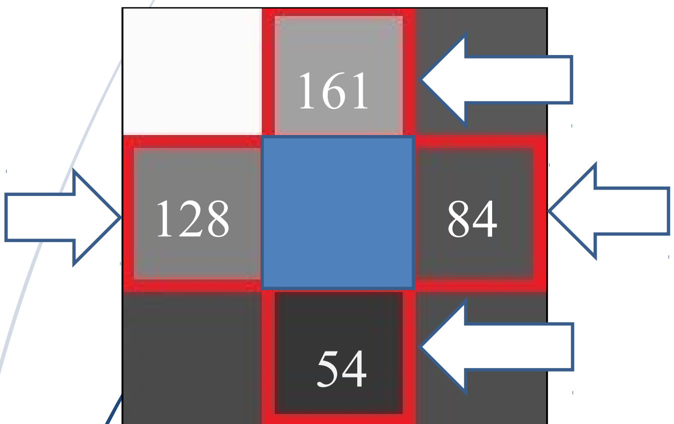


(b)

Fig. 7. (a) Operating pixel(blue color), (b) Grayscale value of N4(P)

Gradient orientation and magnitude (Cont'd)

- Calculation Gradient of the pixel:



Change in X direction:
128-84 = 44

Change in Y direction:
161-54 = 107

Gradient Vector:
$\nabla f = 44\,\hat{\imath} + 107\hat{\jmath}$

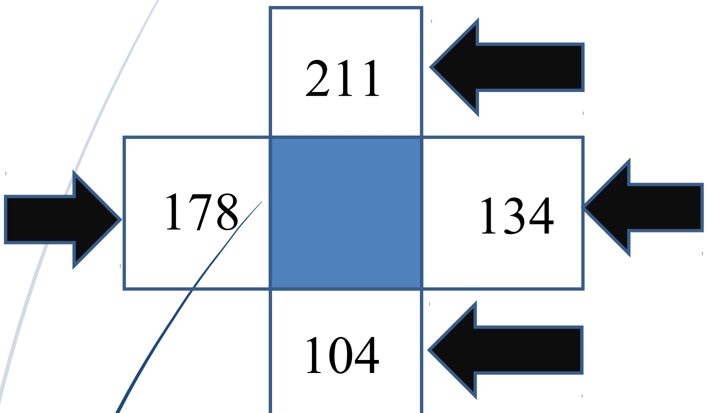
Magnitude:
$\sqrt{44^2 + 107^2} = 115.69$

Orientation:
$\theta = \tan^{-1}\left(\frac{107}{44}\right) = 73.33^o$

Normalization:
$\hat{u} = \frac{\nabla f}{|\nabla f|} = 0.38\,\hat{x} + 0.92\hat{y}$

Gradient orientation and magnitude (Cont'd)

- After Increasing **Brightness** by 50



Change in X direction:
178-134 = 44

Change in Y direction:
211-104 = 107

Gradient Vector:
$\nabla f = 44\,\hat{\imath} + 107\hat{\jmath}$

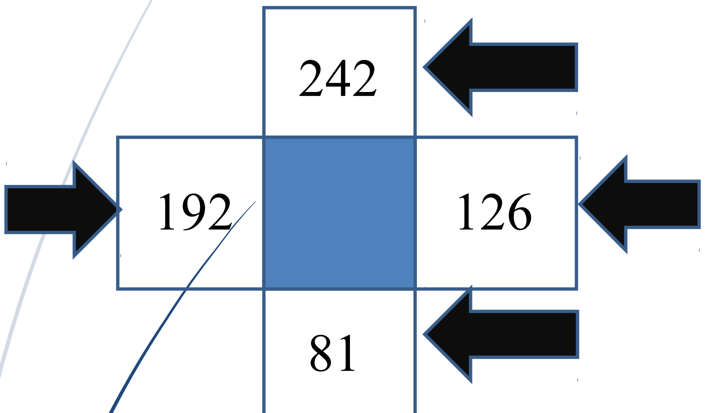
Magnitude:
$\sqrt{44^2 + 107^2} = 115.69$

Orientation:
$\theta = \tan^{-1}\left(\frac{107}{44}\right) = 73.33^{o}$

Normalization:
$\hat{u} = \frac{\nabla f}{|\nabla f|} = 0.38\,\hat{x} + 0.92\hat{y}$

Gradient orientation and magnitude(Cont'd)

- After Increasing **Contrast** by 1.5



Change in X direction:

192-126 = 66

Change in Y direction:

242 - 81 = 161

Gradient Vector:

$\nabla f = 66\,\hat{\imath} + 161\hat{\jmath}$

Magnitude:

$\sqrt{66^2 + 161^2} = 174.00$

Orientation:

$\theta = \tan^{-1}\left(\frac{161}{66}\right) = 67.70^o$

Normalization:

$\hat{u} = \frac{\nabla f}{|\nabla f|} = 0.38\,\hat{x} + 0.92\hat{y}$

Quantizing Histogram

- Histogram contains 9 bins and ranges 0 to 180 degree.
- Each bin is contributed by the magnitudes of the gradient vector.
- Each histogram represents a cell of size 8x8.So one block contains 4 histogram.

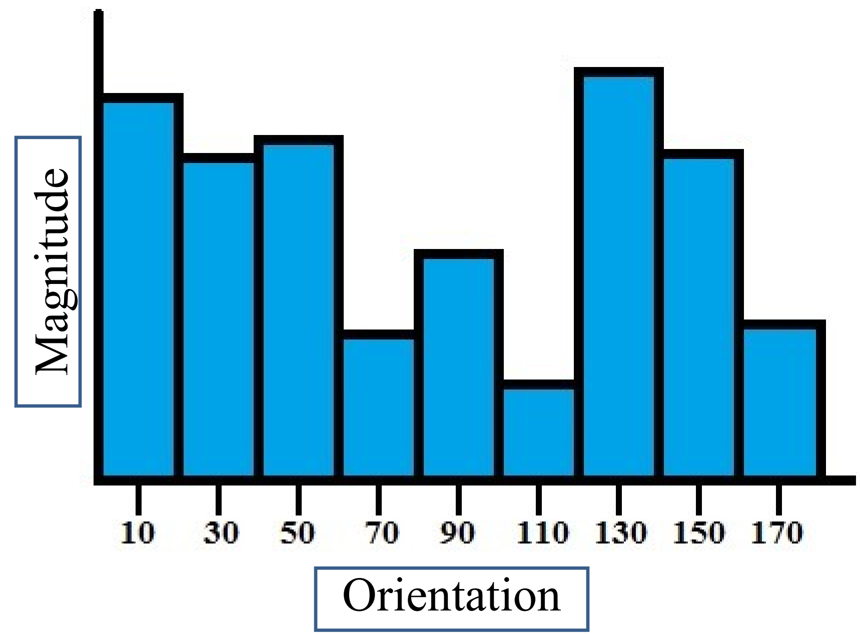


Fig. 8. Quantizing histogram

Quantizing Histogram (Cont’d)

❖ Interpolation:

- Suppose an orientation of 85 degree.
- Split 85 between two nearest neighbors bins.
- Distance of ‘85’ from bin center ’70’ and ’80’ are 15 and 5 respectively.
- So shares of the magnitude are 15/20=3/4 and 5/20=1/4 for 90 and 80 respectively.

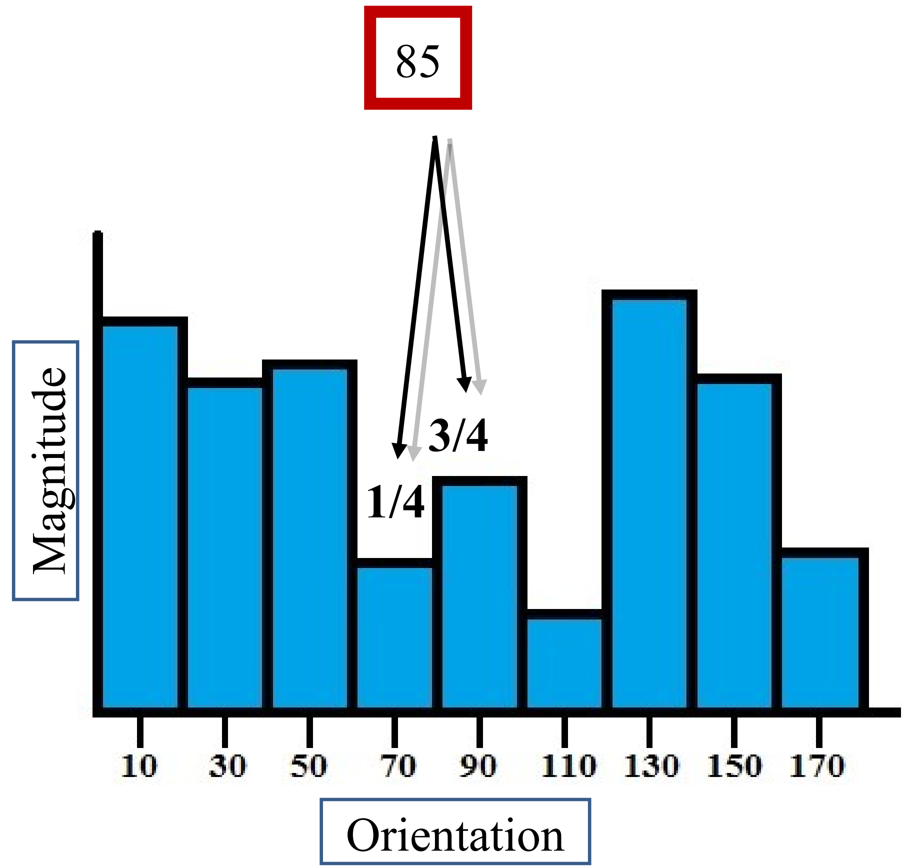


Fig. 9. Interpolation

Final Descriptor Size

Concatenating Histogram:

- Every block with 4 histograms gives
  - 4 x 9 bin = 36 components
- Total 7 x 15= 105 blocks. So there are,
  - 7x15x36= 3,780 components
- Concatenation of histograms produces,
  - 1D matrix of dimension 3,780

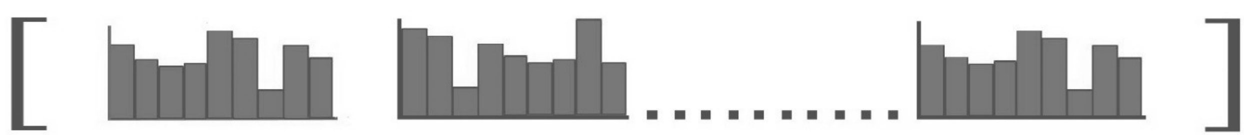


Fig. 10. Final feature vector

Experimental Result

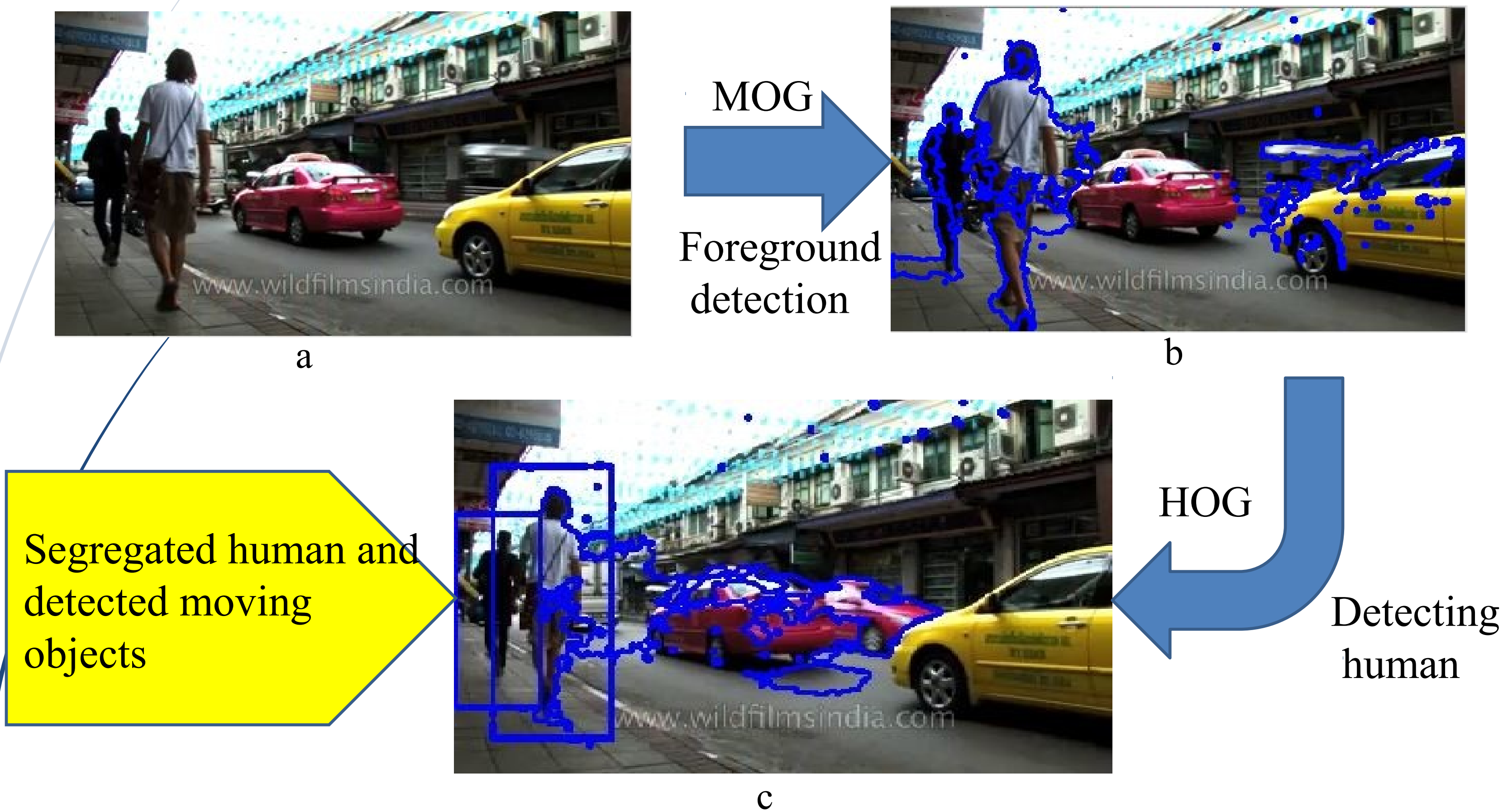


Fig. 11. a. Input image ,b. Object detection, c. Final result [7]

Limitations

- **Limitations of proposed method**
  - Very slow frame rate.
  - Noise sensitive.
  - False shape detection.
  - Humans far from the camera (small size) are hard to detect.

Further Works

- Access control of moving objects and tracking their positions.
- Evaluate performance of proposed methodology.

Conclusion

- A method of distinguish human and also keep detecting the other moving objects is has been proposed here
- Detection is always a challenging task. There are always room for improving the method.

References

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[8] Background model creation output screenshot. Available at: http://code. opencv.org/issues/1931 (Access on: 07-08-15)

Thank You.
Any Question?