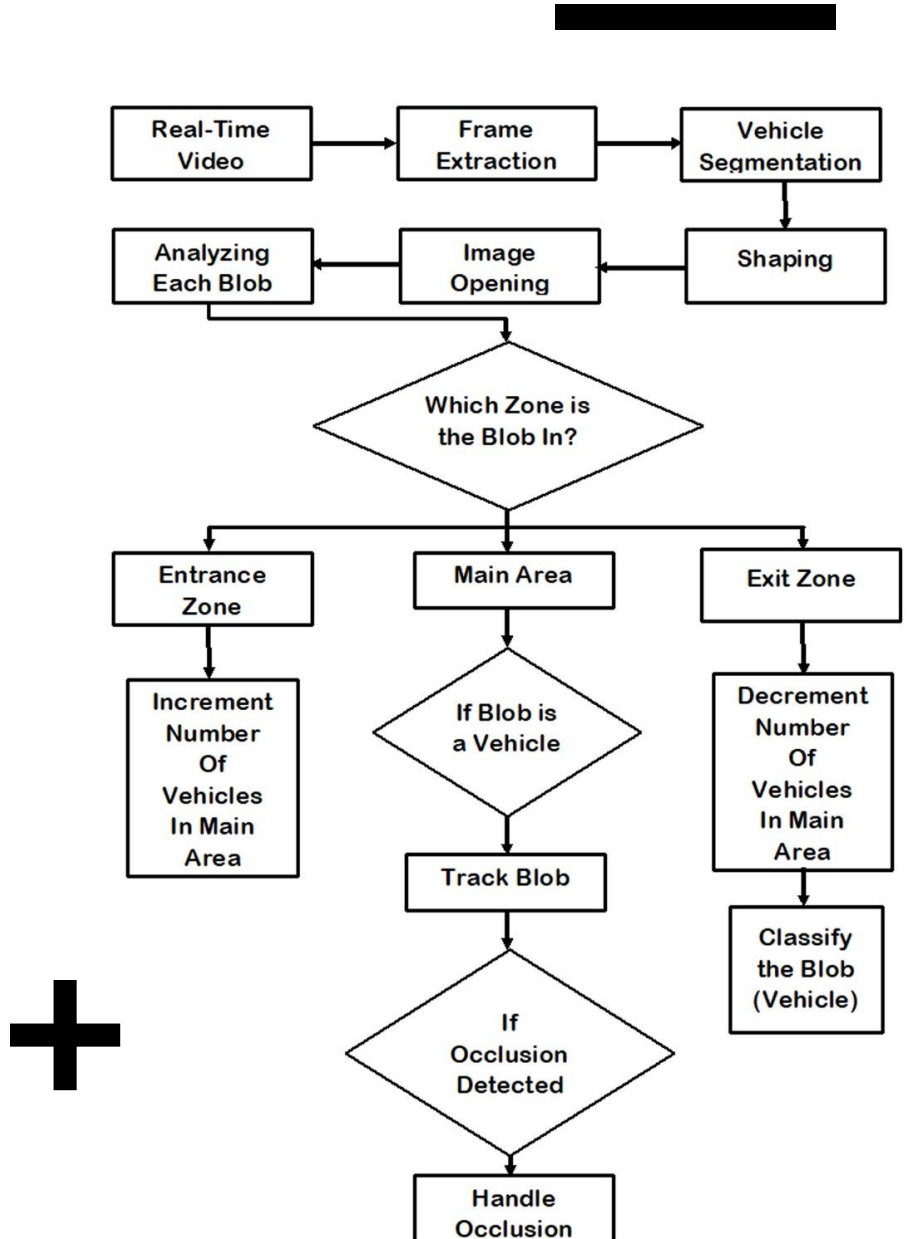
Vehicle detection and Classification

Video Processing

Process


Real-Time Video
Frame Extraction
Vehicle Segmentation
Shaping
Image Opening
Analyzing Each Blob
Which Zone is the Blob In?
Entrance Zone
Main Area
Exit Zone
Increment Number Of Vehicles In Main Area
If Blob is a Vehicle
Track Blob
If Occlusion Detected
Handle Occlusion
Decrement Number Of Vehicles In Main Area
Classify the Blob (Vehicle)

Vehicle Detection using Image Processing

– Background Subtraction

$$if \mid f(x,y) - B(x,y) \mid \geq Th \quad then \quad F(x,y) = 1$$

$$0 \quad otherwise$$

B(x,y) is the corresponding pixel intensity value at (x,y) co-ordinate,
f(x,y) is the current frame pixel value at (x,y) and
F(x,y) is the resulting binary image pixel value at (x,y)

– Adaptive Background Subtraction

$$B_{changed} = (1-\alpha) * B_{initial} + \alpha * I_{current}$$

Vehicle Detection using Image Processing

- Frame Differencing

$$d_{i,i-1} = I_i - I_{i-1}$$

- Three Frame Differencing

$$d_{k-1} = |f_k - f_{k-1}|$$

$$d_{k+1} = |f_k - f_{k+1}|$$

$$d'_k(x,y) = \begin{cases} 1, d'_k(x,y) > T \\ 0, otherwise \end{cases}$$

$$m_p = d_{k-1} \cup d_{k+1}$$

Hybrid Algorithm

– Adaptive Thresholding

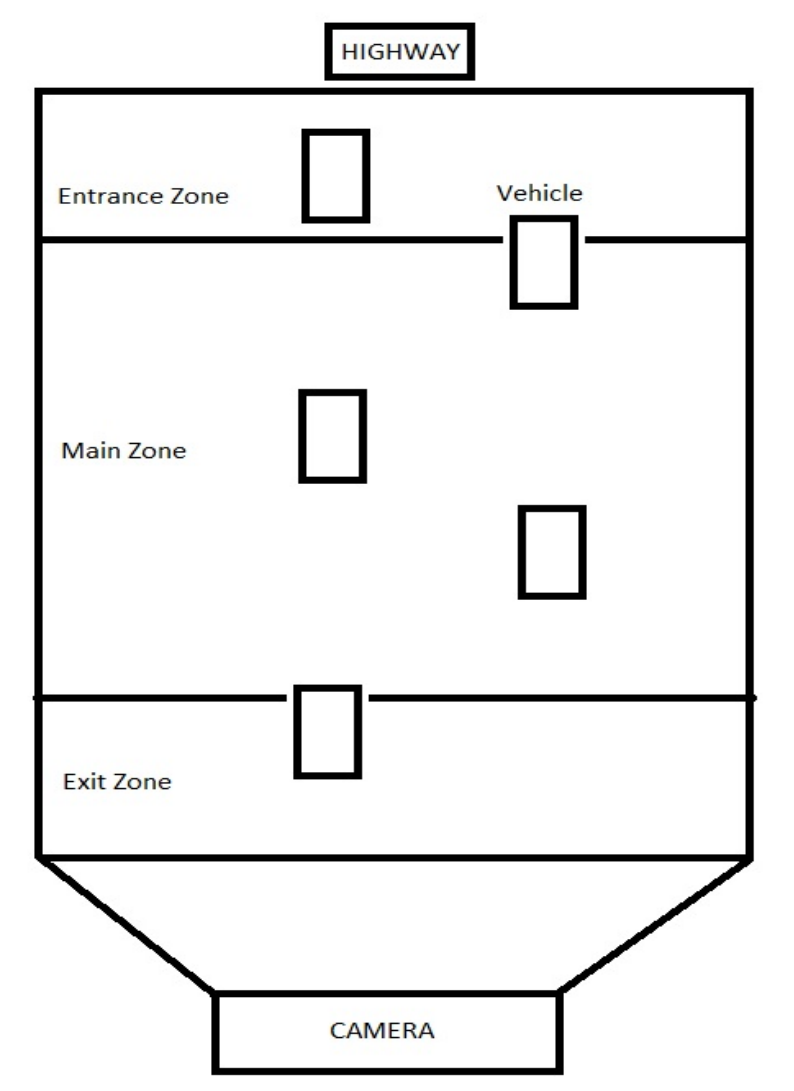
$$T_{new} = T_{old} + a * avg$$

– Adaptive Background Subtraction with Three Frame Differencing

Vehicle Classification

– Zone Classification

– Camera range: 100 meters
– Entrance Zone: 100-70 meters
– Main Zone: 70-20 meters
– Exit Zone: 20-0 meters



Vehicle Classification

- CP Plus Bullet Night Vision CCTV Camera having frame width of 1920 pixels and height of 1080 pixels.

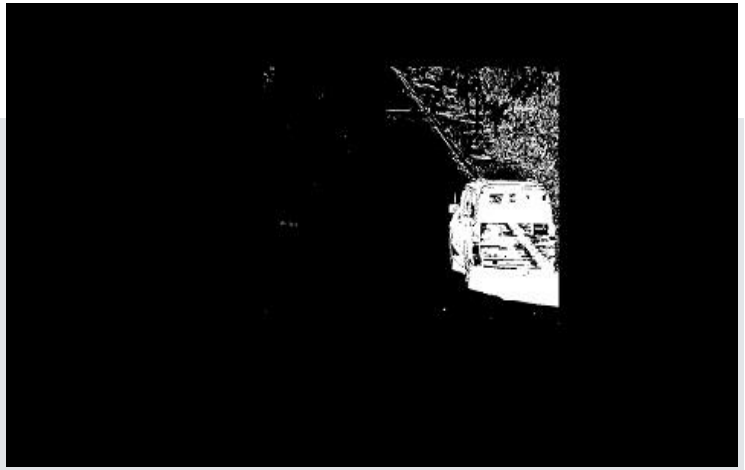
- Any object to be considered as vehicle was having width of more than 200 pixels and height of more than 150 pixels.
- If the vehicle is having dimensions between width of 200 to 220 pixels and height of 150 to 180 pixels and therefore area between 30000 to 39600 pixels, then it is classified as small size vehicle.

Vehicle Classification cont.

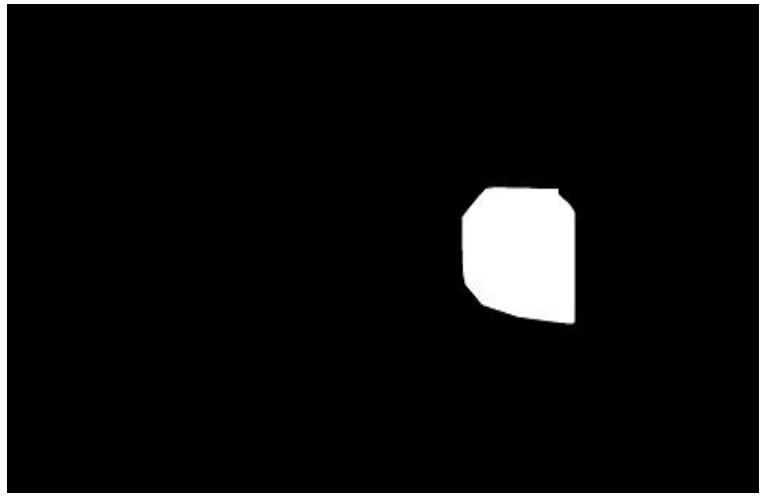
- If the vehicle is having dimensions between width of 220 to 250 pixels and height of 180 to 220 pixels and therefore area of 39600 to 55000 pixels, then it is classified as medium size vehicle.
- If the vehicle is having dimensions more than width of 250 pixels and height 220 pixels and therefore area more than 55000 pixels, then it is classified as large size vehicle.

Initial Background Image

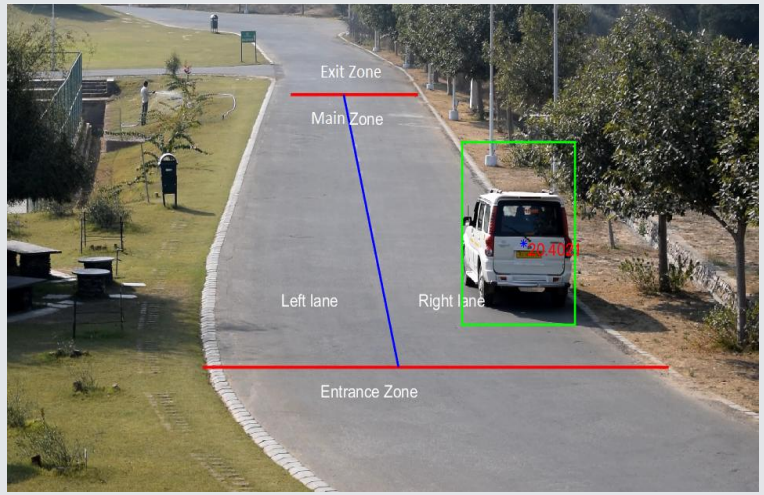
400th Frame of Video



Vehicle Detection



Area Thresholding



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