MULTIPLE OBJECT TRACKING

B.REVATHI   2210315606
G AISHWARYA 2210315612
M ANUDEEP   2210315639
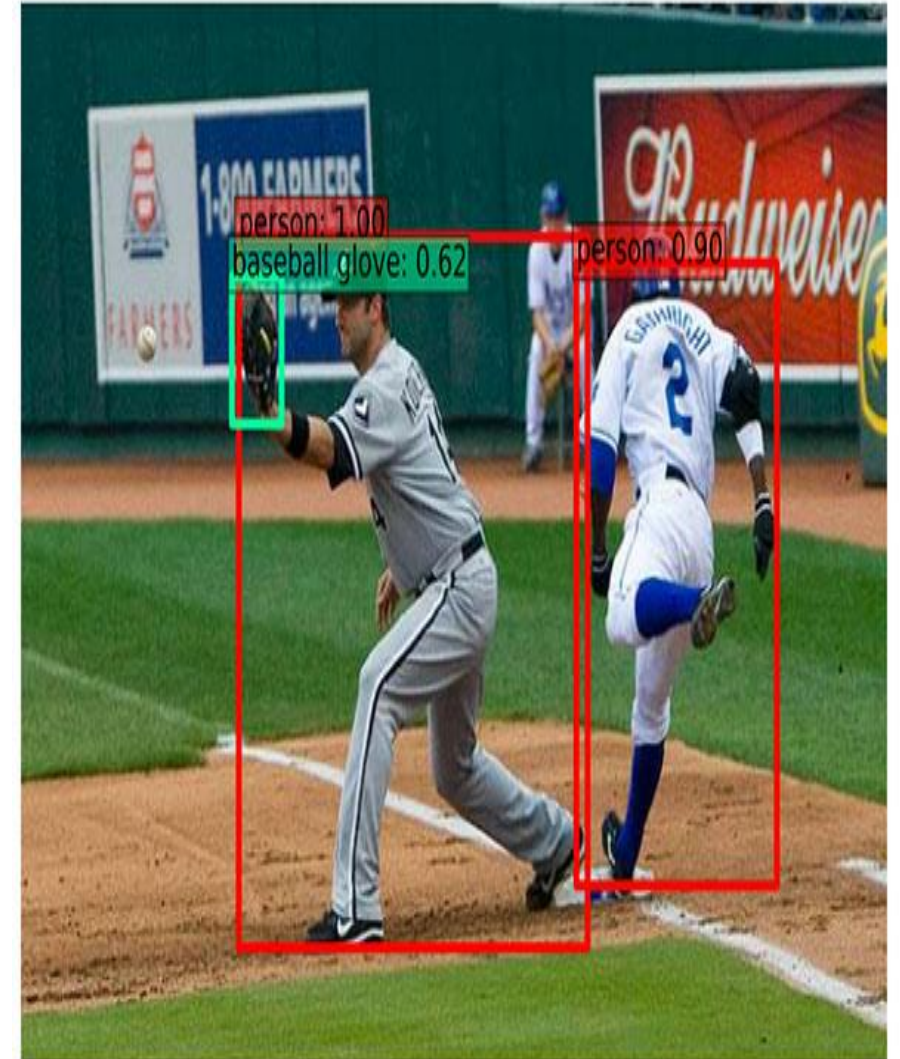K NIKITH   2210315634

<u>Outline</u>

- Introduction
- System Architecture
- System Overview
- Libraries Used for Software Implementation
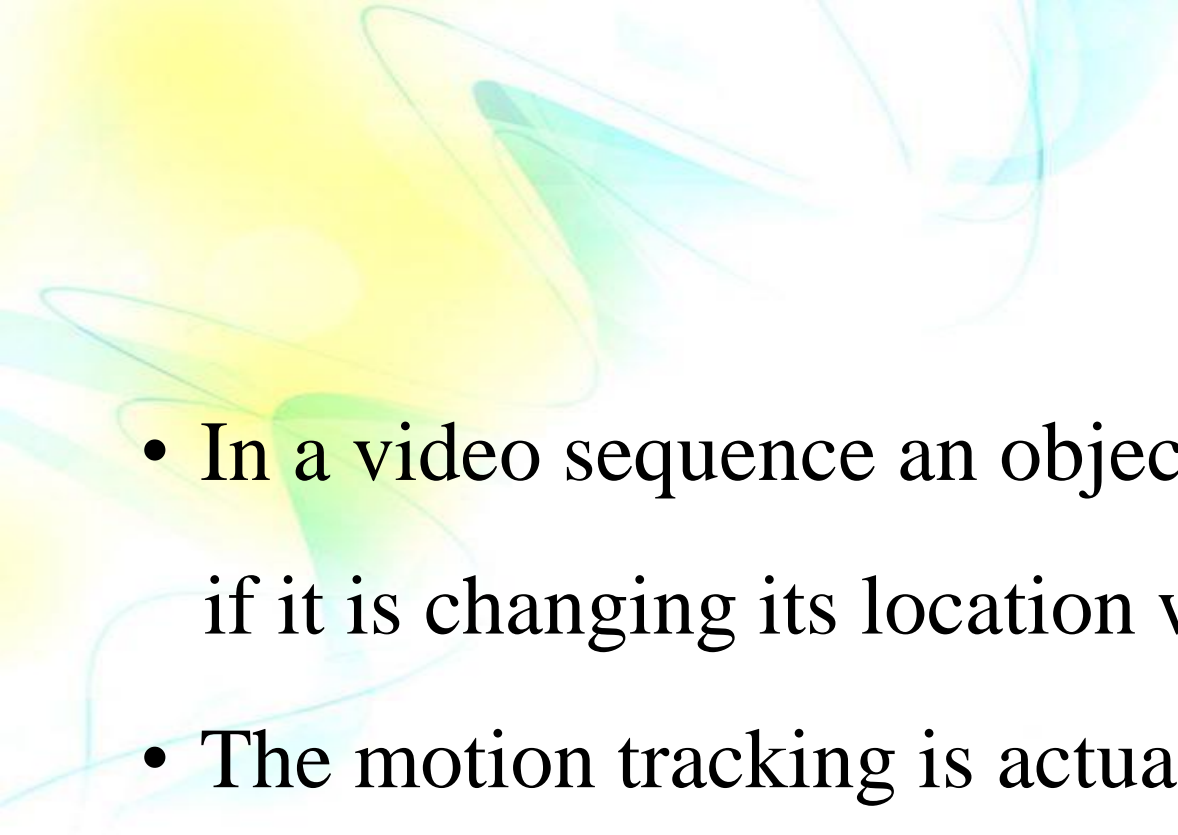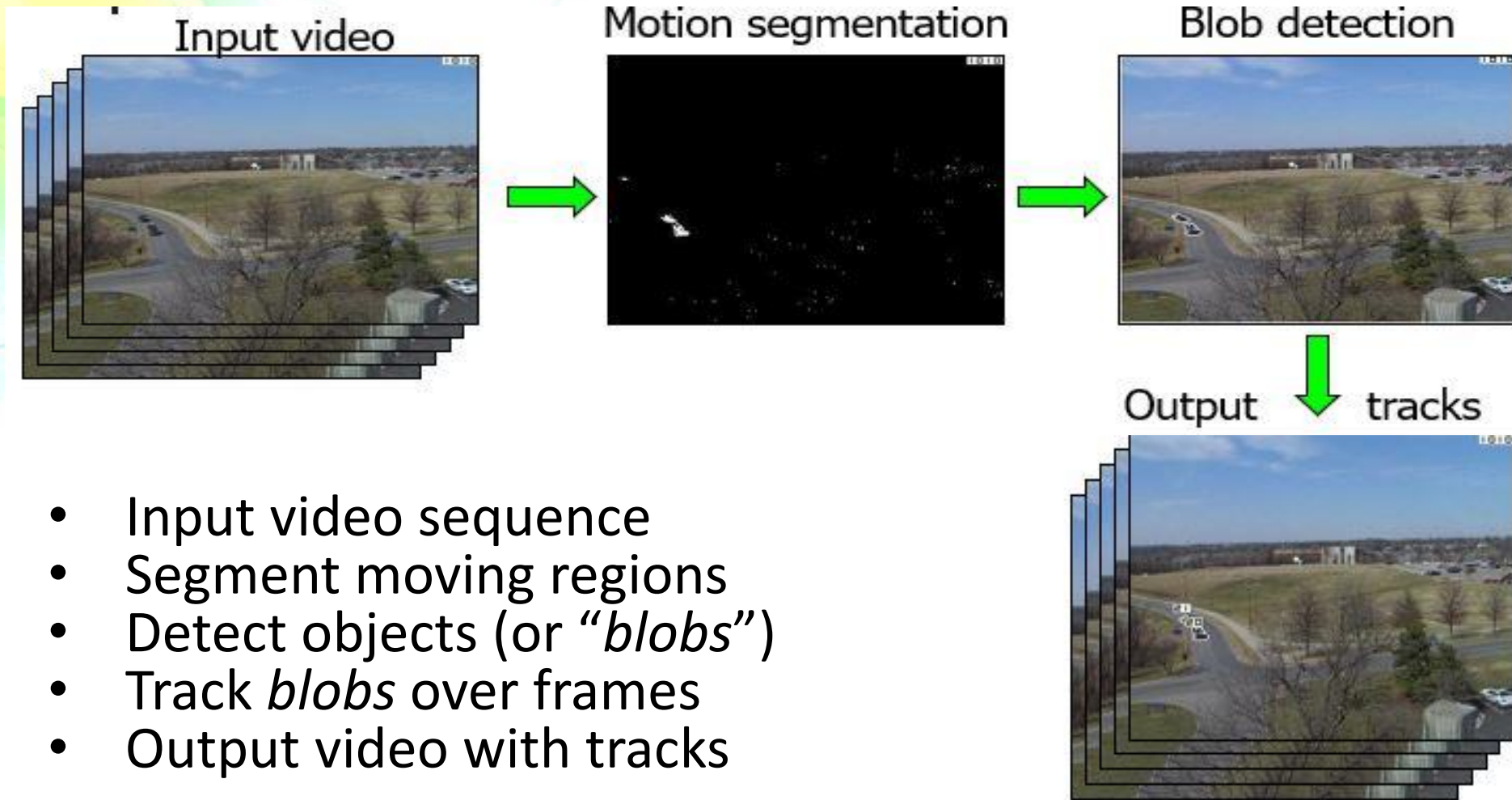- Applications
- Result

Introduction

Definition:

Object tracking :
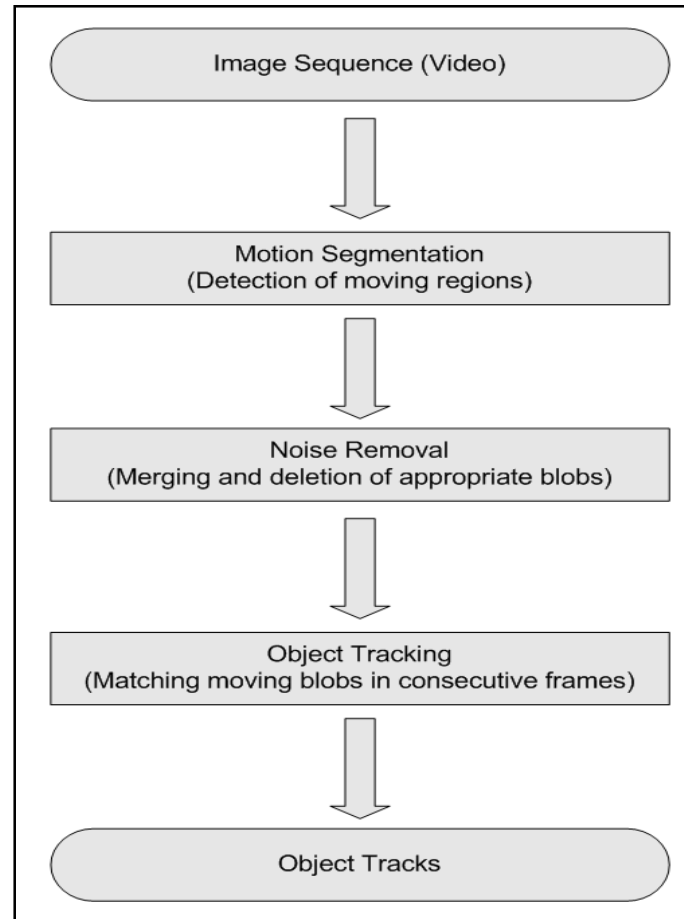   To track an object(or multiple objects) over a sequence of images

- In a video sequence an object is said to be in motion, if it is changing its location with respect to its background.

- The motion tracking is actually the process of keeping tracks of that moving object in video sequence i.e. position of moving object at certain time etc.

System Overview

- Input video sequence
- Segment moving regions
- Detect objects (or "*blobs*")
- Track *blobs* over frames
- Output video with tracks

System Architecture

Input Image Sequence

Image Sequence (Video)

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Motion Segmentation
(Detection of moving regions)

↓

Noise Removal
(Merging and deletion of appropriate blobs)

↓

Object Tracking
(Matching moving blobs in consecutive frames)

↓

Object Tracks
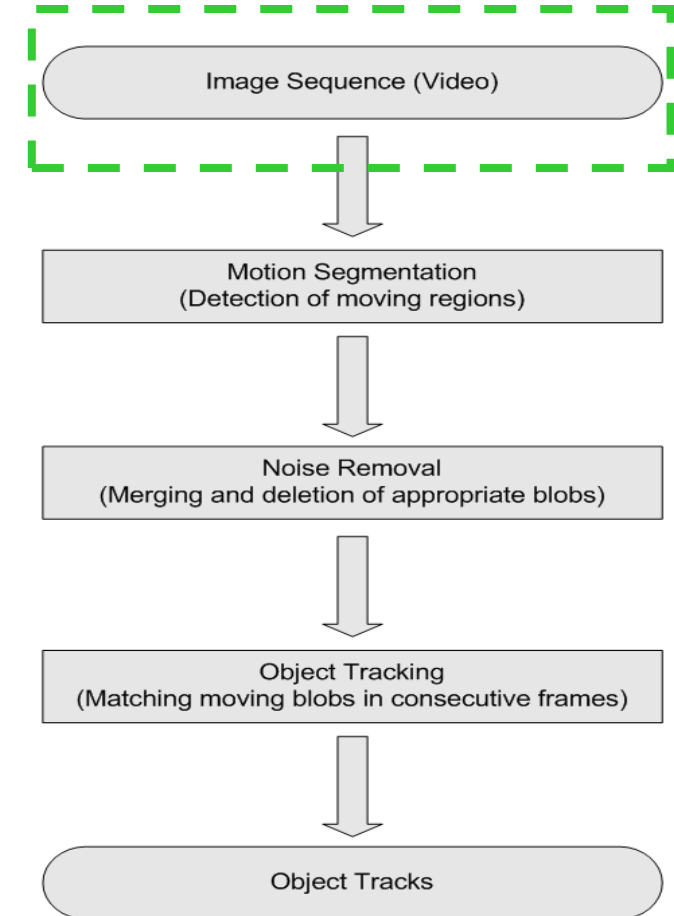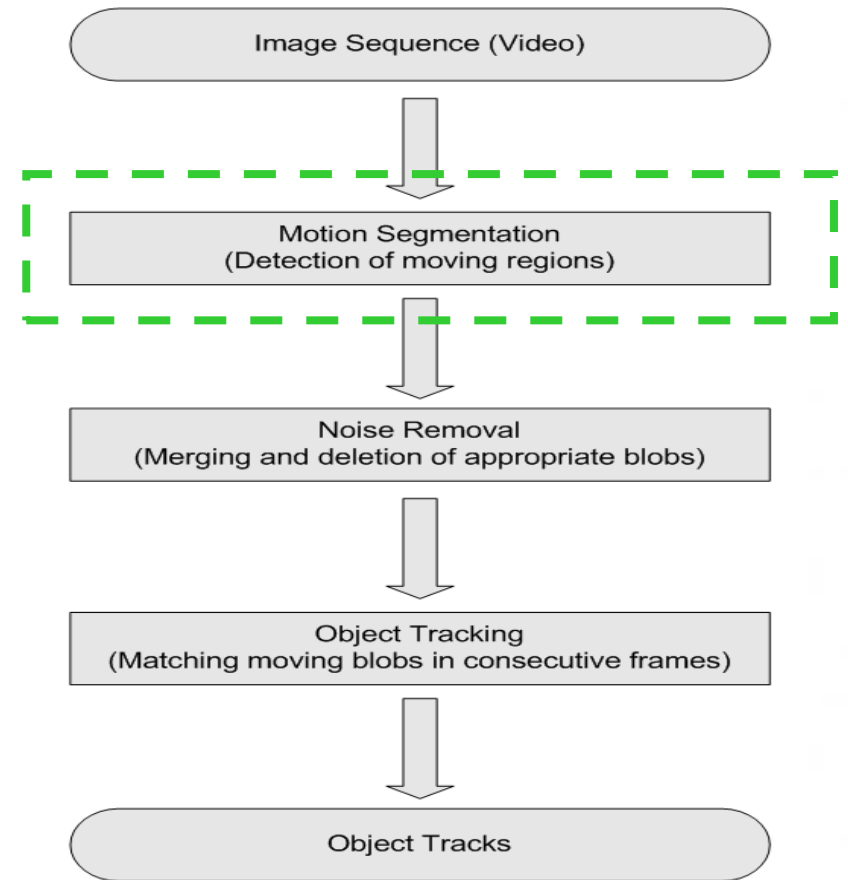
Motion Segmentation

- Develop a model for the background
- Subtract the current frame from background model
- Threshold the difference image
- Challenges:
  - Outdoor sequences are more difficult
  - Illumination changes
  - Camera jitter and noise

Image Sequence (Video)

↓

Motion Segmentation
(Detection of moving regions)

↓

Noise Removal
(Merging and deletion of appropriate blobs)

↓

Object Tracking
(Matching moving blobs in consecutive frames)

↓

Object Tracks

Background model − Current frame = Thresholded difference
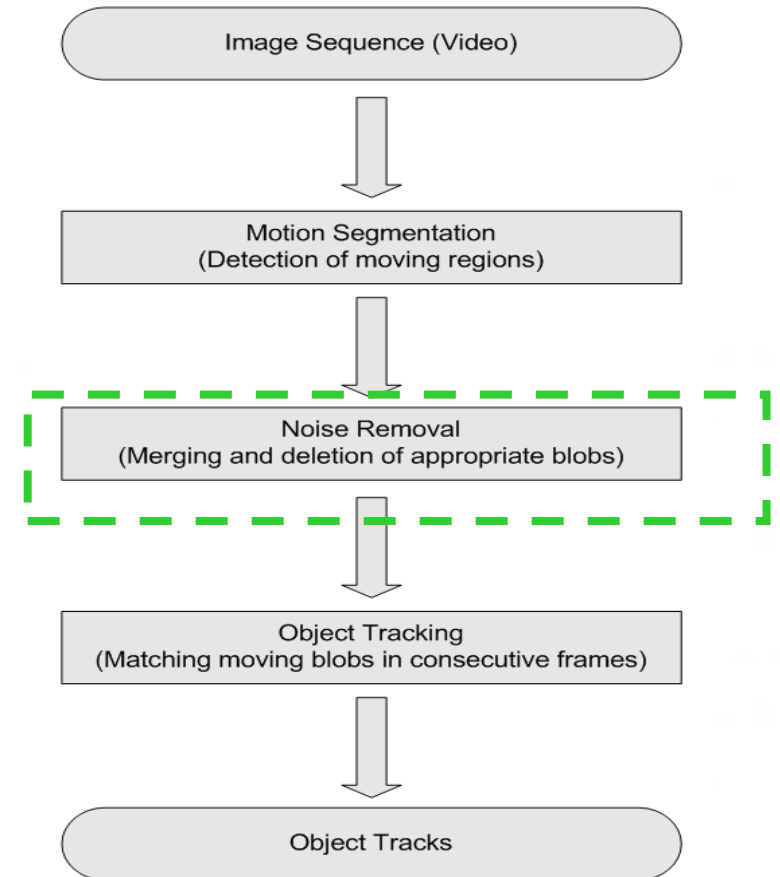
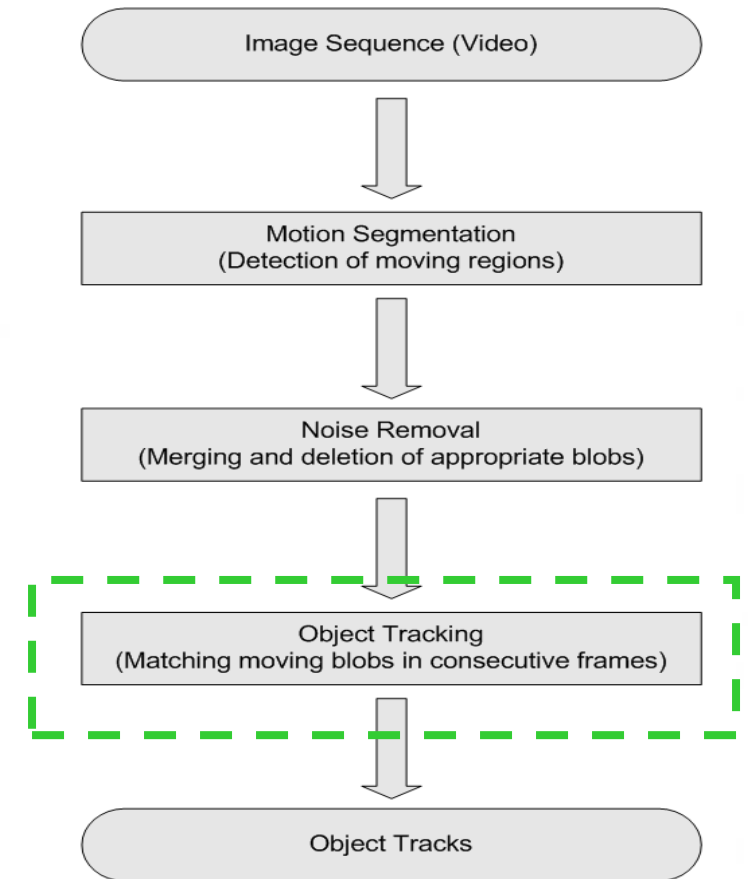Previous 75 frames + Current frame + Next 75 frames

Noise removal

- Remove blobs that are very small
- Group all connected pixels as one object
- Perform Dilation and Erosion morphology operations
  - Small blobs get deleted
  - Envelope is established around each detected object in the color image
- Calculate statistics for each blob (color, position, size)

Image Sequence (Video)

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Object Tracking
(Matching moving blobs in consecutive frames)

Object Tracks

Object Tracking Algorithm

- Once moving objects (*blobs*) detected, find correspondence between tracks of previous frame and *blobs* of current frame
- Most common method: a Match matrix used to determine correspondences
- Euclidean distance between *blobs* commonly used as the measure for a match
- Non-trivial because data is noisy and objects are not predictable
- Objects
  - Appear in the scene
  - Disappear due to exit from scene or occlusion
  - Merge with other objects or the background
  - Break up into two or more objects due to occlusion

Image Sequence (Video)

Motion Segmentation
(Detection of moving regions)

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Object Tracking
(Matching moving blobs in consecutive frames)

Object Tracks

Examples of Tracking Problems

previous frame

Current frame

Tracks: $$T^{k-1} = \{t_1^{k-1}, t_2^{k-1}, t_3^{k-1}, \ldots, t_{u^{k-1}}^{k-1}\}$$

Blobs: $$O^k = \{o_1^k, o_2^k, o_3^k, \ldots, o_{v^k}^k\}$$

Given track set of previous frame and blob set of current frame, calculate the Match matrix of Euclidean distances between them in color space (R,G,B) and Position (Y, X) values

Match Matrix

	Blob O_1	Blob O_2	Blob O_3
t_1	?	?	?
t_2	?	?	?
t_3	?	?	?

$$MM_{j,i} = \sqrt{(\Delta Y/Ydim)^2 + (\Delta X/Xdim)^2}$$
$$+ \sqrt{(\Delta R/255)^2 + (\Delta G/255)^2 + (\Delta B/255)^2}$$

Libraries Used for Software Implementation

Level 1 implementation:

In this implementation, User is given a choice to select an object among all the objects in a sample dataset and track them continuously.(multiple objects can be selected). OpenCv is used.

Level 2 implementation:

In this implementation, all the objects from the sample dataset are automatically tracked. dlib library is used for this implementation.
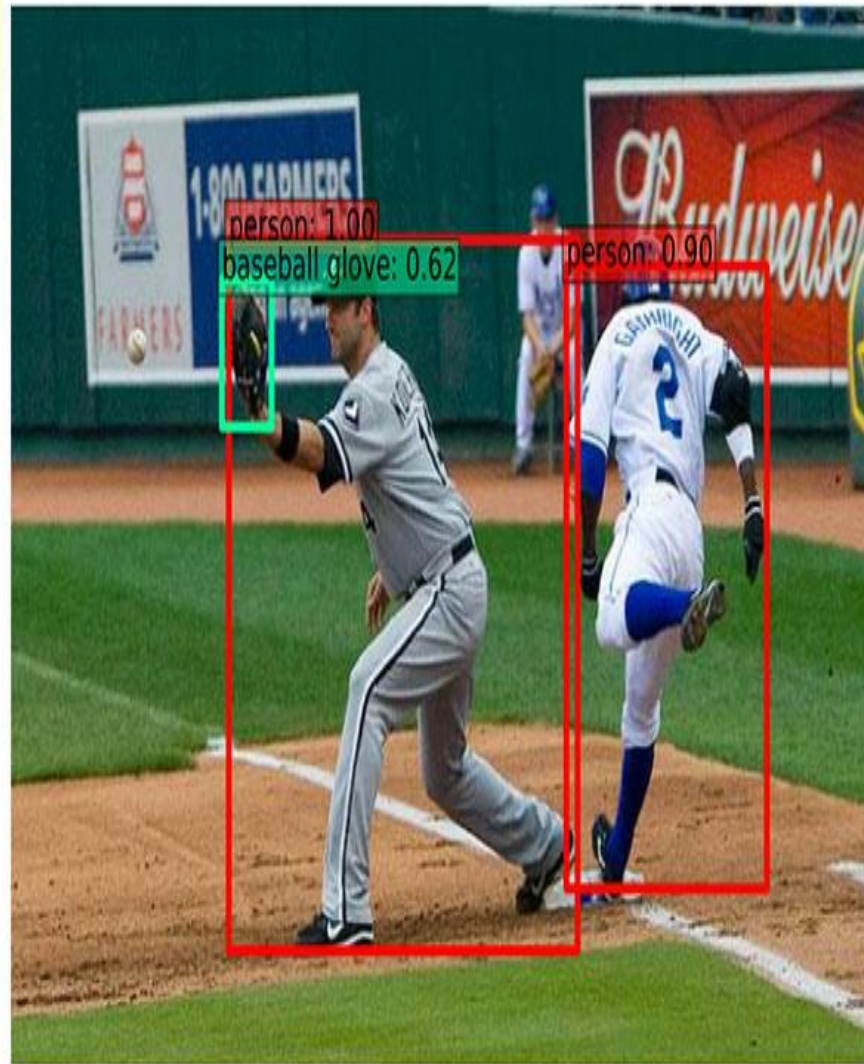
Caffe Framework:

Caffe framework is used to train with the sample dataset. Caffe is a deep learning framework made with expression, speed, and modularity in mind.

Applications

- Traffic Information
- Survelliance
- Mobile Robot

Result

Thank You