Intelligent and Interactive Systems

Tutorial 1 : OpenCV

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March 17, 2017

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Basic Image handling

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1. Import

```
import cv2
```

2. Load I/O

```
img = cv2.imread('some_image.jpg', 0)
```

3. Debug/Display

```
cv2.imshow('image', img)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

4. Process

```
img = manipulateImage(img)
```

5. Save I/O

```
cv2.imwrite('another_image.png', img)
```

Basic Video handling

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1. Import

```
import cv2
```

2. Load I/O

```
cap = cv2.VideoCapture('asterix.mp4')
fourcc =
cv2.VideoWriter_fourcc('X','2','6','4')
width = 1024
height = 640
outVideo =
cv2.VideoWriter('asterix2x.mp4',fourcc,
20.0, (width,height))
```

3. Process

```
while(1):
ret ,frame = cap.read()
if ret == True:
res = cv2.resize(frame,(width,height),
interpolation = cv2.INTER_CUBIC)
outVideo.write(res)
else:
break
```

4. Debug/Display

```
cv2.imshow('frame',frame)
if cv2.waitKey(1) & 0xFF == ord('q'):
break
```

5. Save I/O

```
cap.release()
outVideo.release()
cv2.destroyAllWindows()
```

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Basic image manipulation

(a) Original

(b) Gray

(c) Resize

(d) Binary

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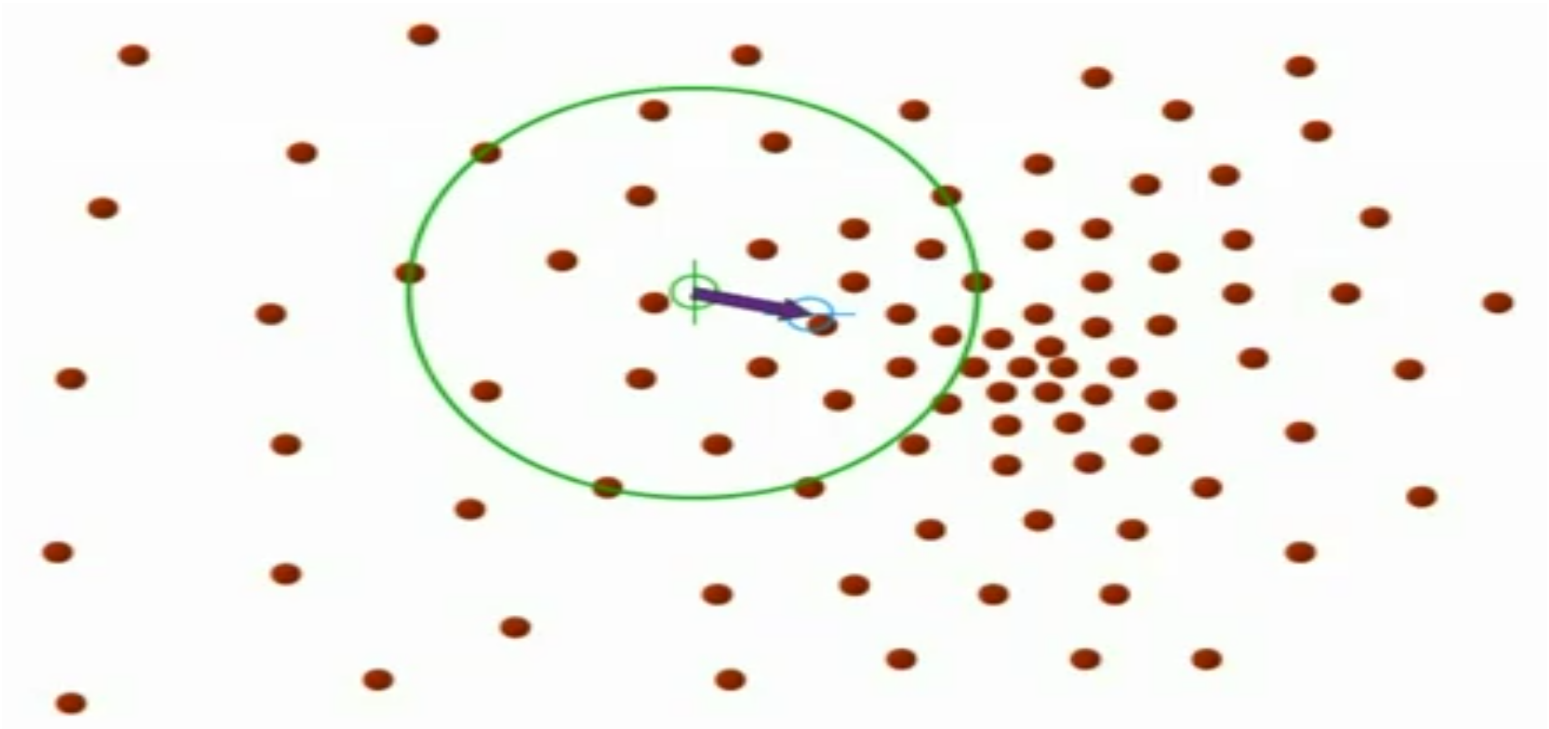
Mean Shift Clustering



Mean Shift Clustering (Cont)

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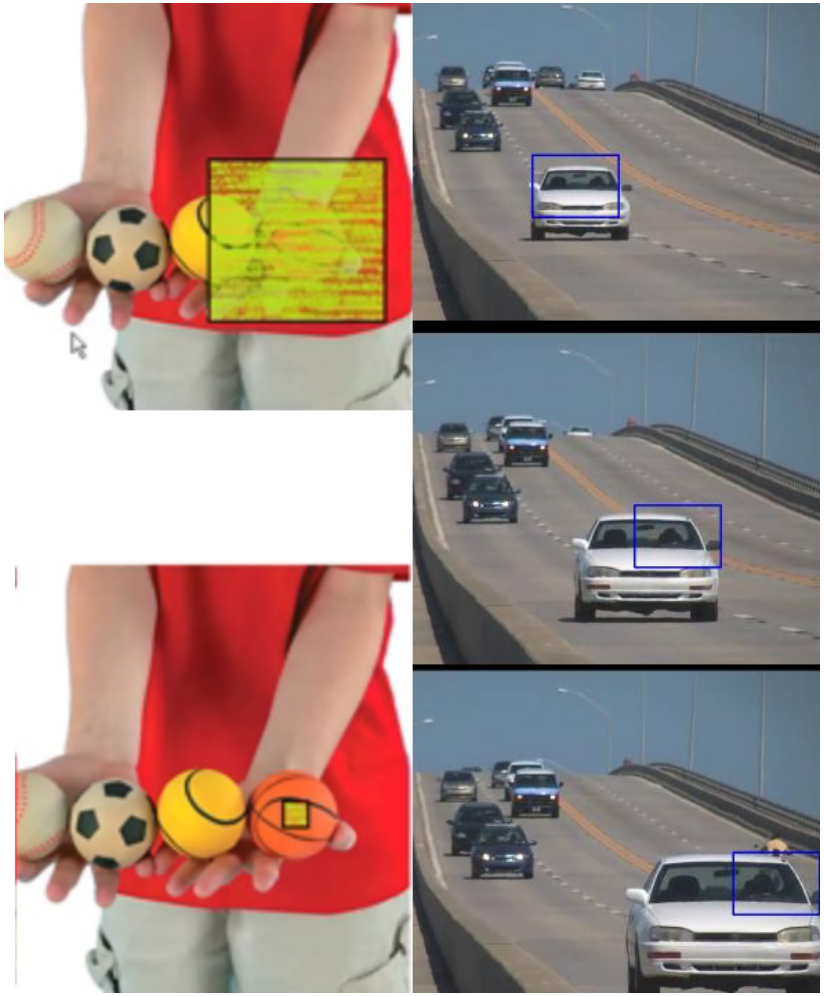
- Mean shift is unstable and leads to errors.
  - Window size too small (missing object).
  - Window size too large (background tracking).
  - Invariance to perspective of object in motion.
- **Sol:** Change the window size as per motion (**C**ontinuously **A**daptive (Window size) **M**ean Shift)



CAM Shift - Outline

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- S_1: Select a region of interest (ROI) to track.
- S_2: Produce a Hue-histogram of the image.
- S_3: Set a search area larger then the ROI set.
- S_4: Iterate Mean-Shift to convergence.
- S_5: Use the centroid from Mean-Shift to center the window in the next frame.
- S_6: Use zero-moment to resize the ROI
- S_7: Repeat $S_3 - S_6$ until all frames are processed.

CAM Shift - Details

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- Why HSL space?

- Compute zero moment:

$$M_{00} = \sum_x \sum_y I(x, y)$$

- Compute 1^{st} moment of (x, y):

$$M_{01} = \sum_x \sum_y xI(x, y), M_{10} = \sum_x \sum_y yI(x, y)$$

- Compute new center for next frame.

$$x_{new} = \frac{M_{01}}{M_{00}}, y_{new} = \frac{M_{10}}{M_{00}}$$

- Compute new window size

$$w = r_1 \sqrt{M_{00}}$$

$$l = r_2 \sqrt{M_{00}}$$

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Viola-Jones detection framework

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- S_1: Haar Feature Selection
- S_2: Creating an Integral Image
- S_3: Adaboost Training
- S_4: Cascading Classifiers