BASIC VIDEO PROCESSING

ACTIVITY 11

Krishna Lyn Delima
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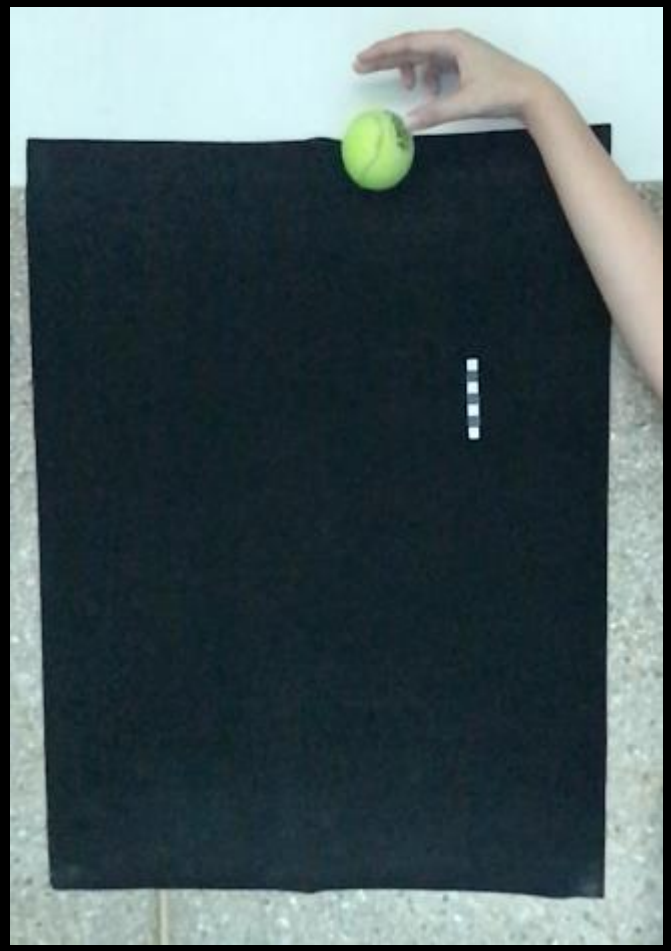
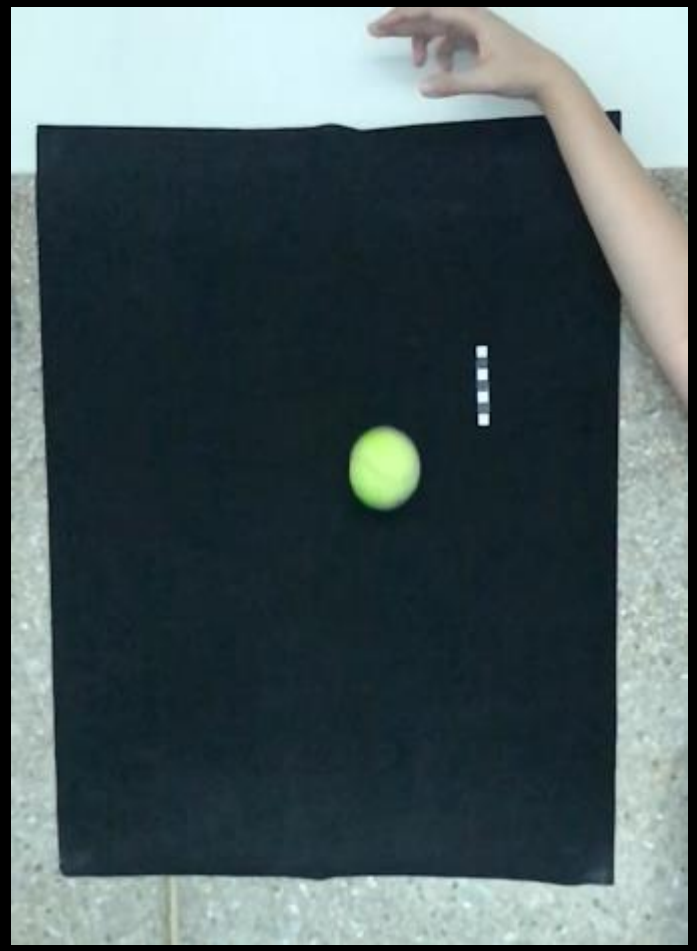
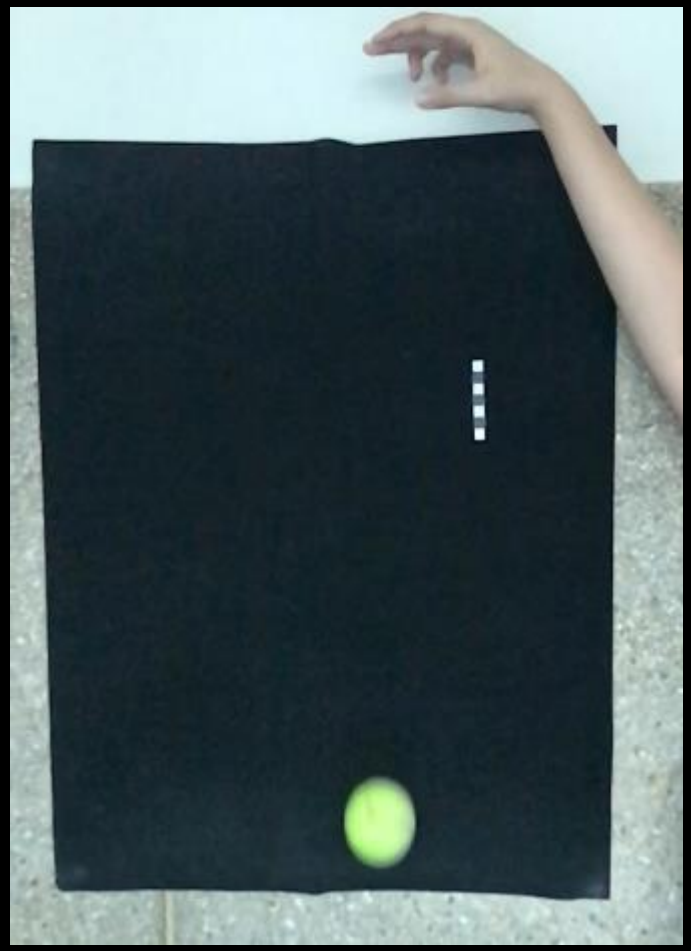
Original Footage







Tennis Ball Dropped

Basic Video Processing:

- Scaling
- Blob Detection
- Tracking of centroid
- Calculation of g

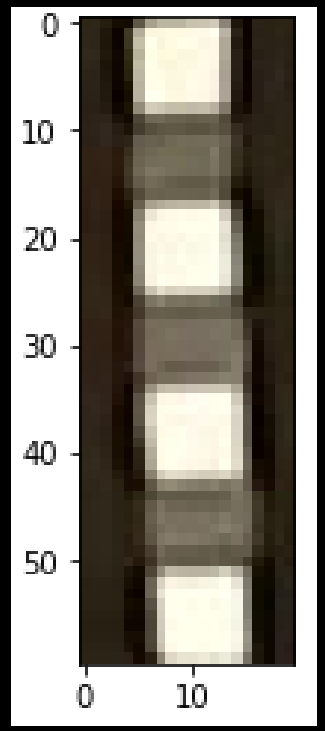
Done using:

- Jupyter Notebook (Python)
  - Packages:

```
import matplotlib.pyplot as plt
import numpy as np
import cv2
```

Step 1 Scaling

- Scale Bar used in the footage:



- Height of the Scale bar on image: 60 px
- Actual height of the Scale bar : 7 cm

- Scale : 1 px = 0.117 cm

Step 2 Blob Detection

- The video was split into 500+ frames
- Each picture was processed by using a for loop:

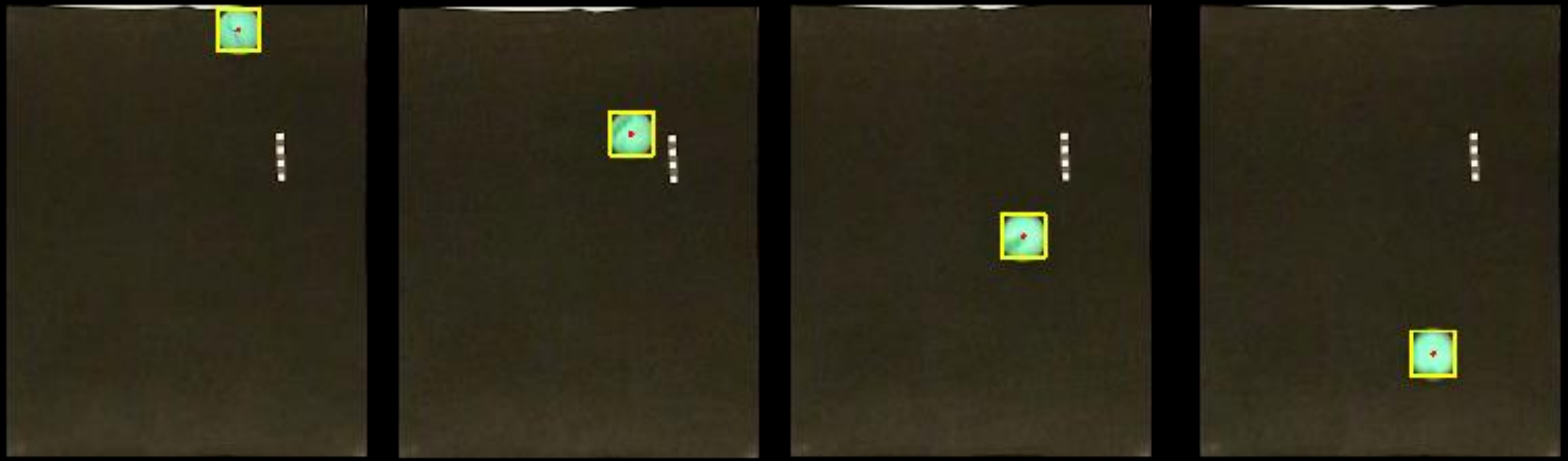
```
first_frame = 156
last_frame = 220
frames = range(first_frame,last_frame+1)

centroids = []
```

```
for i in frames:
    #Read image
    image = cv2.imread('pics/frame'+str(i)+'.jpg')
    #Crop image
    image = image[385:960,120:580]
    #Detect ball
    keypoints = detector.detect(image)
    #Draw center and square
    pt = keypoints[0].pt
    d = keypoints[0].size
    im_with_sq = cv2.rectangle(image, (int(pt[0] - d/2), int(pt[1] - d/2)), (int(pt[0] + d/2), int(pt[1] + d/2)), (255,255,0),
    im_with_sq = cv2.rectangle(image, (int(pt[0]),int(pt[1])), (int(pt[0]+1),int(pt[1]+1)), (255,0,0), 5)
    #Record position
    centroids.append(keypoints[0])
    #Plot and save image
    plt.title('frame '+str(i))
    plt.imshow(im_with_sq)
    plt.axis('off')
    plt.imsave('pics/DETECTED/'+str(i)+'.jpg', im_with_sq)
    plt.show()
```

Step 2 Blob Detection

- Results:



Step 3 Tracking of Centroid

```
traj_x = []
traj_y = []

#Getting x and y values
for keypoint in centroids:
    x,y = keypoint.pt
    traj_x.append(x)
    traj_y.append(y)
```

- The centroid coordinates along x and y were extracted

```
N = len(centroids) #Number of frames
fps = 240 #FPS in camera recording
time = (1/240)*np.array(frames) #Corresponding times of each frame
```

- Converting frames to time

Step 4 Calculation of g

```
#Define function
def y(t,g,v0,y0):
    return y0 + v0*t + (1/2)*g*(t**2)

from scipy.optimize import curve_fit

popt,pcov = curve_fit(y,time,traj_y)
g_fit, v0_fit, y0_fit = popt
```

- A kinematics equation was used to extract g, acceleration due to gravity.

- Result:

```
g = 9.471877341253874
```

Conclusion

- The blob detection was effective in detecting the ball.
- This method was fairly successful in obtaining g.
- A lot of image processing techniques were employed in processing a video that’s split into images/frames.
- It’s amazing how these processing techniques can be applied to just about anything!

Pointssss

- TC : 5
- QP : 5
- IN : 2

- This was so much fun ☺! Thank you!