CSIE Volleyball

112-2 NTU EECV VIVOTEK FINAL PRESENTATION

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MAIN IDEA - BACKGROUND SUBTRACTION

- Use **"Absolute difference"** instead of original background subtraction to reduce the impact of light-changing
- Apply **frame-by-frame absolute difference** to find out moving objects
- We can see that in the video, **white pixels** means moving object

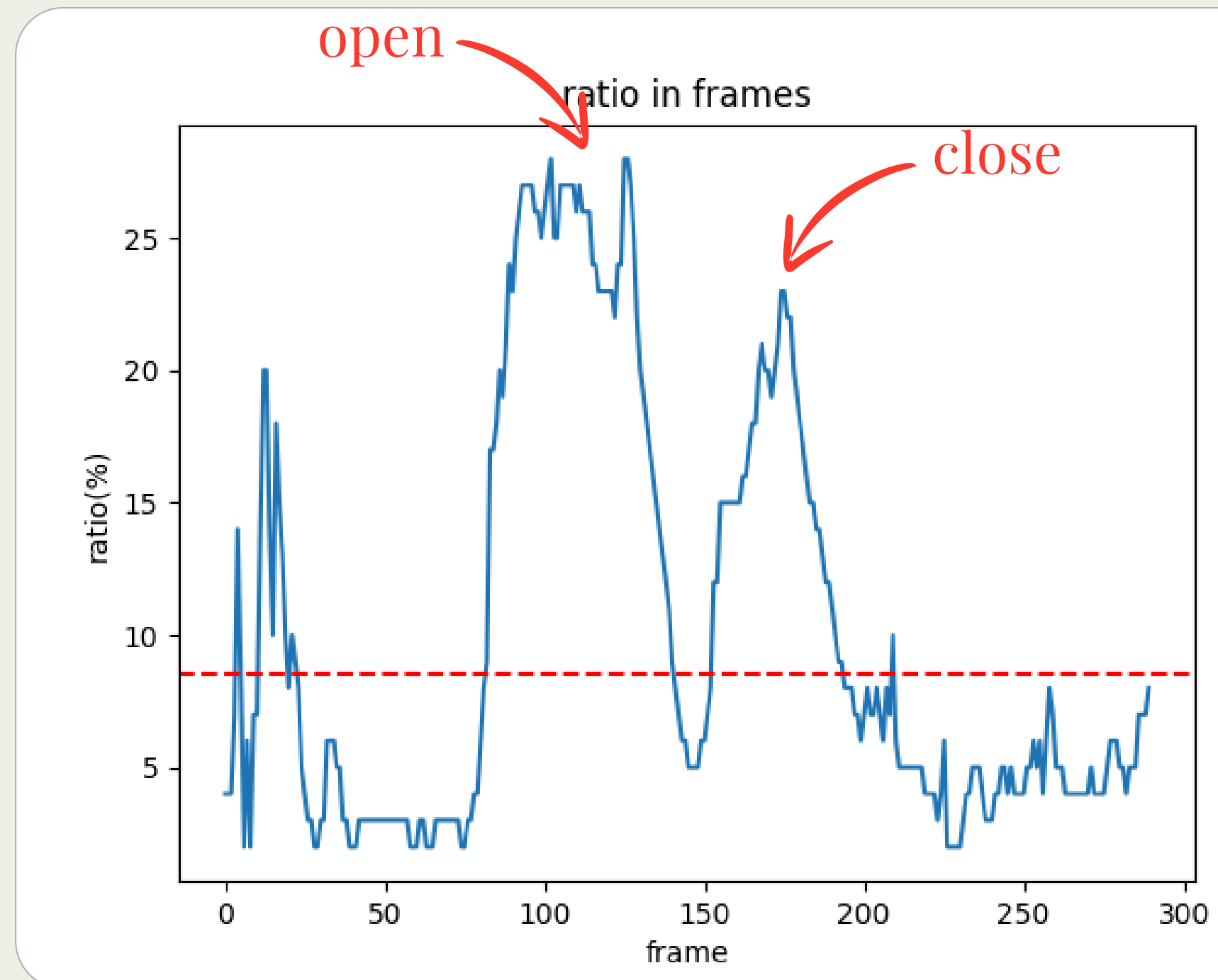# AFTER APPLYING ABSOLUTE DIFFERENCE

- What's remaining?

  a. **Door opening and closing**

  b. People moving with their bags

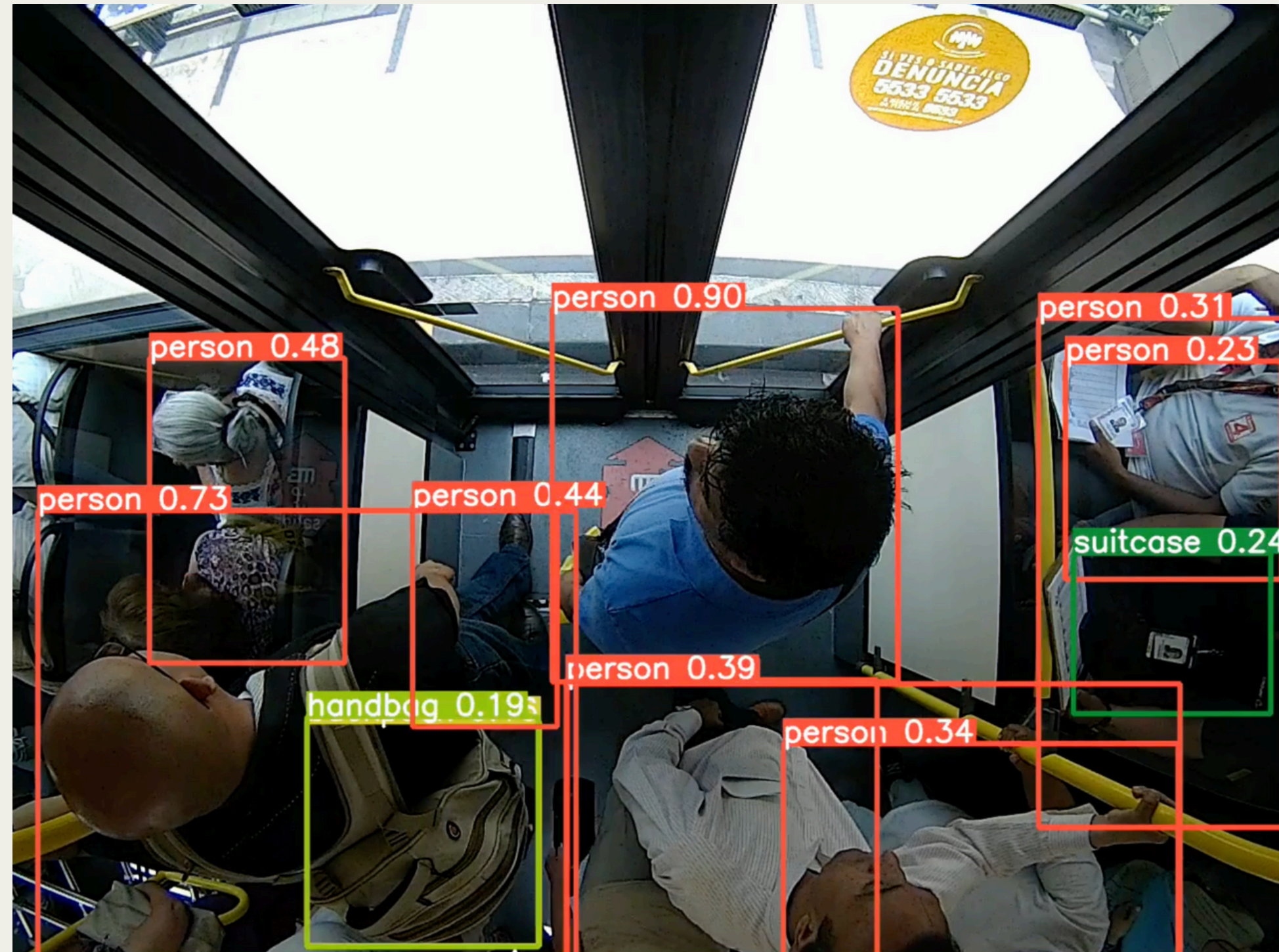 c. Scenery and light change outside the window

WAVEFORM

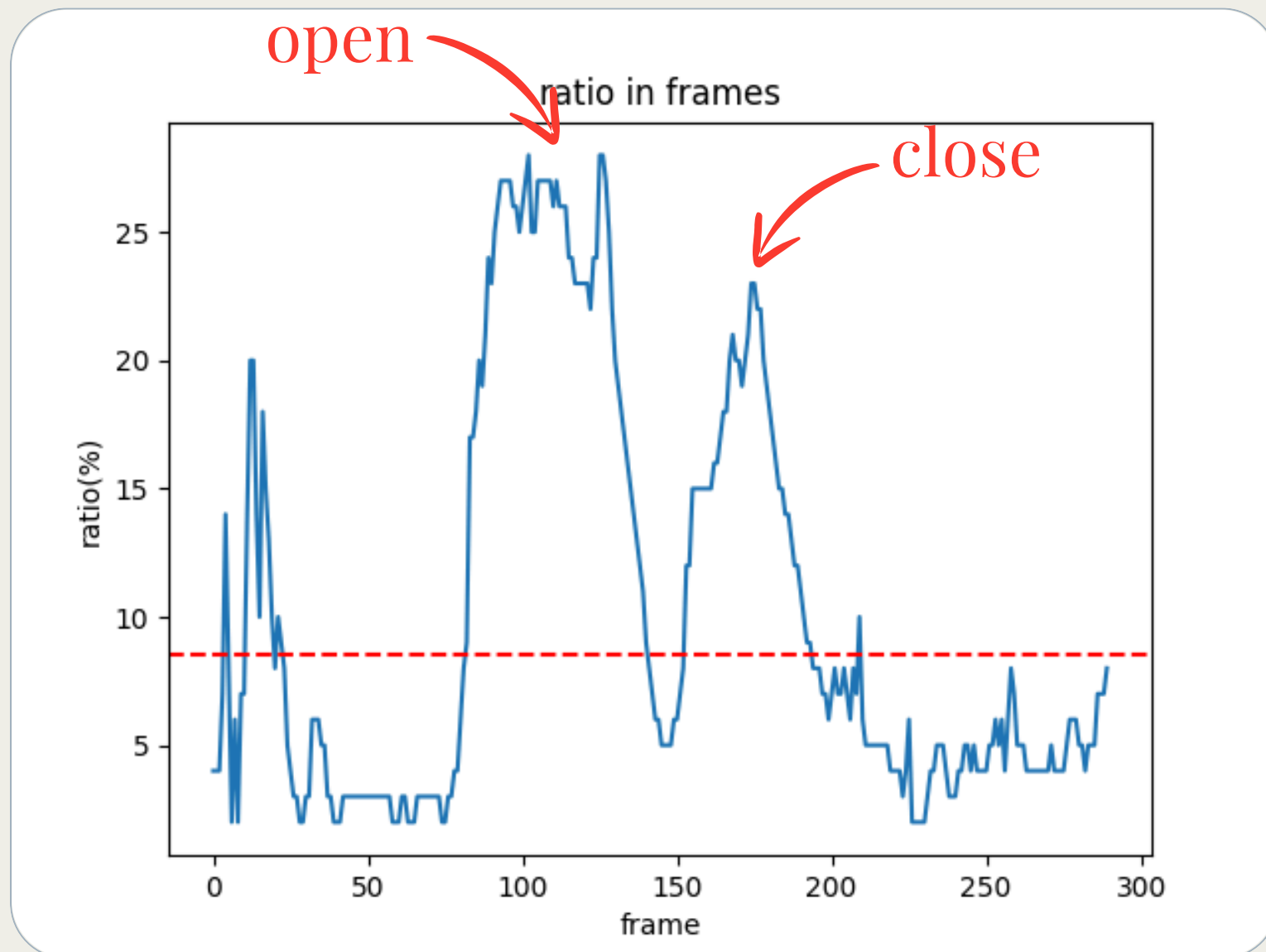- When door is **opening** or **closing**, the waveform hits the **max. value**

MOVING OBJECT- PEOPLE AND BAG
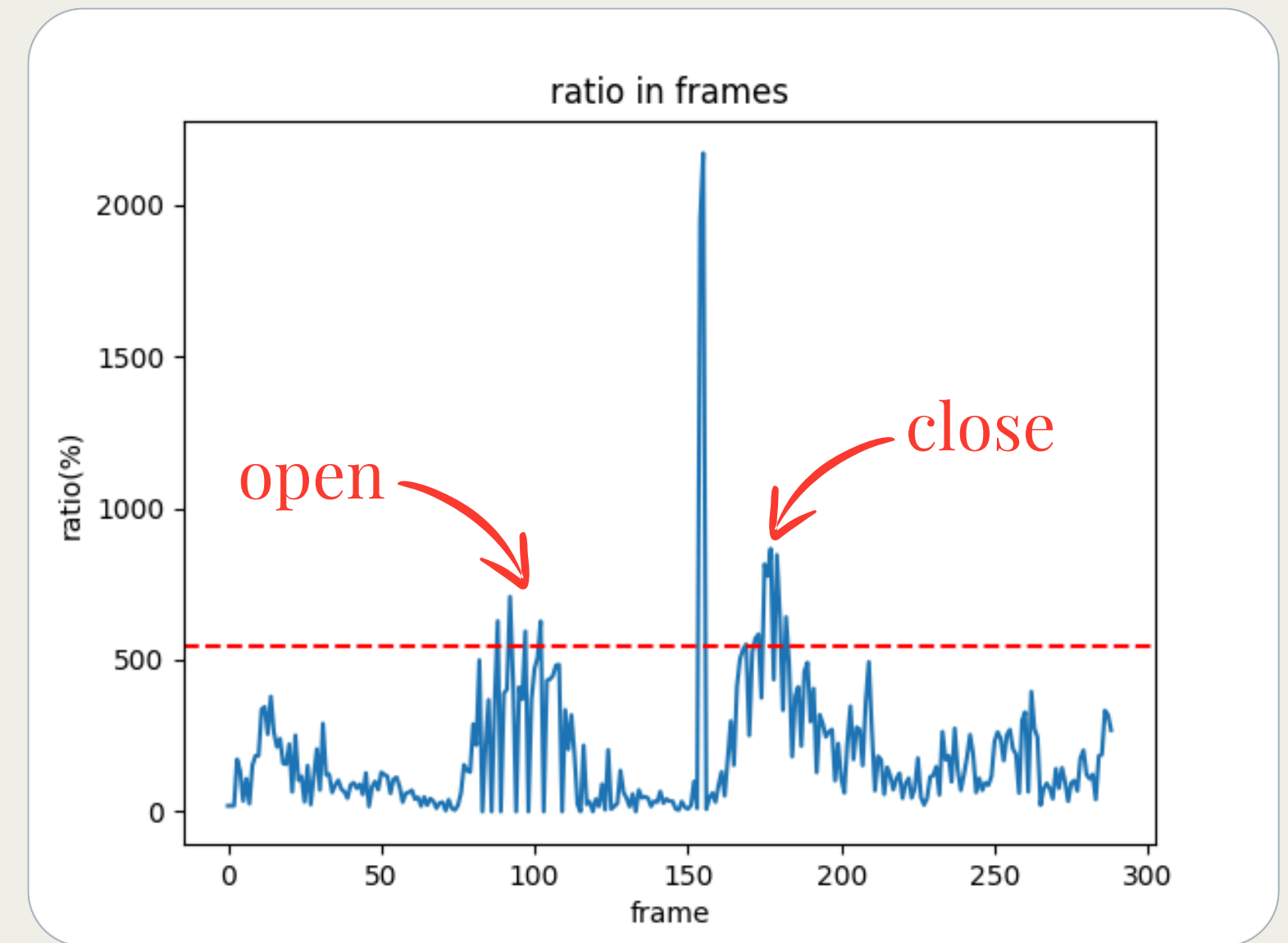
WAVEFORM

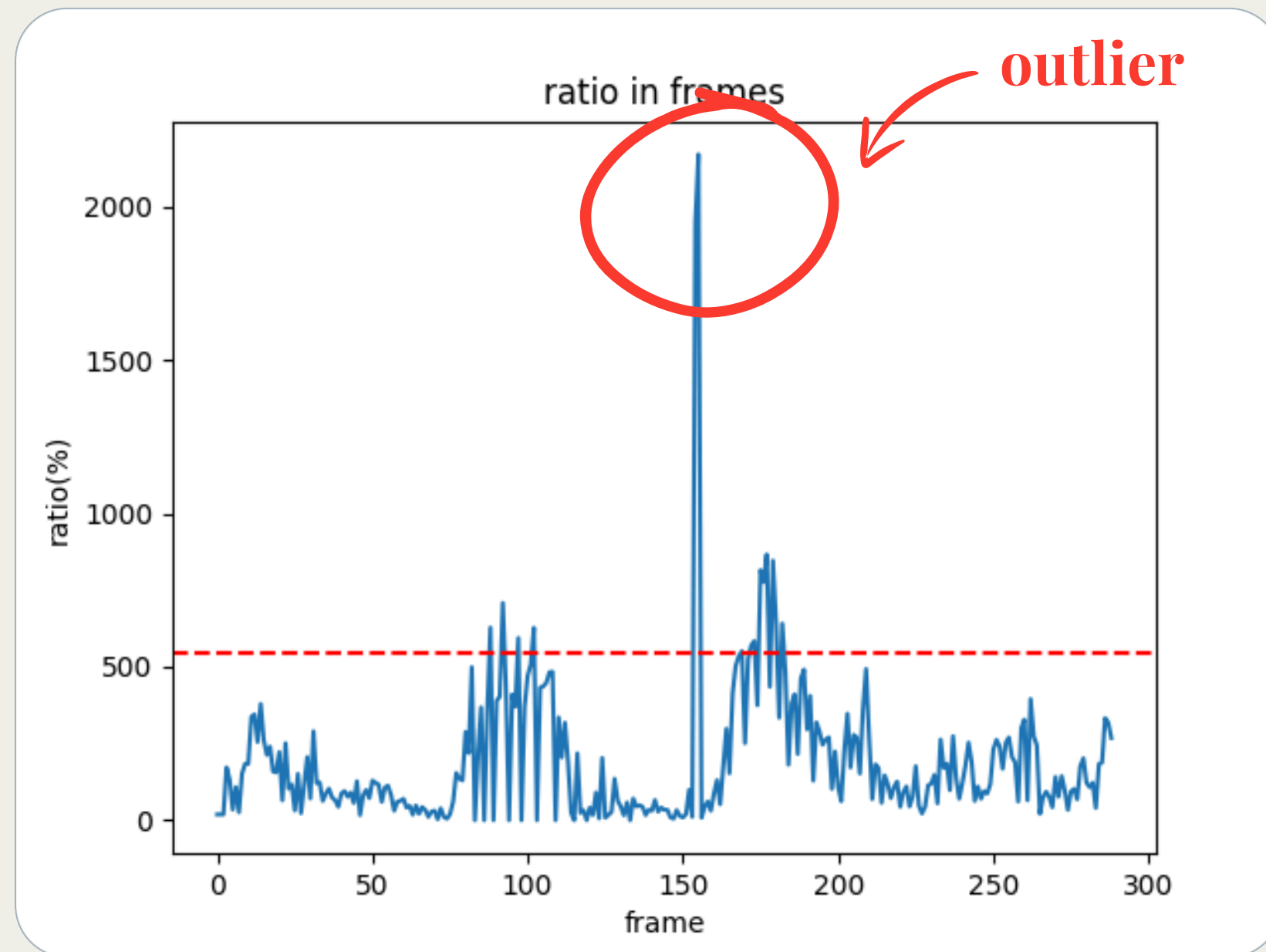- Waveform **before** and **after** applying <u>YOLO</u>
- noisy and spiky

Before
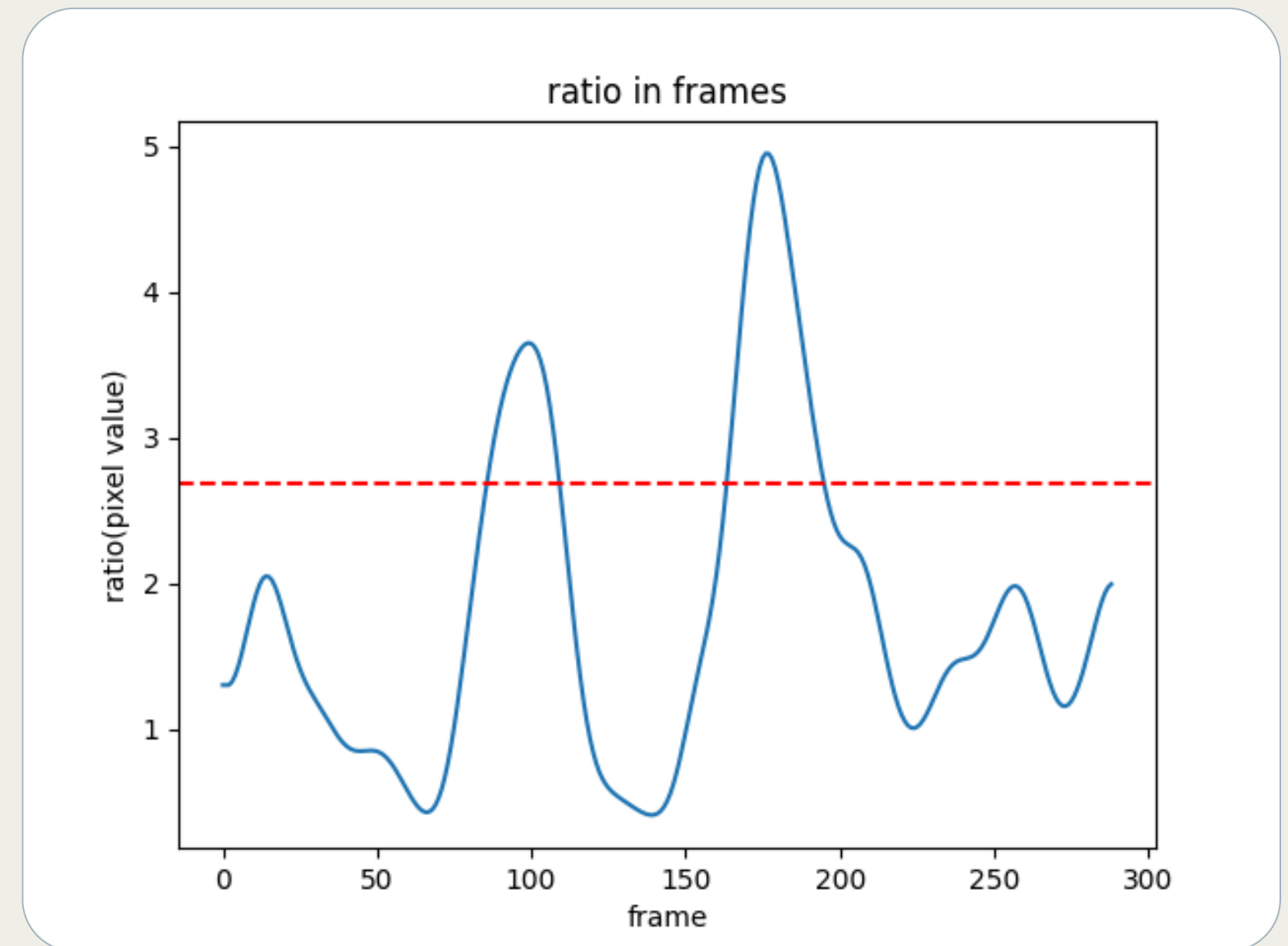
After

NORMALIZATION

1. Remove outliers
2. Gaussian filter

Before
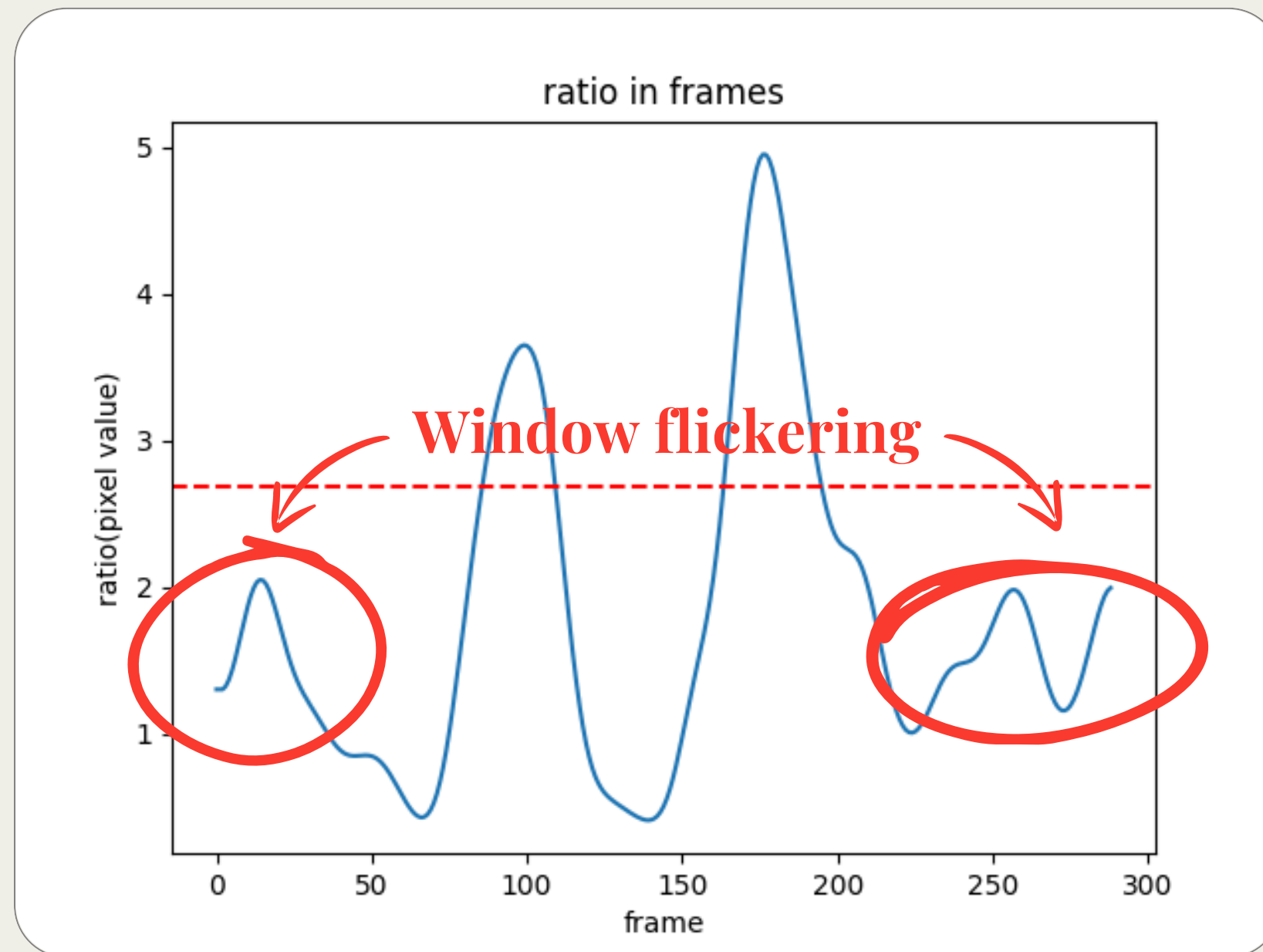
After

MOVING OBJECT- LIGHT THROUGH THE WINDOW

- Since the **lighting condition varies significantly** on the windows, their average value after applying absolute difference tends to be high.

- Thus, we design a **two-pass method**:

    i. Calculate the average value of the absolute difference of each pixel

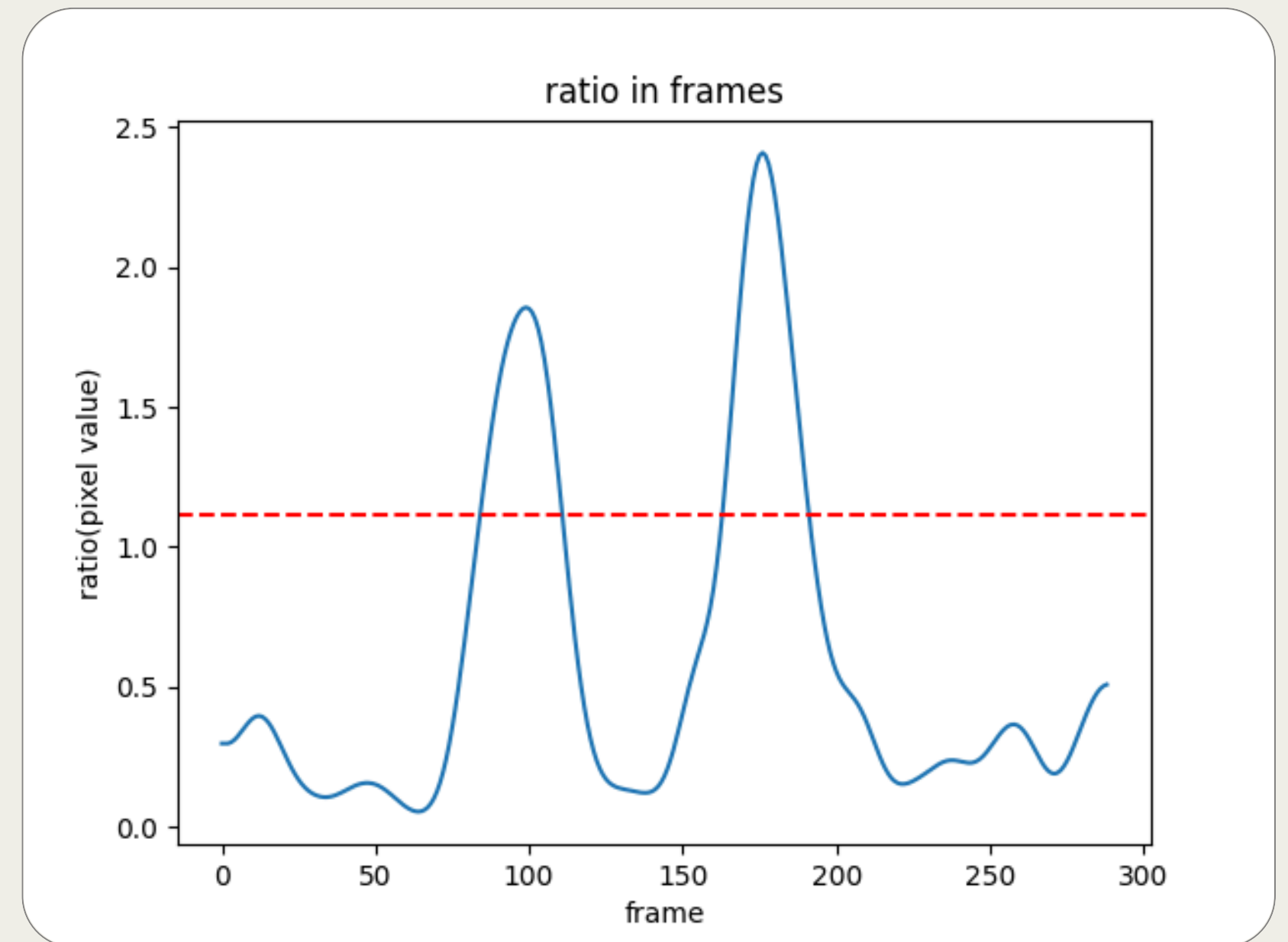   ii. Use the average value as a **mask** to mitigate the noise of flickering window

WAVEFORM

- Waveform **before** and **after** filtering out the <u>window light influence</u>

Before

After

DETECTION FLOW

First pass

- Compute absolute differences between consecutive frames to highlight moving areas.
- Accumulate these differences to average out pixel values for noise reduction.

Second pass

- Apply YOLOv8 to detect and mask people and bags.
- Mask window areas using the average calculated by first-pass
- Mask the middle area since the door must be by the side
- Focus on the remaining unmasked areas to monitor door movements

Guess

- Normalize and apply Gaussian filtering to smooth the pixel value data.
- Use a sliding window to detect consistent movement patterns above a threshold.
- Cluster detected movement patterns to identify distinct door opening and closing events.
- Label central frames in clusters as either door opening or closing based on their sequence.
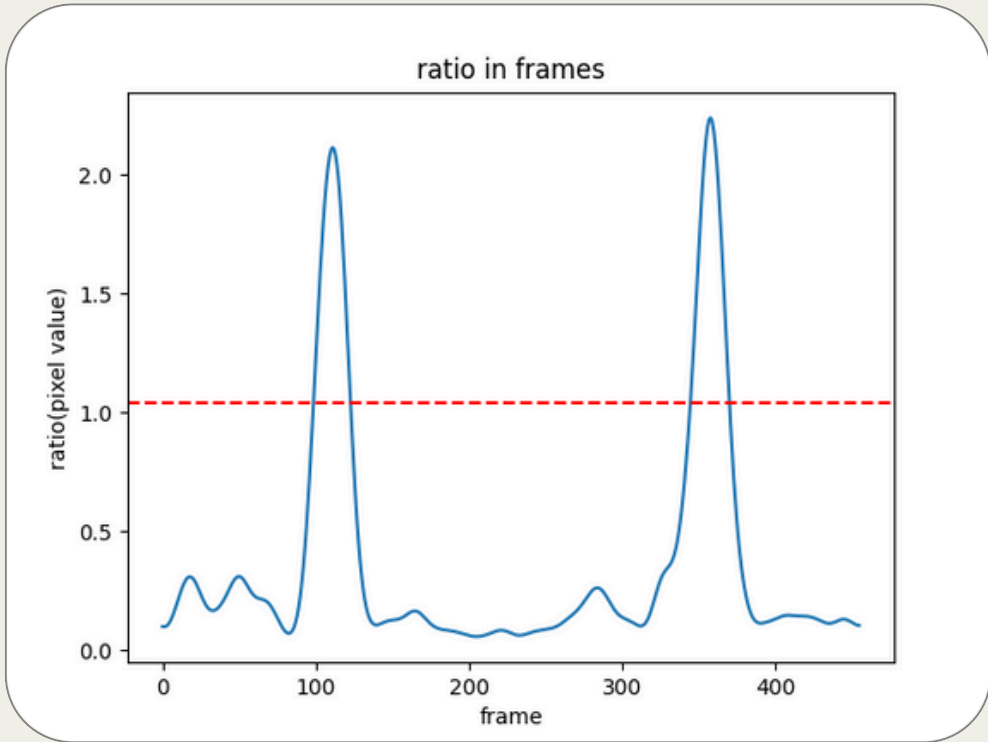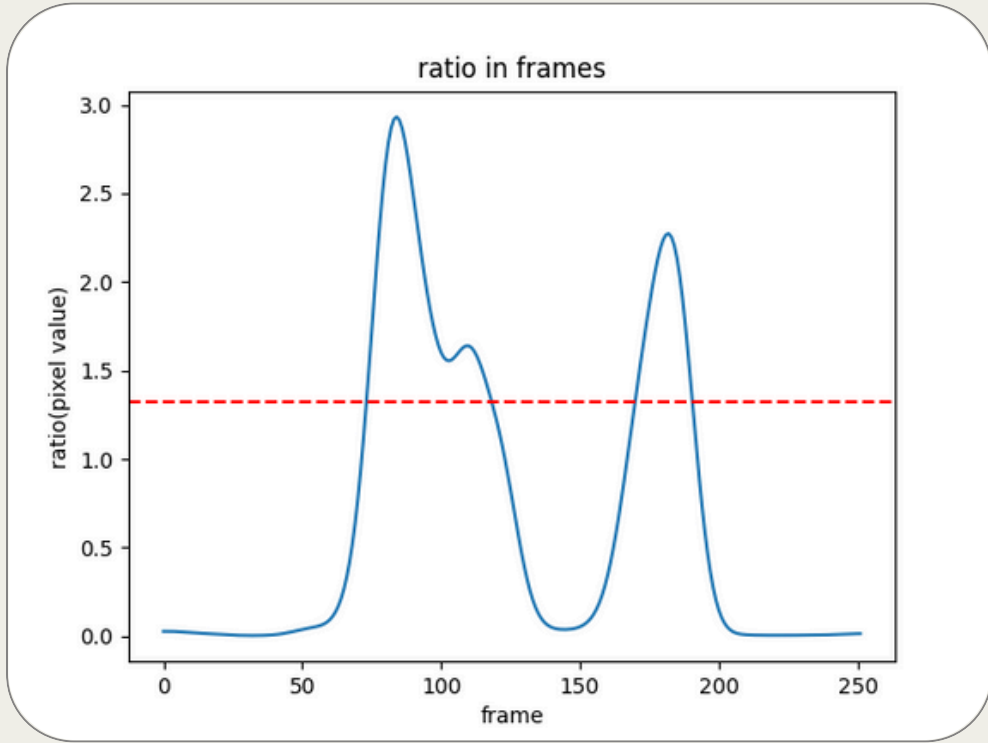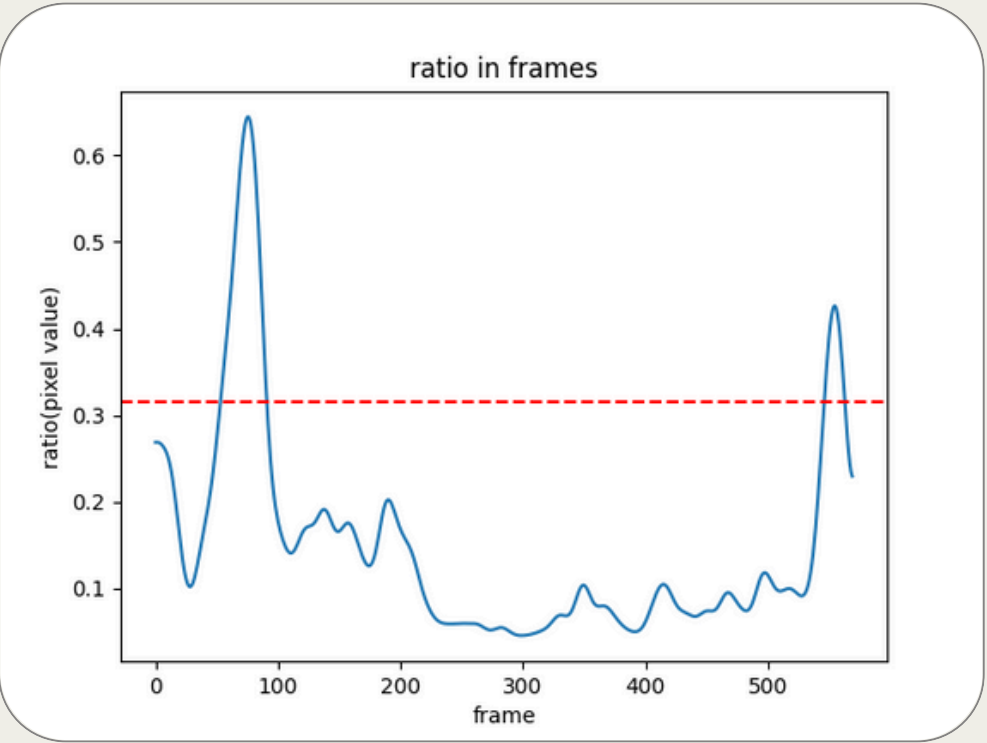
RESULT

Test1
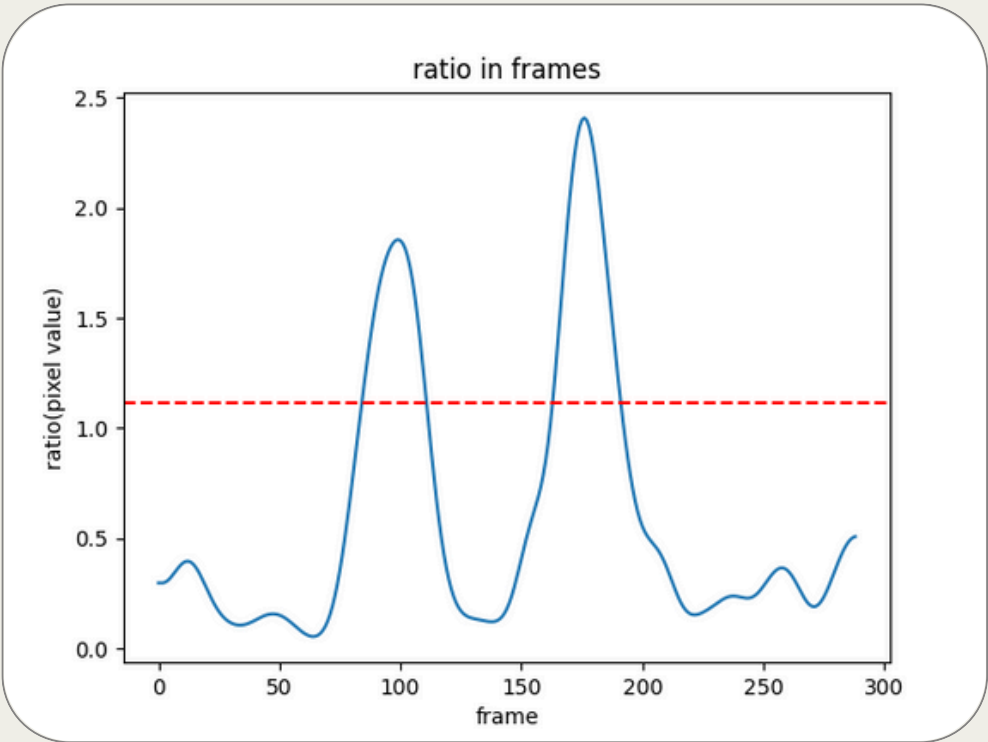
Test3
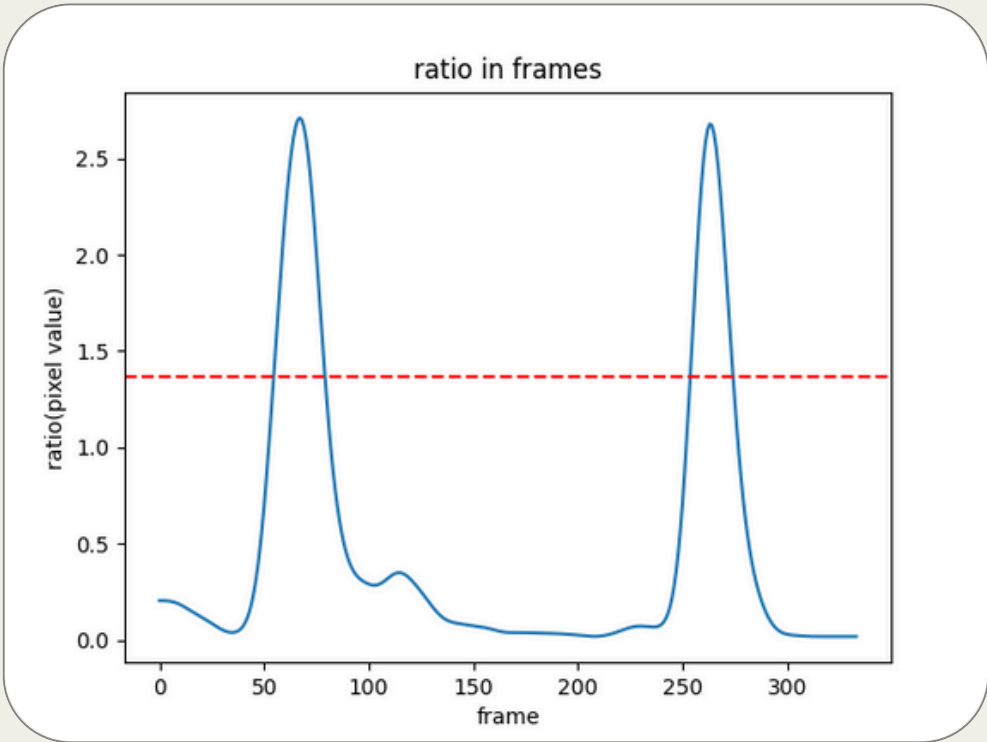
Test5

Test7

Test9

Public Recall: 100%

Public Precision: 100%

Total Recall :   90%

Total Precision: 85.7%

Thank you!

TEAM CSIE VOLLEYBALL