Image Processing

Video Subtitles Detector Program

Agenda

Topics Covered

- Read and Process the video
- Preprocessing
- Segmentation
- Bounding boxes dimensions
- Results

Read and Process the video

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1. Create a folder to hold the frames.

2. Open the video file and read it using openCV library.

3. Save the frame while the video is still in progress.

Preprocessing

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HSV (hue, saturation, value, also known as HSB [hue, saturation, brightness]) is an alternative representation of the RGB (Red-Green-Blue) color model.
it's designed to match more closely to the way our human vision interprets color attributes.

The whole idea is, we will be creating a binary mask where the white region will represent our target color (text) and black will represent rest of the colors.

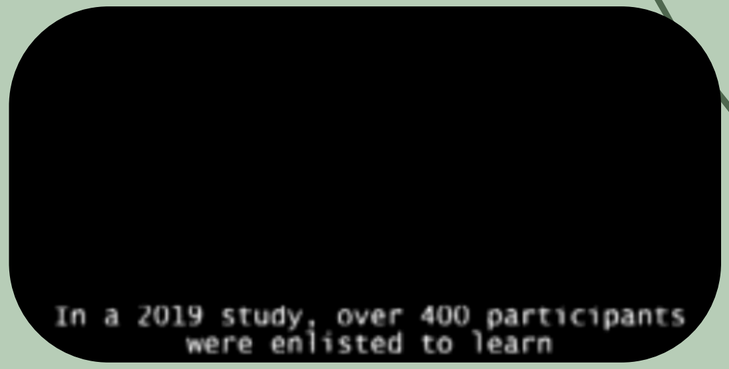
Steps:

- Changing the COLOR format from BGR to HSV
- Get the lower and upper boundaries with a GUI interface to find that particular boundary for a particular color in several tries.
- Putting the MASK to the HSV image with lower and upper boundaries.
- Get the resulting image with text only

Images Before and After

original image

converting HSV



the mask

Segmentation

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Dilation

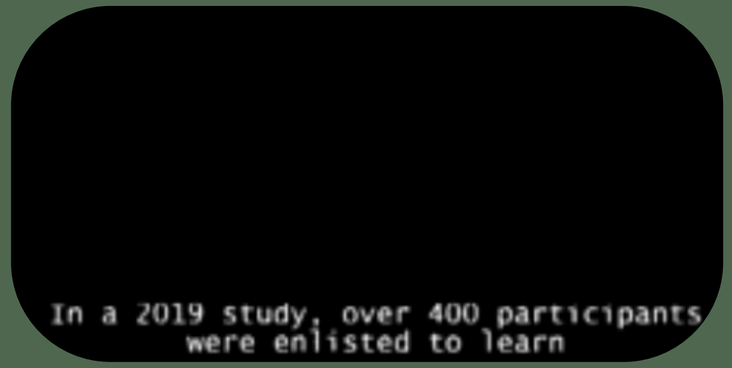
Morphological operator:

- Dilation: The first step involves applying dilation to the image. This operation expands the foreground objects (text) by incorporating neighboring pixels that meet certain criteria based on the structuring element.

Steps

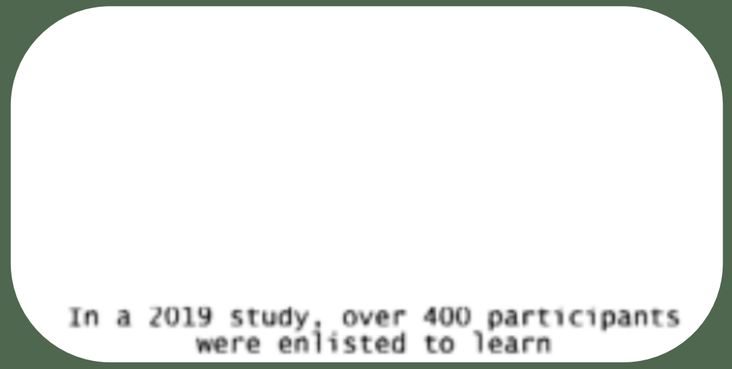
- **Define the structuring element:** Use cv2.getStructuringElement to create a kernel suitable for text characteristics. A rectangular kernel is a common choice for horizontal text lines.
- **Apply morphological dilation:** Use the defined kernel and OpenCV's morphology functions to perform dilation on the binary image.
- **Text localization:** After dilation, the improved binary image can be fed into text localization algorithms: contour detection. These algorithms identify connected white regions, which should correspond to text objects after dilation.
- **Bounding boxes:** Finally, draw bounding boxes around the detected text contours to highlight the text regions in the original image.

Images Before and After



mask

after dilation



mask on the image

Bounding Boxes

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Steps

Dilate

we get the image after dilation

Contours

we find contours on the dilated text

Calculations

Calculate the dimensions of suitable rectangles

Bounding Rectangles

Draw rectangles

How the dimensions of the bounding boxes are calculated?

Steps

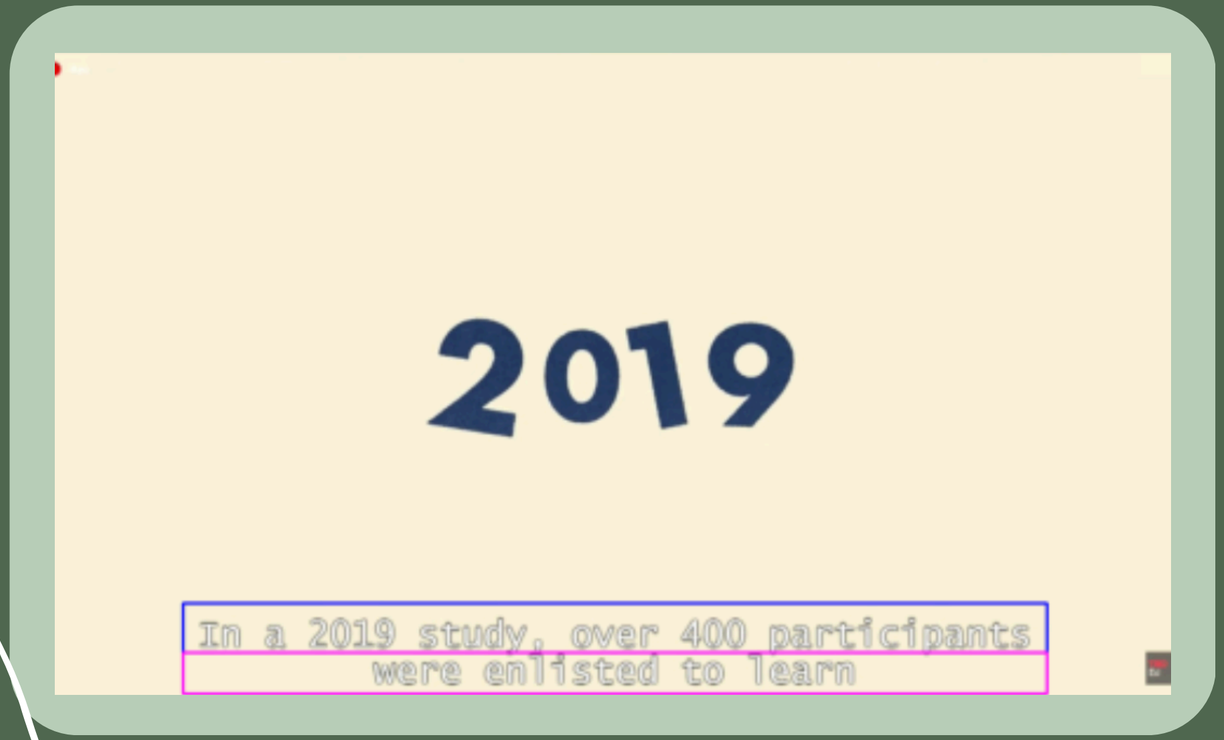
- Extract the y-axis coordinates of the contours to determine the vertical extent of the subtitles, then obtain the minimum and maximum y-axis values from the detected contours.

- Calculate the average y-axis position by taking the mean of the minimum and maximum y-axis values. This average position serves as the reference point for positioning bounding boxes around each subtitle.

- To differentiate between single and multiple sentences within the subtitle area, compute the vertical difference between the maximum and minimum y-axis values.
  If the difference exceeds a predefined threshold (e.g. 100), infer the presence of multiple sentences. Otherwise, assume a single sentence.

- Similarly, extract the x-axis coordinates of the contours to establish the horizontal extent of the subtitles. Identify the minimum and maximum x-axis values to define the left and right boundaries of the text.

- Based on the calculated y-axis average and x-axis extents, draw bounding boxes around each subtitle. If multiple sentences are detected, ensure each sentence is enclosed within its respective bounding box.



line

words

Images with bounding boxes

Results

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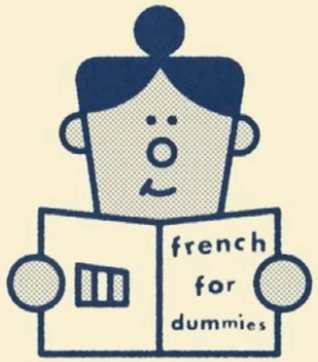
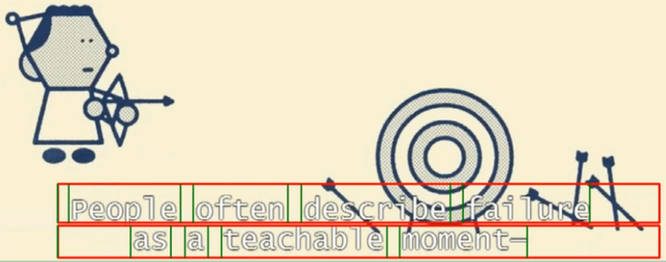
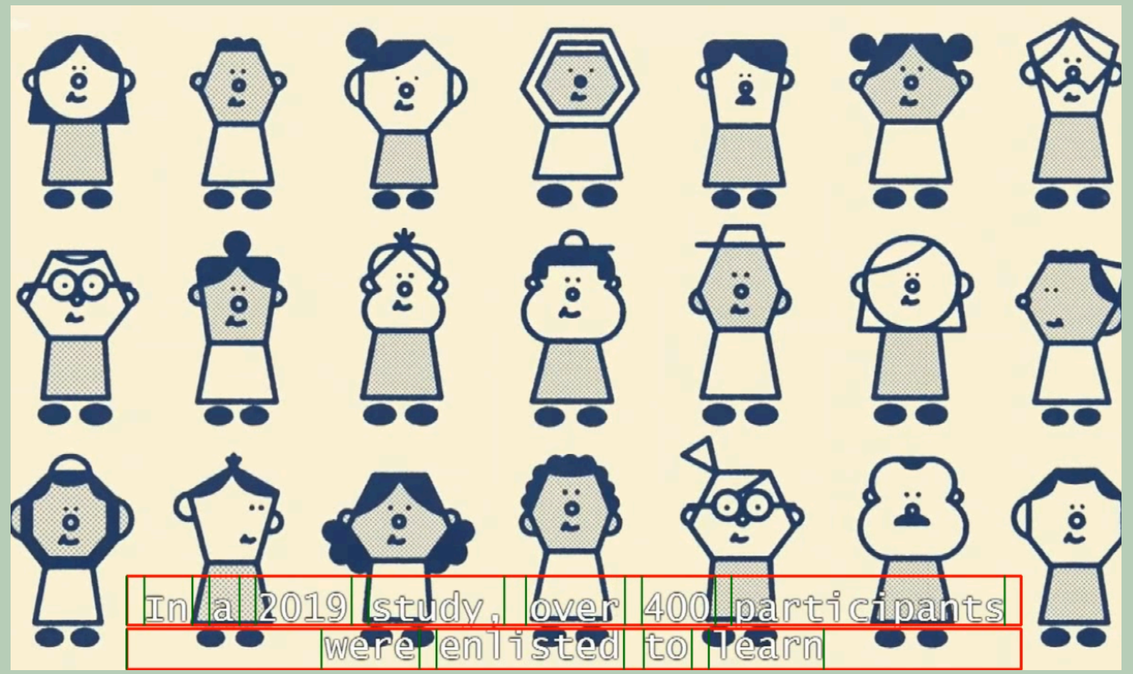


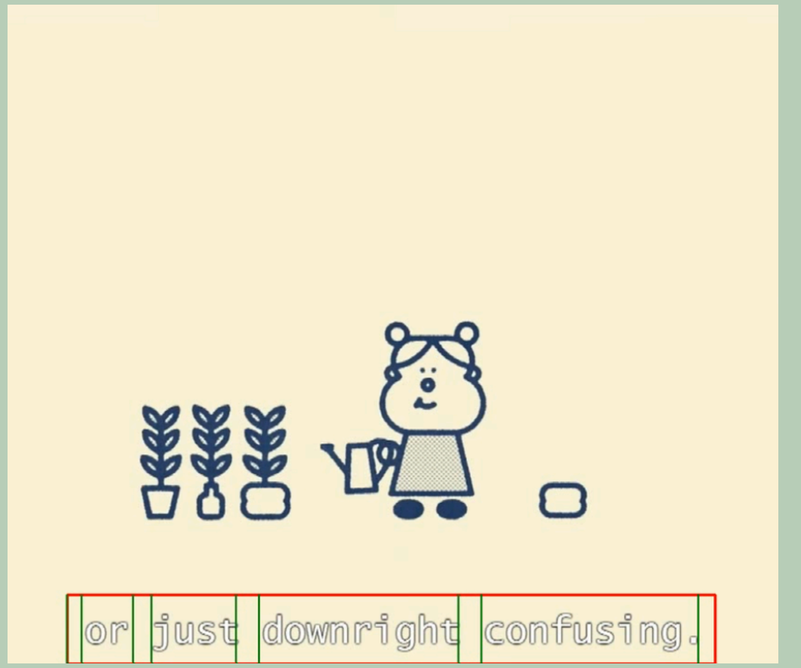
maybe you studied the wrong information.
or maybe you did everything right



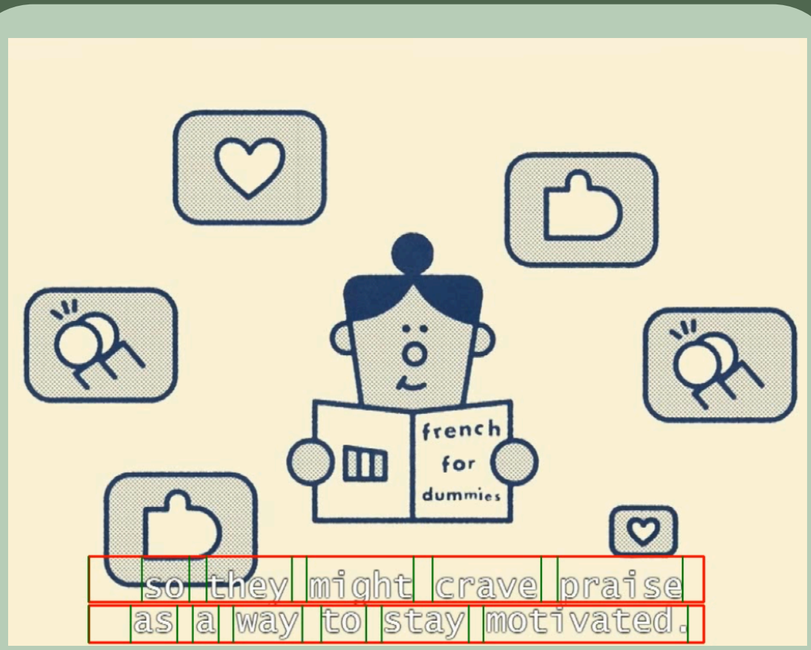
People often describe failure
as a teachable moment—



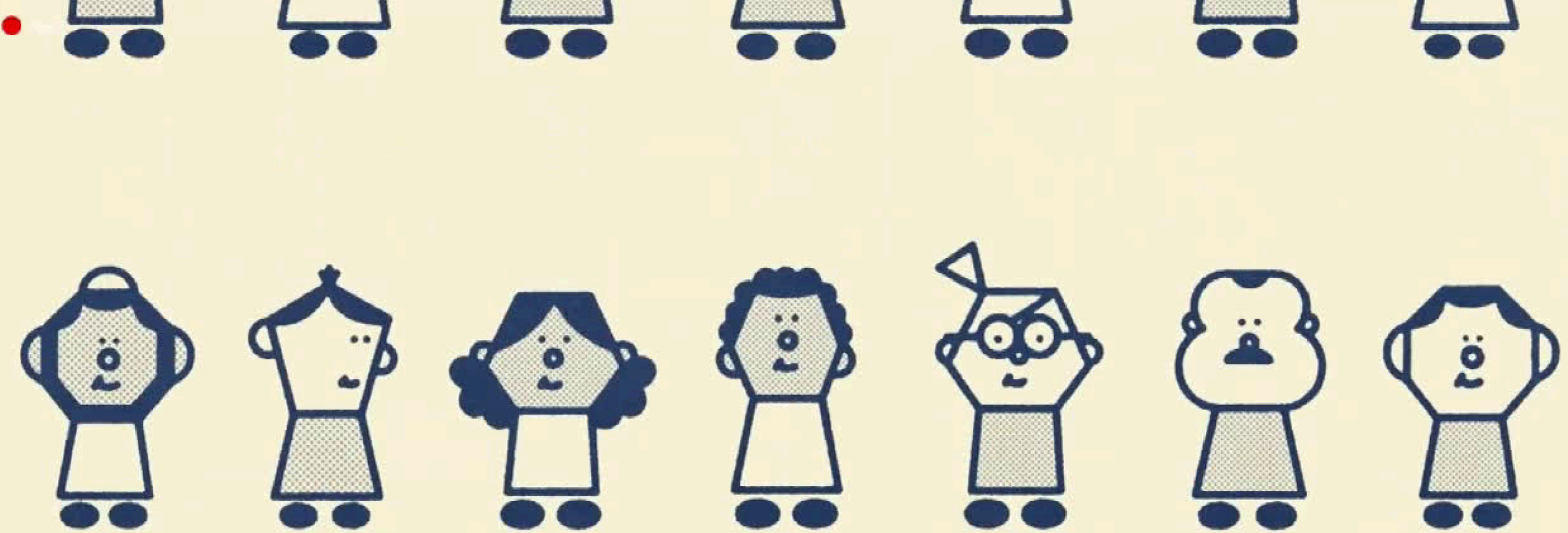
In a 2019 study, over 400 participants were enlisted to learn



or just downright confusing.



so they might crave praise as a way to stay motivated.



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Our Team

Arwa Sallam
20200067

ALMoatasim
20200865

Mahmoud Wael
20200505

Yousef Sherif
20200655

Contacts

Arwa Sallam

arwasallam6@gmail.com

Almoatasim

moutasem.hamdi14@gmail.com

Mahmoud Wael

mahmoudwael677@gmail.com

Yousef sherif

yousefsherif979@gmail.com

Thank you!