Image Processing Project

Under Supervision:
- Dr. Ahmed Samy
- Eng. Nada Ibrahim

Image Processing Basics Processes:

- **Pre-processing:** Adjustments for noise reduction, contrast enhancement.
- **Image Segmentation:** Divide an image into meaningful parts.
- **Feature Extraction:** Identify and extract important characteristics.
- **Image Recognition:** Assign labels or classifications to objects.

Pre-Processing

1. Converting image into grayscale

Using cvtColor to change from 3 channel image into one channel image
which is between [0:255] for fast and easy processing
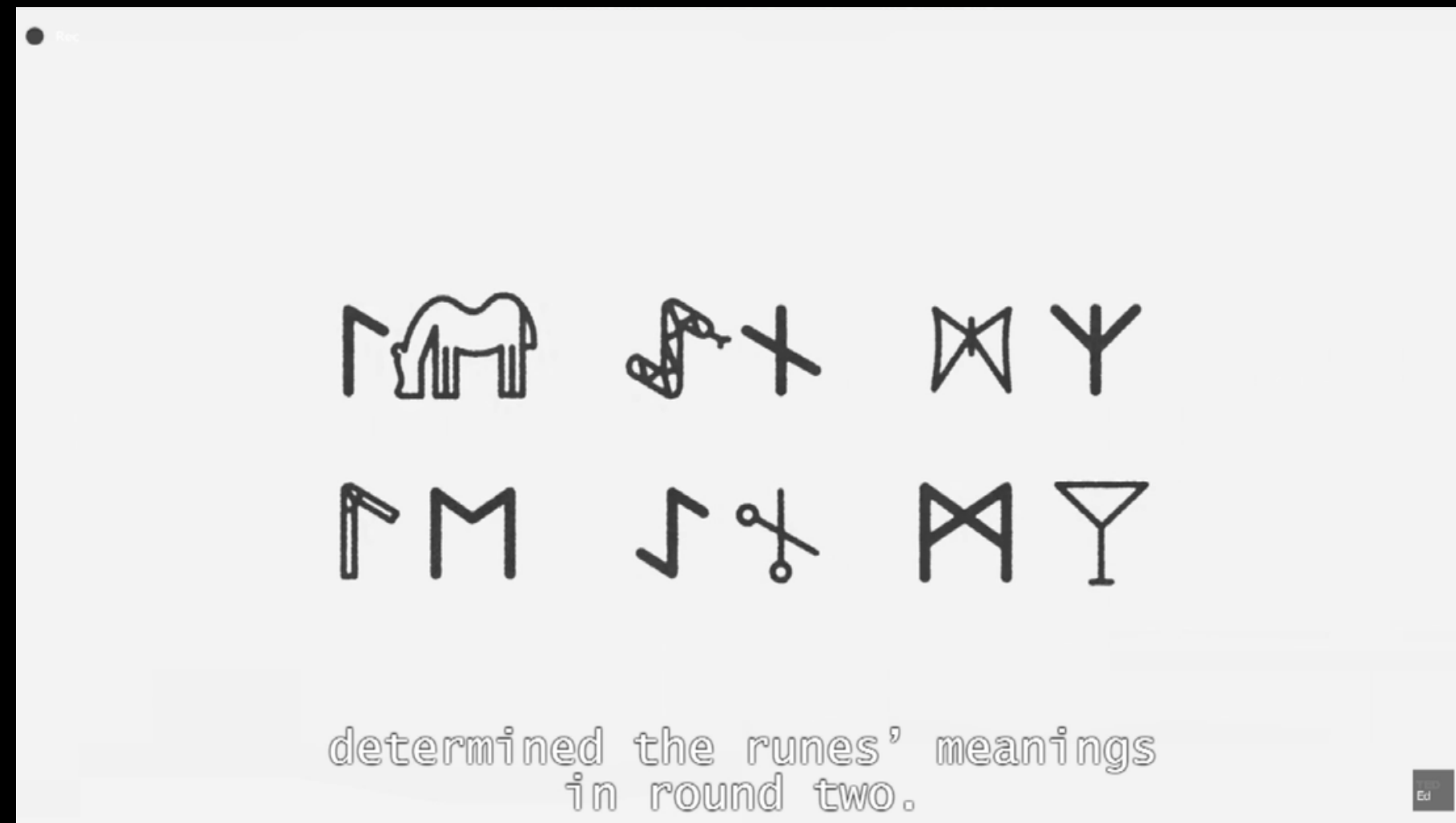
code snippet

```
frame = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
```

Pre-Processing

2. Noise Removal

Using GaussianBlur to smooth the image and remove noisy pixels
by [3x3] Window.

code snippet

```python
frame = cv2.GaussianBlur(frame, (kernel_size, kernel_size), 0)
```

3. Thresholding & Connectivity

applying threshold to convert image into binary image with white pixels, then
making a connectivity of components for the bounding box of each connected
ones.

code snippet

```python
_, binary_frame = cv2.threshold(frame, 1, 255, cv2.THRESH_BINARY)
_, labels, stats, _ = cv2.connectedComponentsWithStats(binary_frame, connectivity=8)
```

Image Segementation

1. Region of Interest (ROI)

Working on specific region to apply other processing with no need to apply these processors on the whole framework.

code snippet

```python
# Get the region which the subtitle at
roi_width = int(width * width_percentage)
roi_height = int(height * height_percentage)
roi_x = int((width - roi_width) / 2)
roi_y = int(height - roi_height)
roi = frame[roi_y:roi_y + roi_height, roi_x:roi_x + roi_width]
```
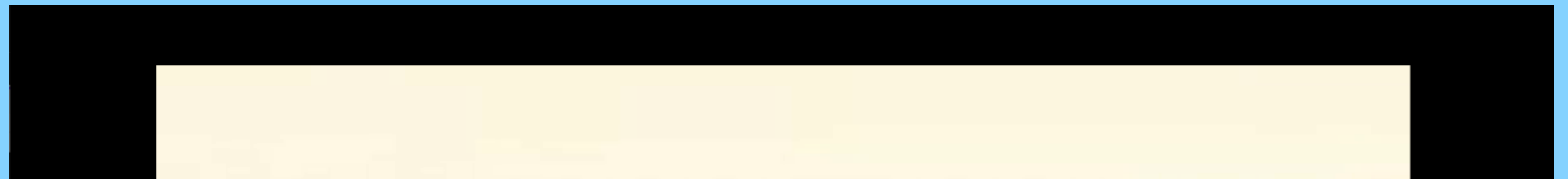
ROI:

Image Segementation

2. Mask Filtration

Making mask filtration which filter pixels and only pass the white pixels from a range [240: 255], otherwise the pixel become black one.

code snippet

```python
# Change the roi background into black except white pixels
hsv_roi = cv2.cvtColor(roi, cv2.COLOR_BGR2HSV)
lower_white = np.array([0, 0, 200], dtype=np.uint8)
upper_white = np.array([255, 15, 255], dtype=np.uint8)
white_mask = cv2.inRange(hsv_roi, lower_white, upper_white)
```
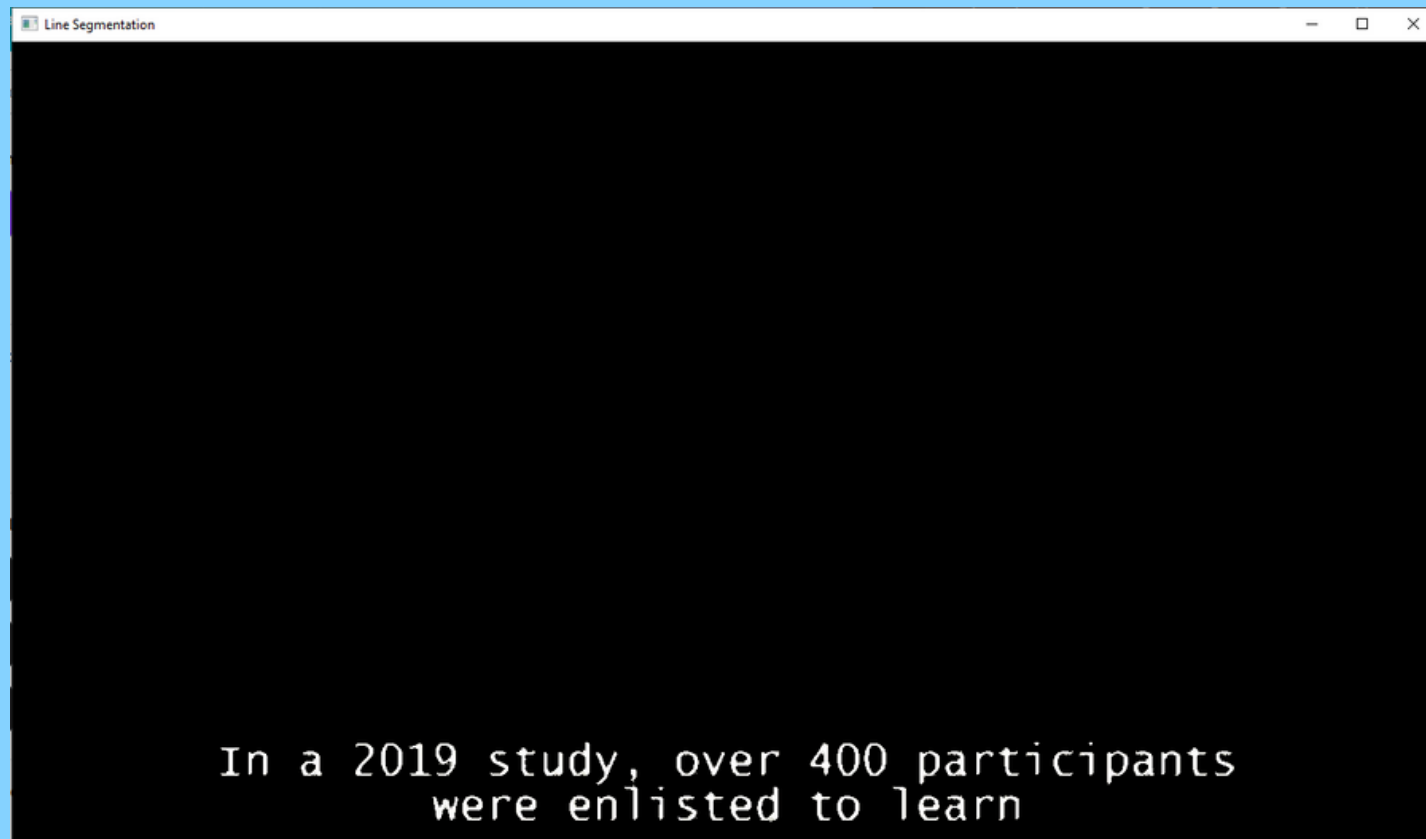
Image Segementation

3. Remove Noise using Morphology

code snippet

```python
# Remove white noise
# kernel = np.ones((1,5), np.uint8)
kernel = create_cross_kernel(4)
black_frame = cv2.dilate(black_frame, kernel, iterations=1)
black_frame = cv2.erode(black_frame, kernel, iterations=1)
return black_frame
```
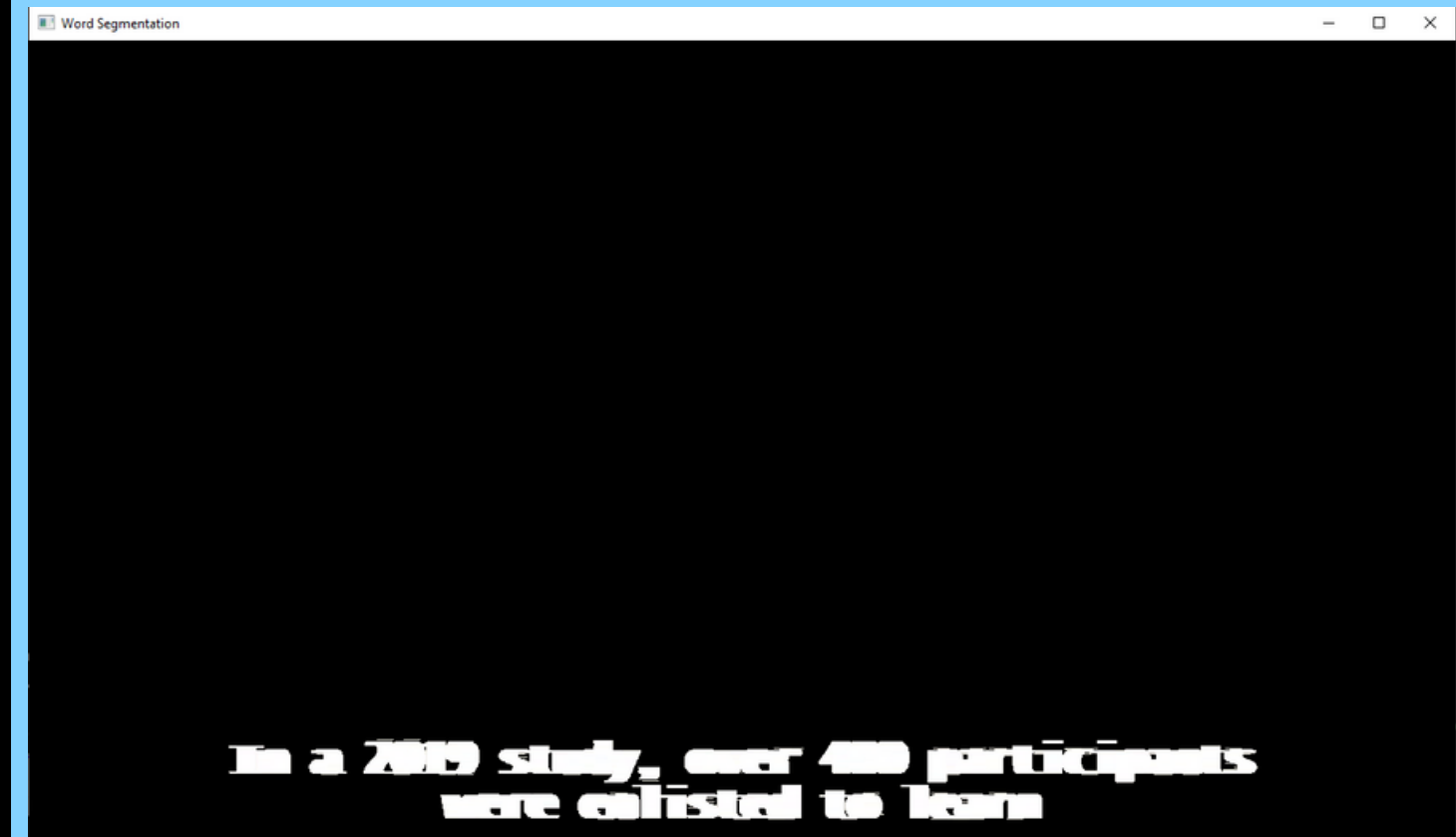
Image Segementation

Line Segmentation

line bounding box applied on sorted y-coordinate boxes

Word Segmentation

bounding box applied on a connect series of white pixels
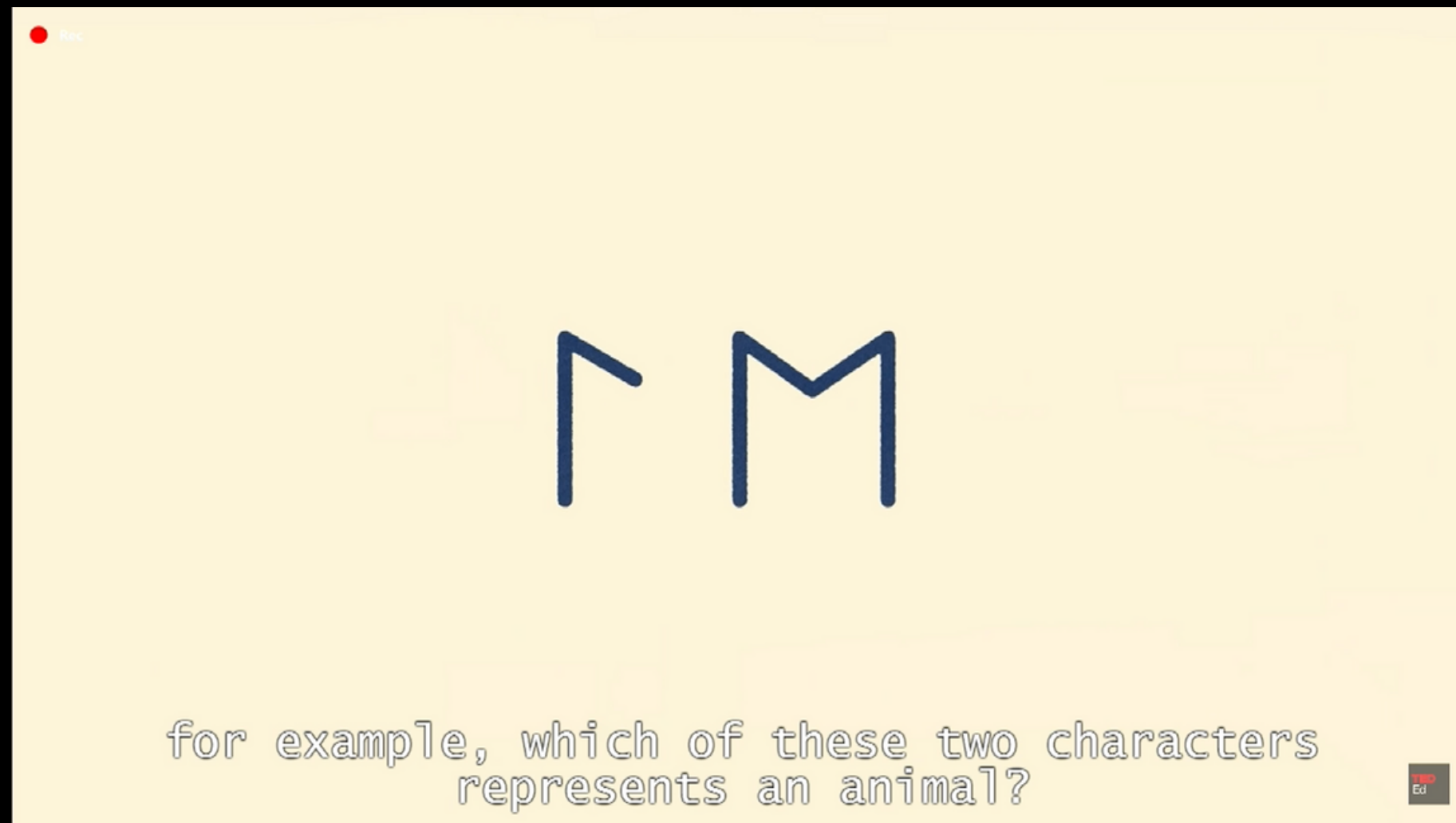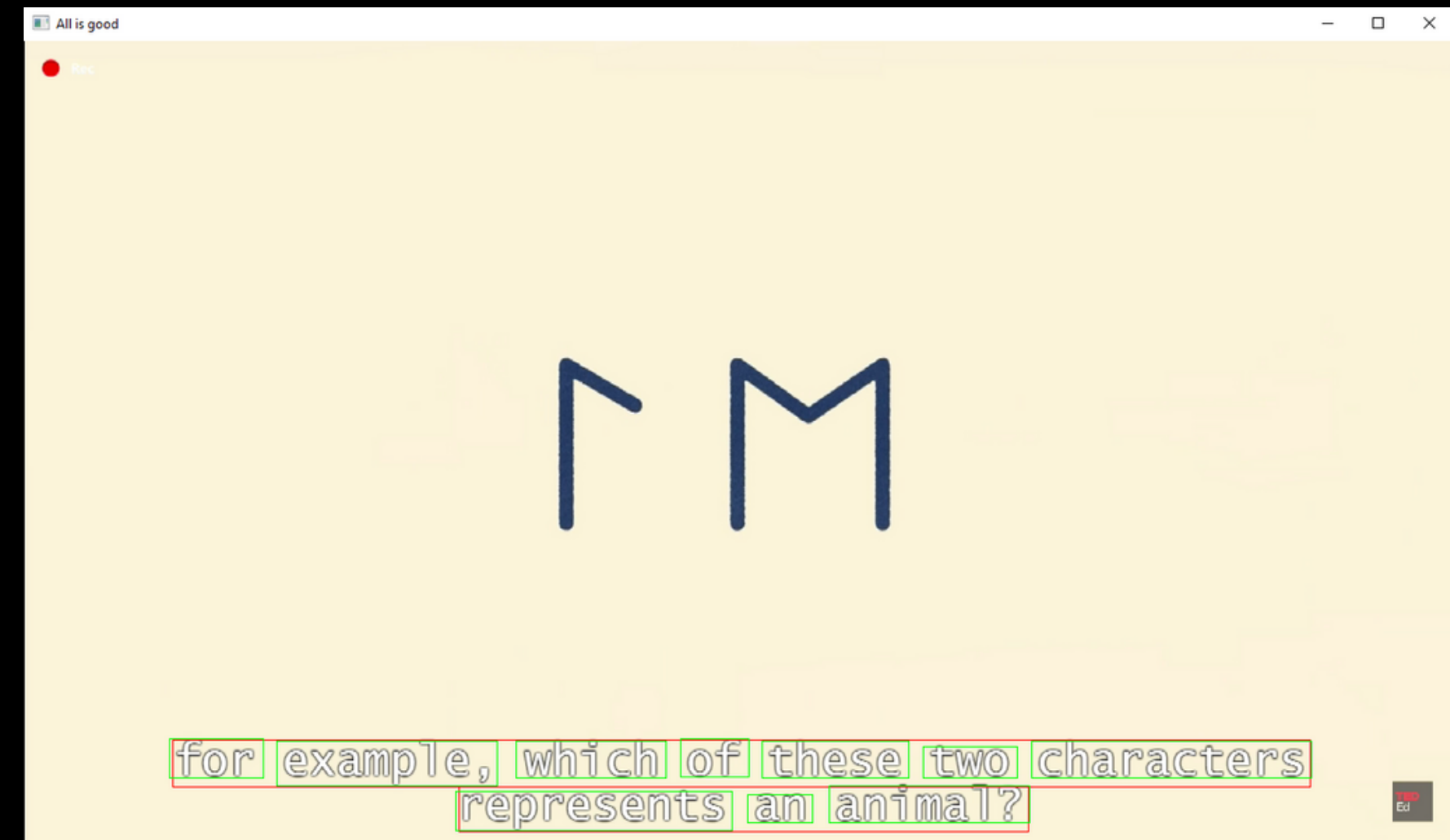
Feature Extraction

Line Frame

Word Frame

Feature Extraction

Final Result

Original Frame

After Processing

Conclusion

We can do a lot with image processing on this project we could extract subtitle from an image with no need the original text or document.

With image processing we can achieve more in object detection and classification.

And finally, image processing is the first step of machine learning and computer vision which makes image processing is the base for any new methodology or technology.