

# Finger count Project

# Computer Vision

- Figner count Project
  - We will be creating a program that can detect a hand, segment the hand, and count the number of fingers being held up!
  - Let's take a peek at what the finished project will look like!

# **Finger count Project**

Part One - Variables and Background

# Computer Vision

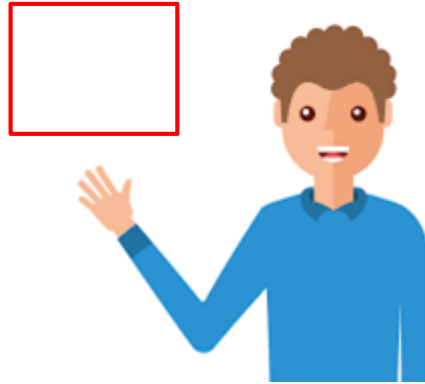
- Part One
  - First let's define some global variables.
  - Afterwards, we'll set up a function that updates a running average of the background values in an ROI.
  - This will later on allow us to detect new objects (hand) in the ROI

# Computer Vision

- Strategy for counting fingers
  - Grab an ROI
  - Calculate a running average background value for 60 frames of video
  - Once avg value is found, then the hand can enter the ROI.

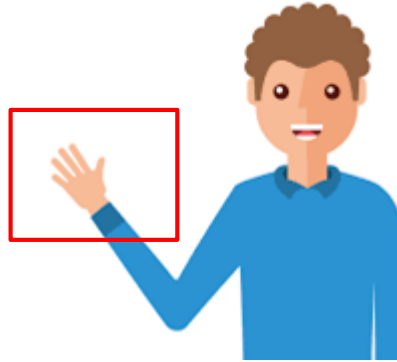
# Computer Vision

- Set an ROI and calculate the average running value for some amount of frames.



# Computer Vision

- Then once a hand enters, we can detect a change and apply thresholding.



# Computer Vision

- Strategy for counting fingers
  - Once the hand enters the ROI, we will use a Convex Hull to draw a polygon around the hand.





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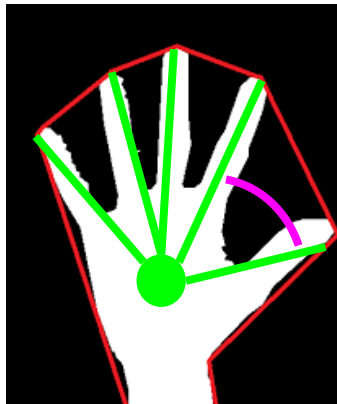
# Computer Vision

- Strategy for counting fingers
  - Using some math, we'll calculate the center of the hand against the angle of outer points to infer finger count.



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# **Finger count Project**

Part Two - Segmenting the Hand in ROI

# Computer Vision

- The next step is to use thresholding to grab the hand segment from the ROI.
- Let's create a function that can do this!

# Finger count Project

Part Three - Finger Counting with Convex Hull



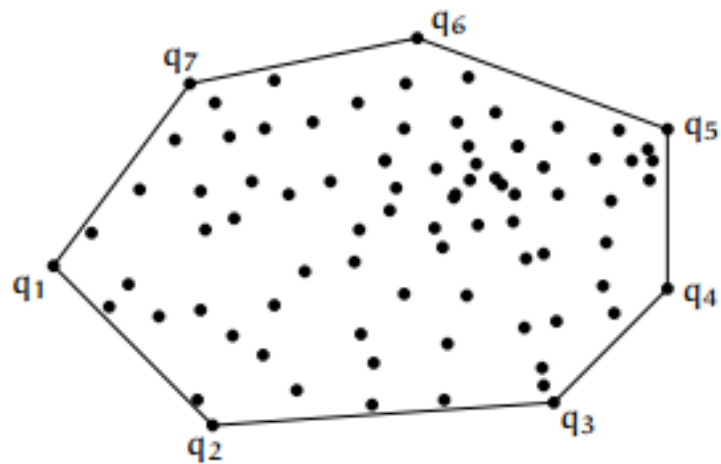
# Computer Vision

- Now that we have the hand segment, the next step is to actually count the fingers being held up.
- We can do this by utilizing a Convex Hull.
- A convex hull draws a polygon by connecting points around the most external points in a frame.

# Computer Vision



(a) Input.



(b) Output.

# Computer Vision

- In our case, this set of points is actually just our thresholded image of a hand (and the external contour information)



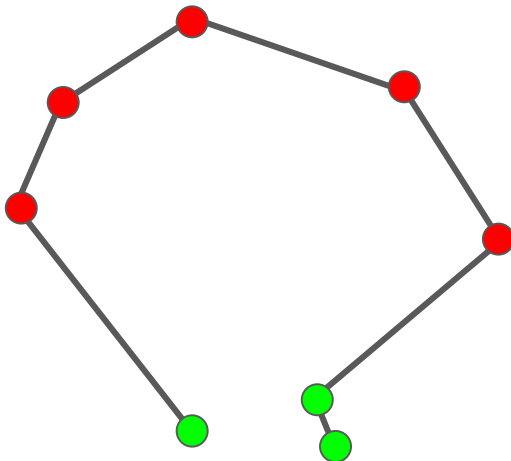
# Computer Vision

- We can expect a general shape of our polygon to be something like this:



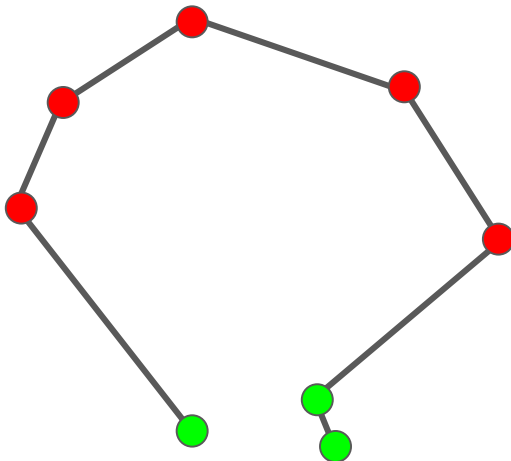
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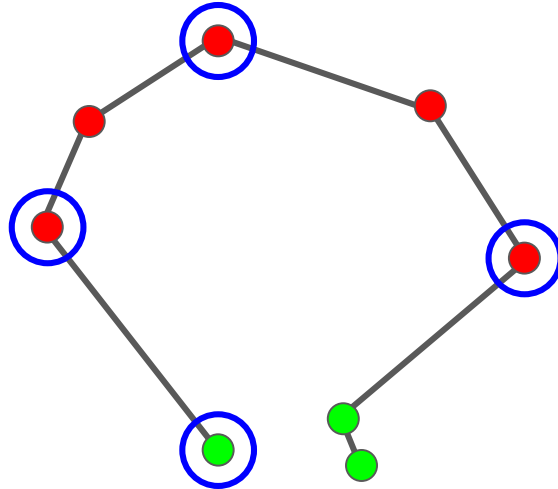
# Computer Vision

- Notice that we'll need to account for lines from the wrist.



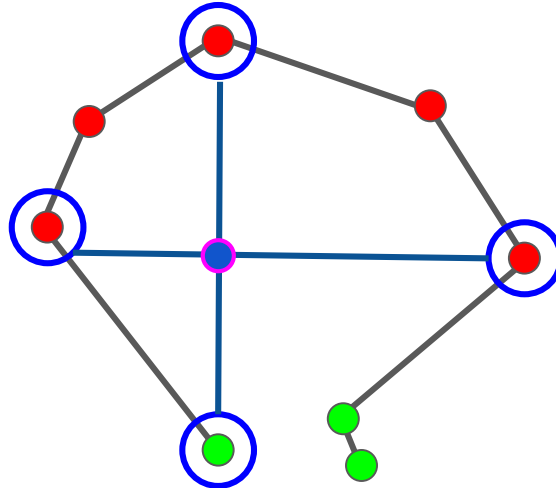
# Computer Vision

- First we will calculate the most extreme points (top, bottom, left, and right).



# Computer Vision

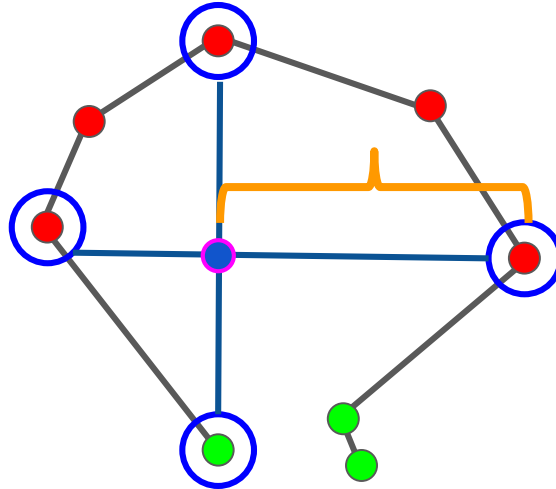
- We can then calculate their intersection and estimate that as the center of the hand





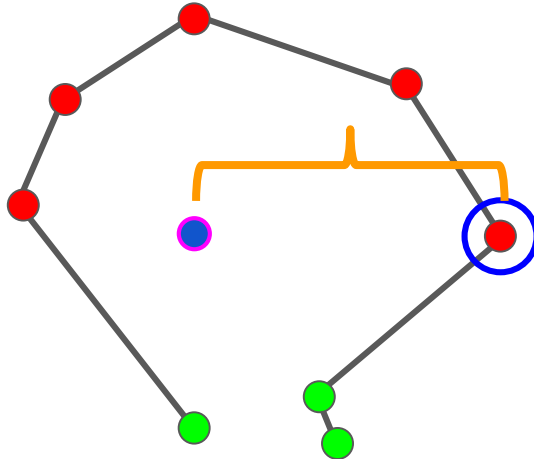
# Computer Vision

- Next we will calculate the distance for the point furthest away from the center



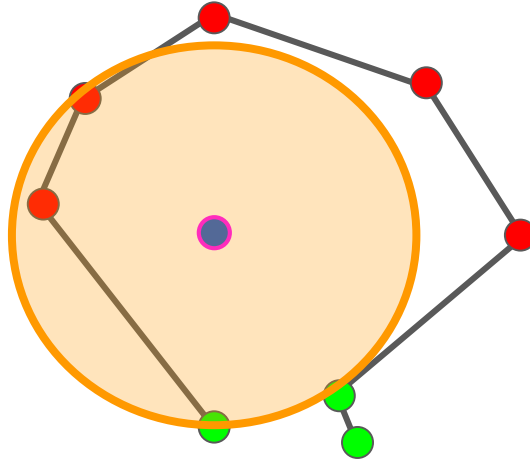
# Computer Vision

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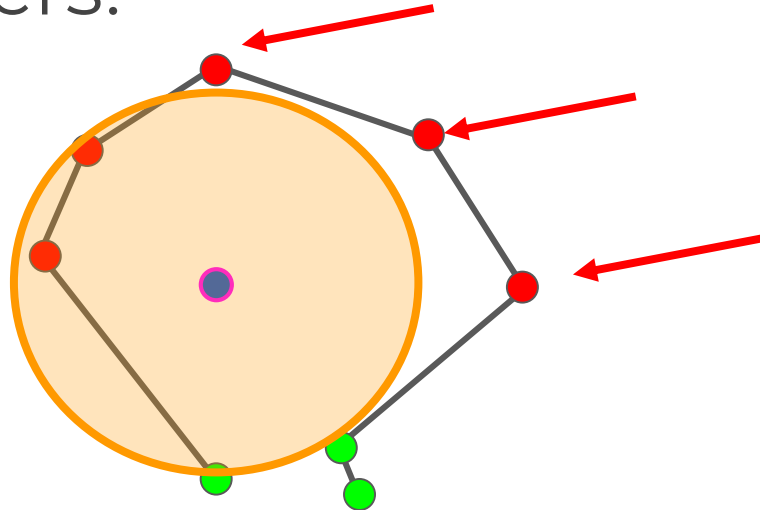
# Computer Vision

- Then using a ratio of that distance we create a circle



# Computer Vision

- Any points outside of this circle and far away enough from the bottom, should be extended fingers!



# **Finger count Project**

Part Four - Bringing it all Together