

# Hand Gesture recognition with opencv :

In today's world, computers play a very important role in our lives. Moreover, every company or individual is trying to move towards robotics and Artificial Intelligence to make our daily lives more comfortable and easier.

Hand gesture is the application in which a computer recognizes the positions or certain shapes of hands with the help of mathematics and software.

This program recognizes the fingers count and other gestures like OK sign, best of luck sign etc.

The hardware requirements are:

Minimum

1. 4GB RAM
2. 2GB graphics
3. 20 GB free space

Software Requirements:

1. Python 3.7
2. OpenCV 3.4
3. Numpy
4. Math
5. IDE (anaconda, pycharm)

The first **8 lines** are for accessing the webcam or any other camera associated.

**Lines 11-12** draw a green rectangle on the screen to get the data of the hand in it and process it.

**Line 15** just converts the cropped image of the gesture of the hand in the rectangle box so that it is easier to process.

**Lines 18-23** generate a value for downsampling the image through Gaussian blur and generating a threshold value for processing.

**Line 29** finds the contours in the threshold image and returns three parameters namely image, contour and hierarchy which checks opencv version to avoid unpacking error.

We take the maximum area generated by the contour and create a bounding rectangle around the contour.

Then we find the convexhull and convexarea in the lines **38-41** which is the area between the different fingers when certain gesture is made. We take the convex hull from tip of one finger to another.

Area ratio is generated by the formulae”

$$\text{arearatio} = ((\text{areahull} - \text{areacnt}) / \text{areacnt}) * 100$$

we draw blue contours between the fingers after a certain area is maintained between the fingers to count them differently.

The convexity defect( i.e Any deviation of the object from this hull can be considered as convexity defect.) is calculated.

The cosine rule is applied to find the angle between the fingers.

The angle greater than 90 are ignored as we cannot have more than 90 degree angle between two fingers.

A triangle is observed and its area is calculated using heron’s rule.

We make the conditions based on the area ratio and the angle between the fingers.

Upon completion of these conditions the message is displayed on the current window with red font and if the hand is not in the box then the code suggests the user to put his hand in the box for processing.

The **lines 133-147** shows the appropriate windows of gesture and contours with a waitkey of 27( i.e esc button) to release the object of videocapture and destroy the windows.

