**NUECE 332 - Introduction to Computer Vision**
Northwestern University
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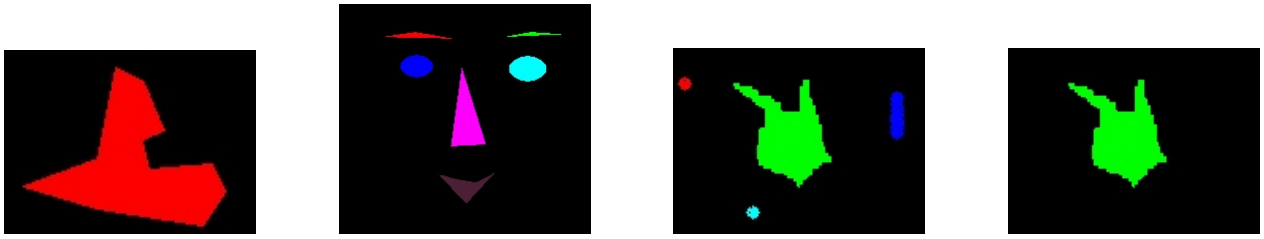
# MP#1 - Connected Component Labeling

## 1 Method

Connected Component Labeling known as CCL is an algorithm which lets you cluster connected pixels in a binary image in the same class based on their connectivity. In a more general format, this algorithm can be used for a graph where we want to assign a unique label to each vertex based on the connectivity and relativity to neighbors.
In computer vision, this method helps to detect connected regions on an image. We do that by starting to visit every pixel on the image grid from top left, row by row. The algorithm first checks if there is a positive pixel (1) that needs to be labeled and ignores negative (0) pixels until it reaches a positive. Once arrived at a positive pixel which needs labeling, it checks if the upper or left pixel has already been labeled and if one of them is labeled, the label of current pixel would be equal to that. However, if both the upper and left pixels are labeled, the algorithm chooses the minimum value to assign to the label and assumes the equality of those two labels by memorizing it. When a full pass is done on the image, we would be left with a labeled image and a set of equal labels. Then, we merge those components with equal labels. This will give us the final result with all regions labeled based on their connectivity.



**(a)** **(b)** **(c)** **(d)**

**Figure 1:** CCL results on three test cases

## 2 Result

In this section we show the result of this algorithm on three test cases. After running CCL algorithm, we map each label to a color to visualize and understand the result better. Figure

1a to 1c shows the out put of the algorithm. Figure 1d shows how we can use this algorithm to filter noises from the image. In this case, those components with a size less than a threshold were removed from the image.