

**Problem on Image Segmentation:** Compute fore-ground segmentation mask for the attached images.

**Solution:**

Problem is to find fore-ground segmentation mask, which can be done easily using **GrabCut algorithm** and we can find its implementation in **openCv** module. But to **use grabcut in openCv more effectively** we need to **augment it with other method**.

The grabcut algorithm takes an input image and one of this parameter

- A bounding box that specifies the location of the object in the image we wanted to segment.
- A mask that approximate the segmentation.

So to give bounding box, we need to first detect object in the image which can be done using pre-trained YOLO model. And to find approximate segmentation mask, we can use pre-trained mask rcnn model.

**Approach 1: [Object detection followed by grab cut.]**

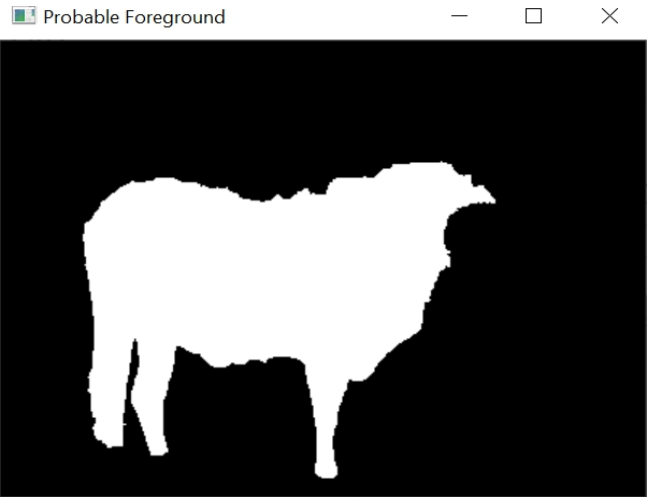
OpenCv has built in method called `grabcut()` which does fore-ground segmentation and extraction. But it needs a bounding box coordinates for the object present in it as parameters to be passed only then it will work effectively.

To detect objects in image, I had used YOLO trained on COCO dataset. So first passed the image to YOLO module which returns the coordinates of bounding box of the detected object and then that coordinates are feed to `grabcut()` which does fore-ground segmentation in that region.

**NOTE:** By giving this coordinates, we are saying that apart from this coordinates everything else is surely background. So grabcut has to extract foreground only in this region.

**Results:**

**On cow image the output mask is as below (Dice score: 0.9615):**



**On kangaroo image:**



**On 3<sup>rd</sup> image:**



### Observation:

YOLO is failing in detecting kangaroo in the second image properly. Hence we can see the second mask is not at all in the shape of kangaroo.

Moreover in the 3<sup>rd</sup> image there is no proper object to be detected hence, YOLO returns None and so I had given bounding box coordinates as complete image.

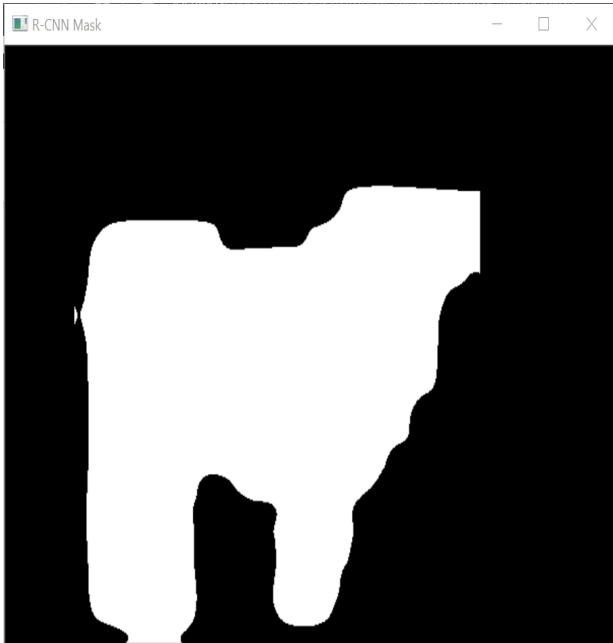
### Approach 2: [Mask RCNN followed by grab cut]

In this approach I have used **pretrained mask RCNN model** to do image segmentation followed by grabcut() to improve the results. In above method we had used grabcut() with bounding boxes but in this method we will use grabcut with mask. **The RCNN model will return a segmentation mask which is feed as an parameter along with original image to grabcut function.** Hence at the end we will get a better mask compared to intermediate formed by RCNN.

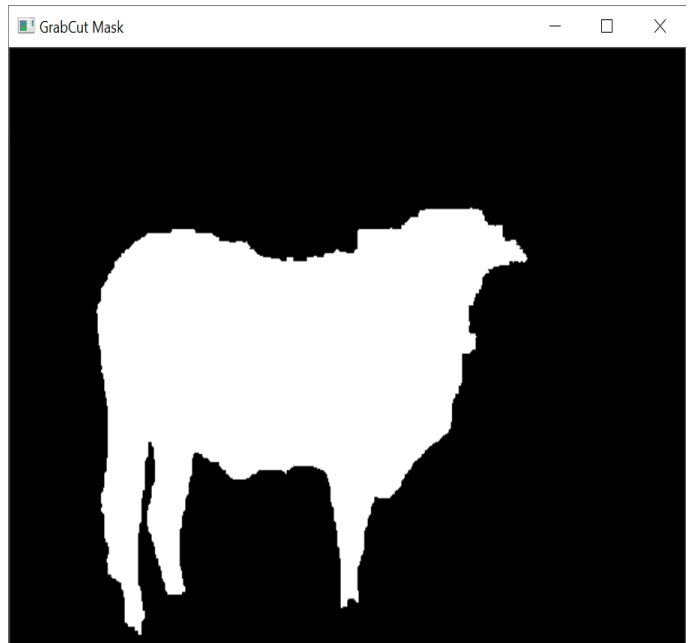
### Results:

#### Cow image:

RCNN output (Intermediate)



After grabcut(Dice score 0.95):

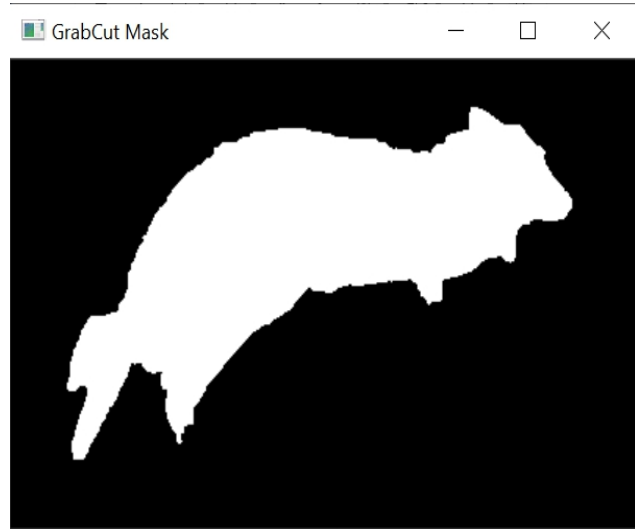


**Kangaroo image:**

**RCNN output (Intermediate)**



**grabcut output:**



**3<sup>rd</sup> Image:**

Here RCNN was not able to detect any object in the image hence return None. So for this image we have to directly apply grab cut with bounding box around complete image.

**Observation:**

As we have ground truth image for 1<sup>st</sup> image, we can calculate Dice Score for that predicted masks and we can see 1<sup>st</sup> method is giving slightly better dice score but the problem is that method is not working for kangaroo image. Whereas the second approach is giving better mask for that image.