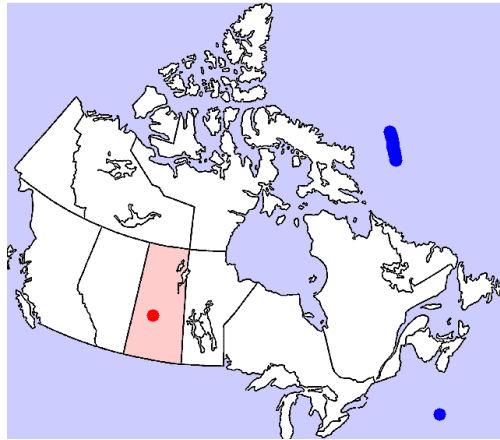


## Graph-cut Segmentation

To begin the comparison of the three modes presented (Edge, Color-f and Color-e), we will first compare the results on the simple Canada image.



Canada - EDGE



Canada – Color-F and Color-E (same result)

The results are quite intuitive. In the edge situation, the seed brushes act like a filling tool; they will simply mark all nearby white pixels as part of that segment, but will not cross any black borders as it is expensive to do so. In the Color-F and Color-E modes, all of the white pixels will be put into the same segment, and all the black pixels into the other segment.

The rose image is useful to examine the effectiveness of each technique. First, consider some differently seeded cuts of this image using the EDGE method in order to evaluate the importance of seed quality.



Edge Rose #1



Edge Rose #2

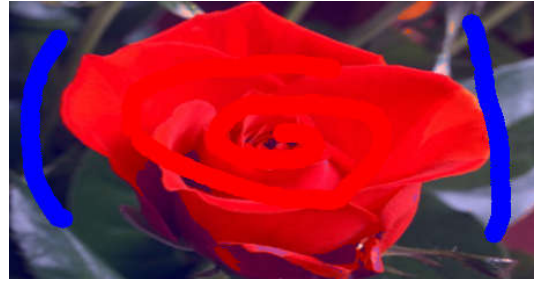


Edge Rose #3

These images show edge mode's extreme sensitivity to spatial position of seeds, as well as gradients within a segment. In Figure 1, the background segment is "trapped" by the leaf on the bottom, and the rose on the left. As a result, it will not grow any more than these boundaries. In #2, we see better seeds and consequently a much better result. In #3, one of the seeds bleeds out of the the rose, resulting in a consequential amount of background being included in the object.



Color-F



Color-E



Color-F



Color-E



Color-F



Color-E

The first thing to note when comparing these two methods is how well noise is handled. The hand image is rather noisy, both with the patterned background and the hand having different colors created by shadows. Color-E handles this noise much better, since it takes the unseeded pixels into account and averages them out.

Similarly, in the rose, we see that some bits of the background are selected to be part of the object if they are light in color and not seeded (since most seeds are the darker green). Color-E does a better job of handling this, but also thinks that the shadowed part of the rose is part of the background since it is darker than the rest of the rose (closer to the background color). This also happens when better seeds that do not touch the rose are given.

The bunny demonstrates similar results to the previous two, and we see a nice segmentation despite the multicolored background. This is expected since all the background colors are given as seeds – poor seeds result in a poor segmentation in such an image; more so in Color-F. There is some noise around the bunny's fur in Color-F, which is nicely eliminated in Color-E, since those slightly different colors are included in the object color calculations.