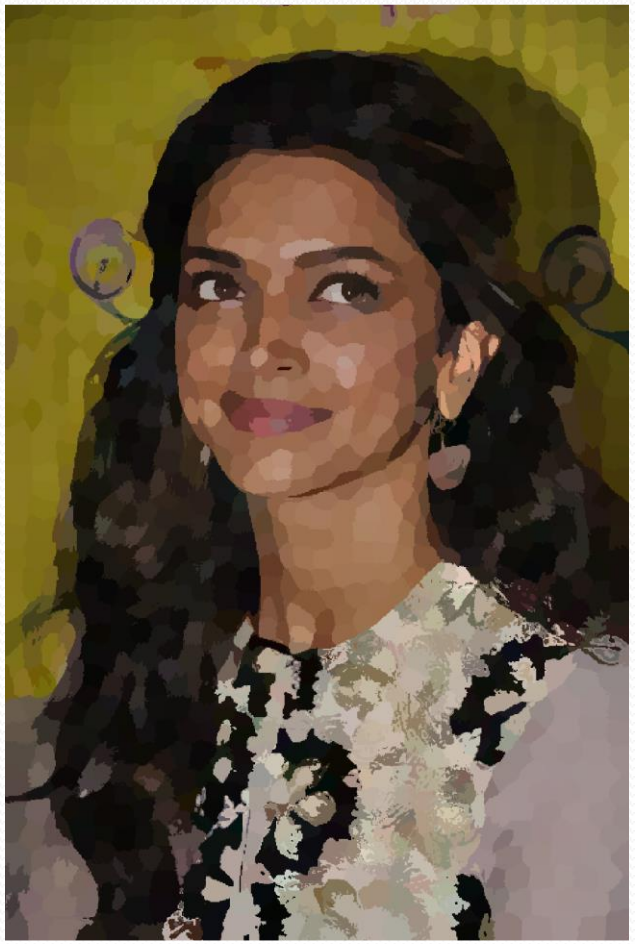
SLIC Segmentation (Simple Linear Iterative Clustering)

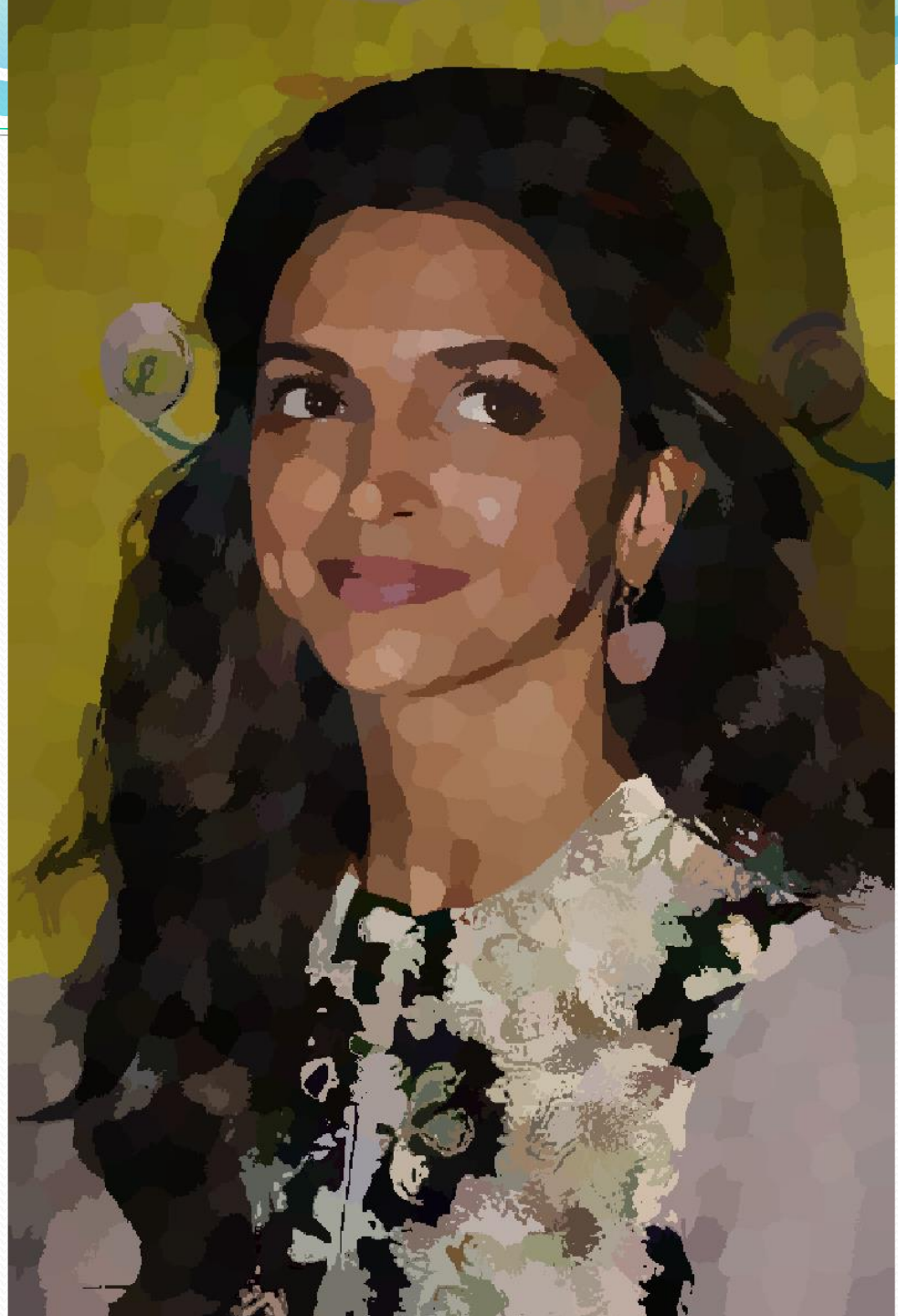
Pratik Jain

Super pixels



Notations

- K = no. of super pixels (Parameter given by user)
- N = total no. of pixels
- A = approximate no. of pixels in 1 super pixel
- $A = \frac{N}{K}$
- S = Approximate length of a super pixel
- $S = \sqrt{\frac{N}{K}}$

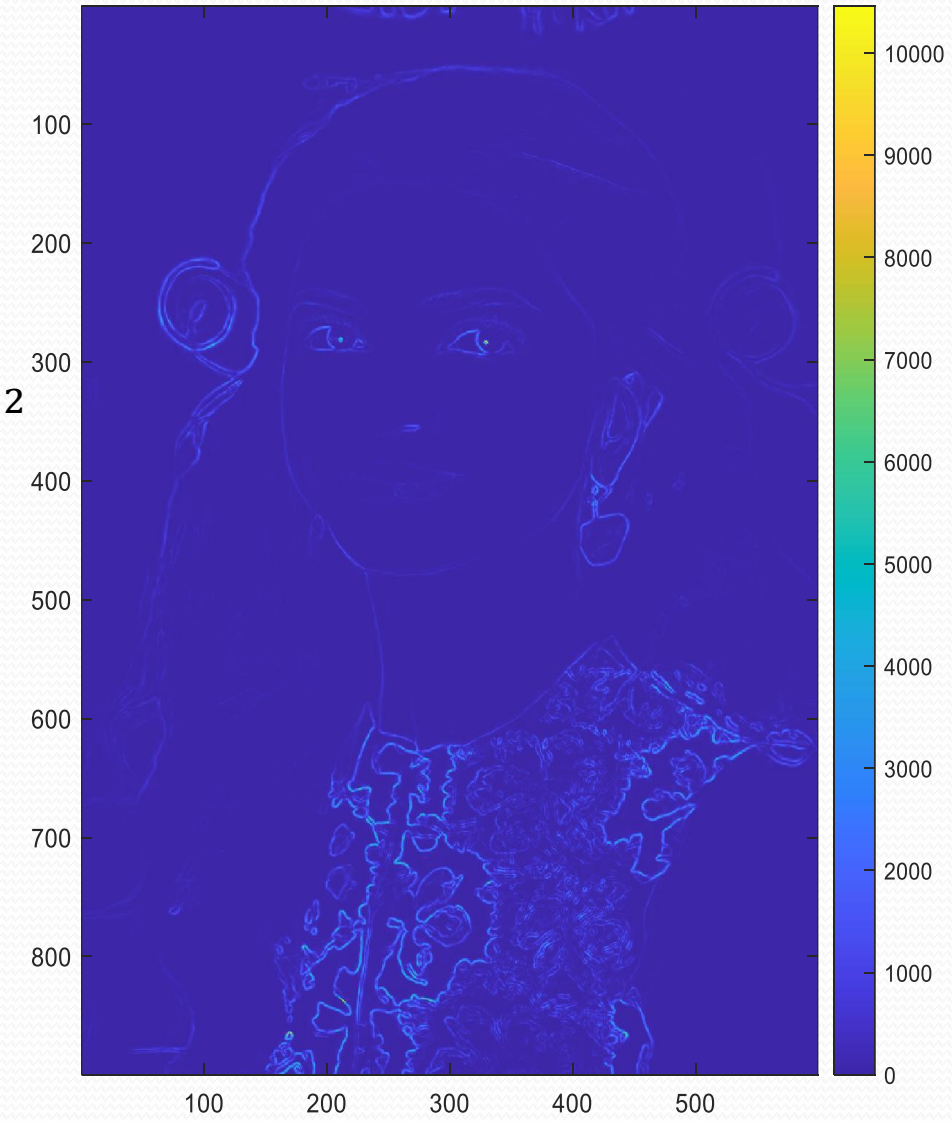


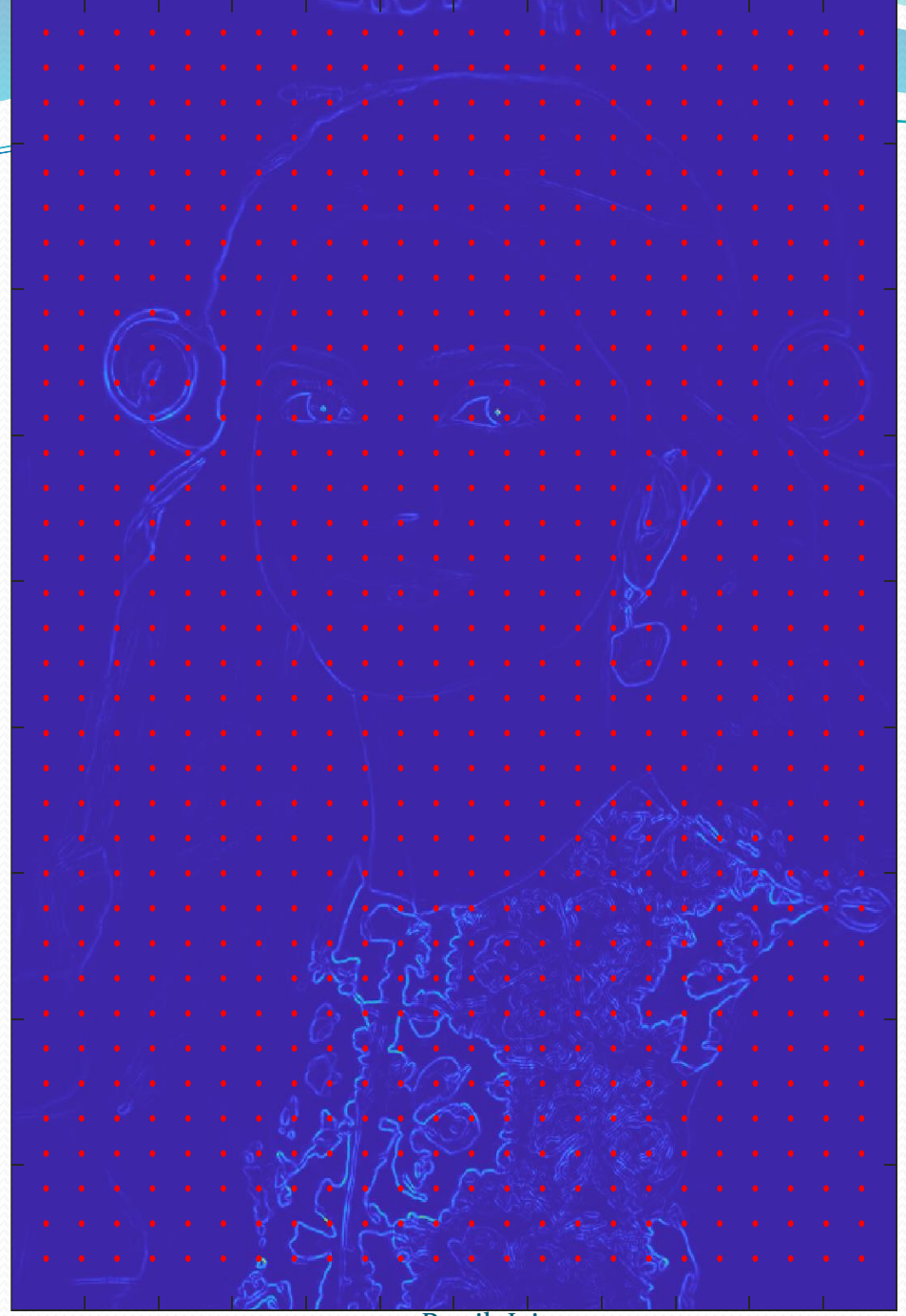
Initialization

- Given K we can calculate S.
- Next, we can make a grid of initial points
- Which are spaced by S
- These are our initial location of means
- Each pixel can be represented as $[l\ a\ b\ x\ y]$
- Where $[l\ a\ b]$ is Cielab space which is perceptually
- uniform for small color distances
- $d_{lab} = \sqrt{(l_i - l_j)^2 + (a_i - a_j)^2 + (b_i - b_j)^2}$
- $d_{xy} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$
- $D_s = d_{lab} + \frac{m}{s} d_{xy}$
- m is parameter which weights the xy distance

Gradient Image

$$G(x,y) = \|I(x+1,y) - I(x-1,y)\|^2 + \|I(x,y+1) - I(x,y-1)\|^2$$

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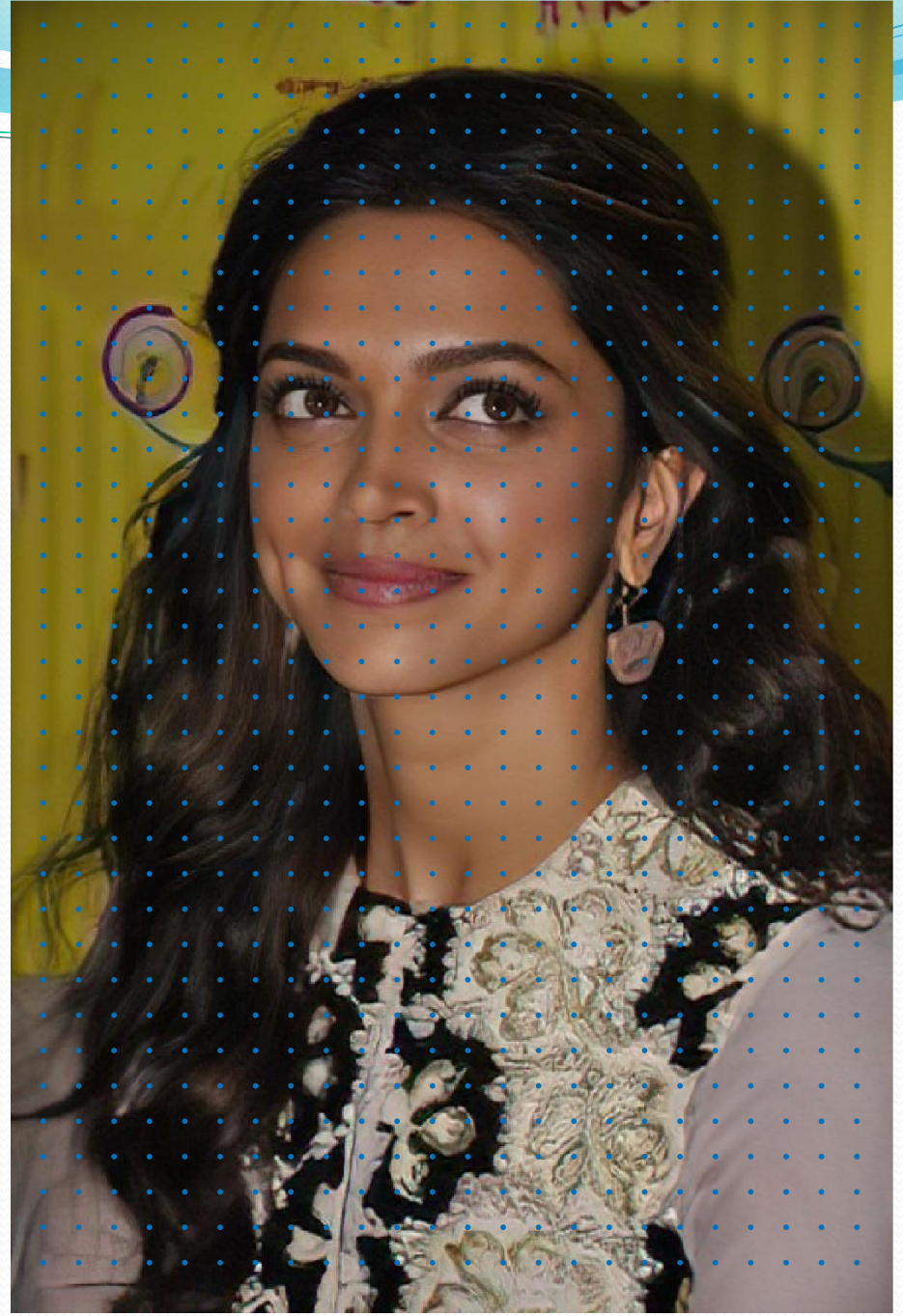

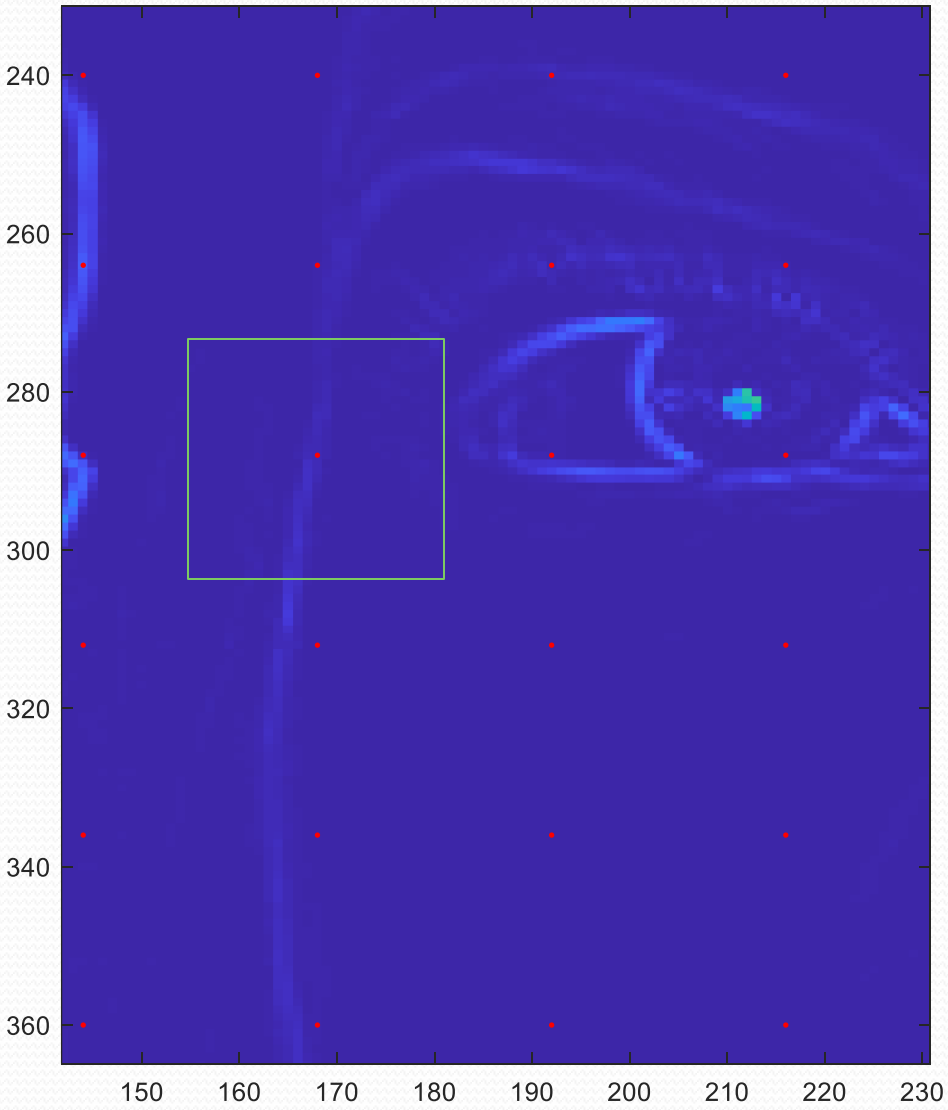
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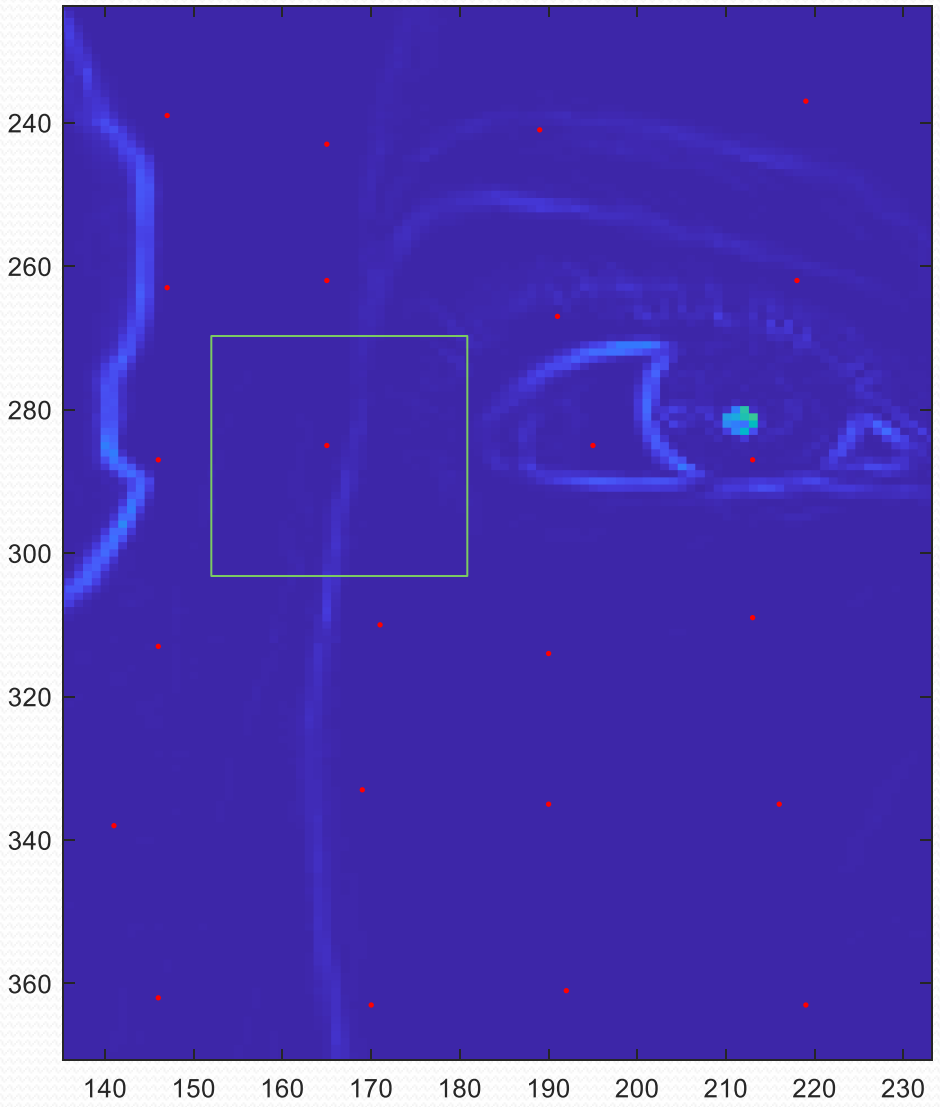
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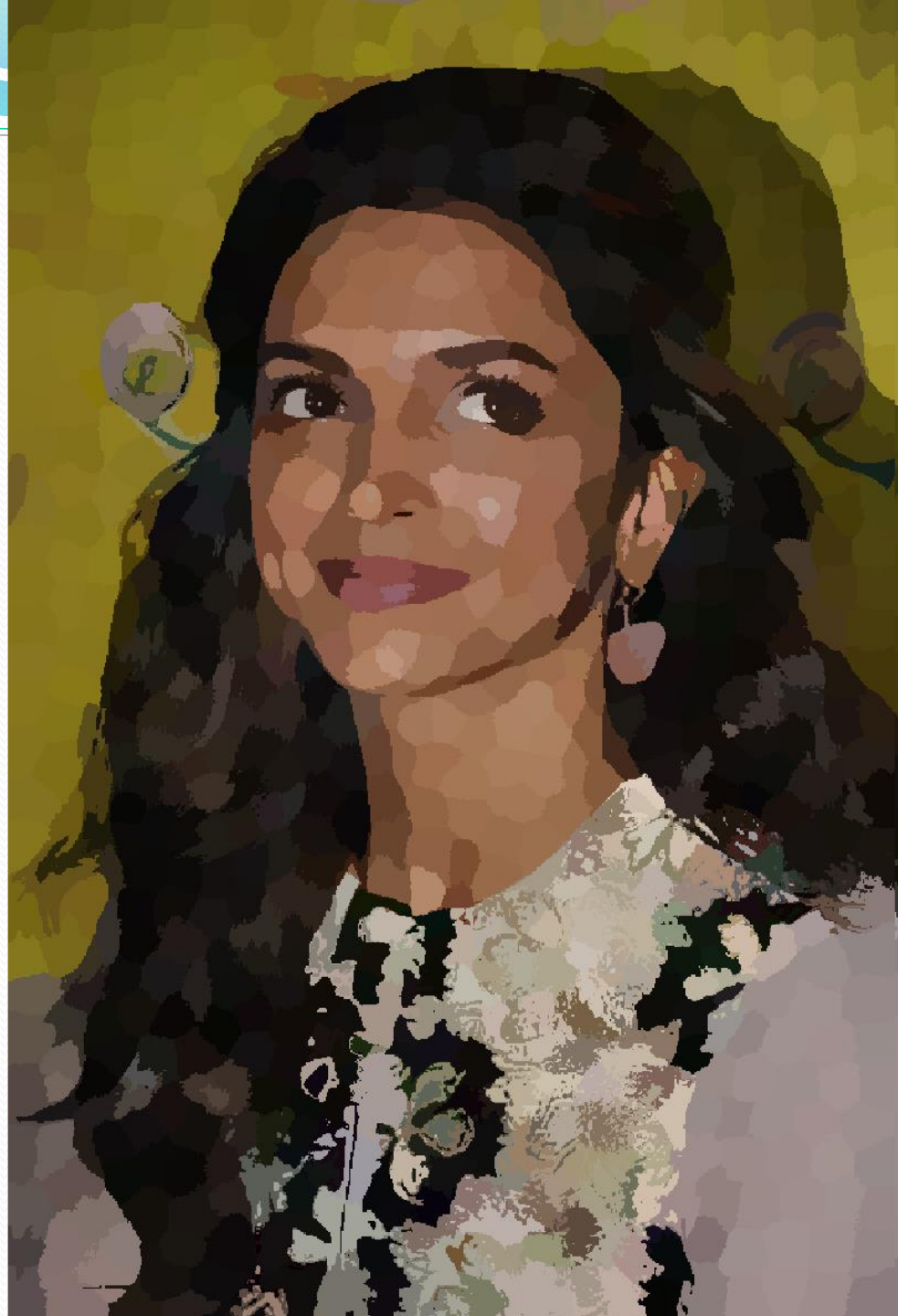
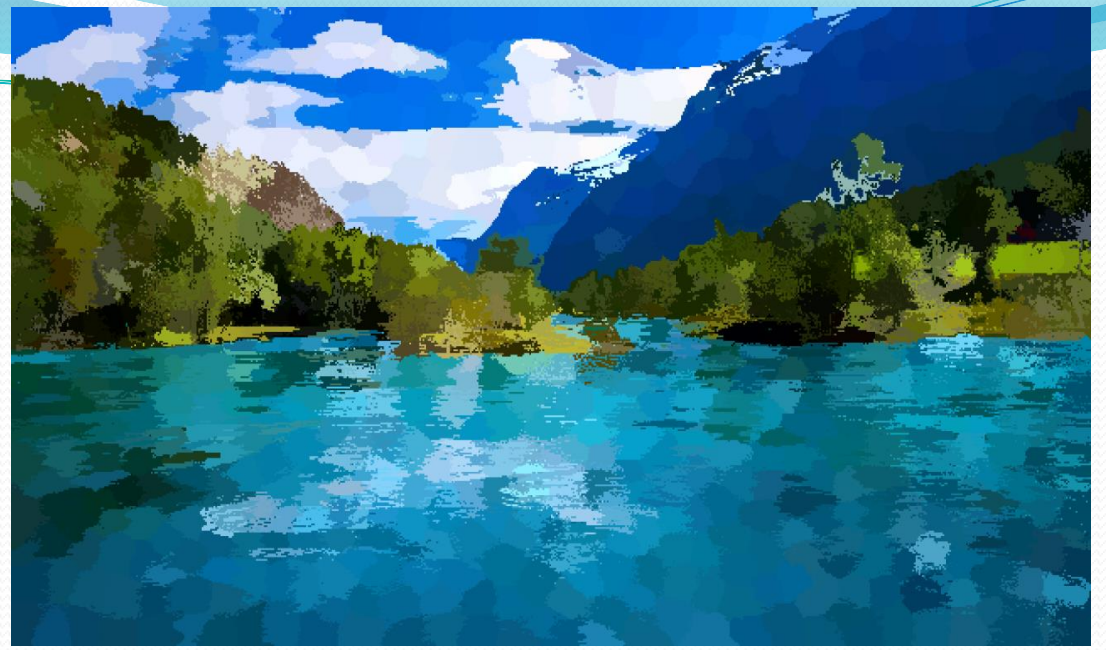
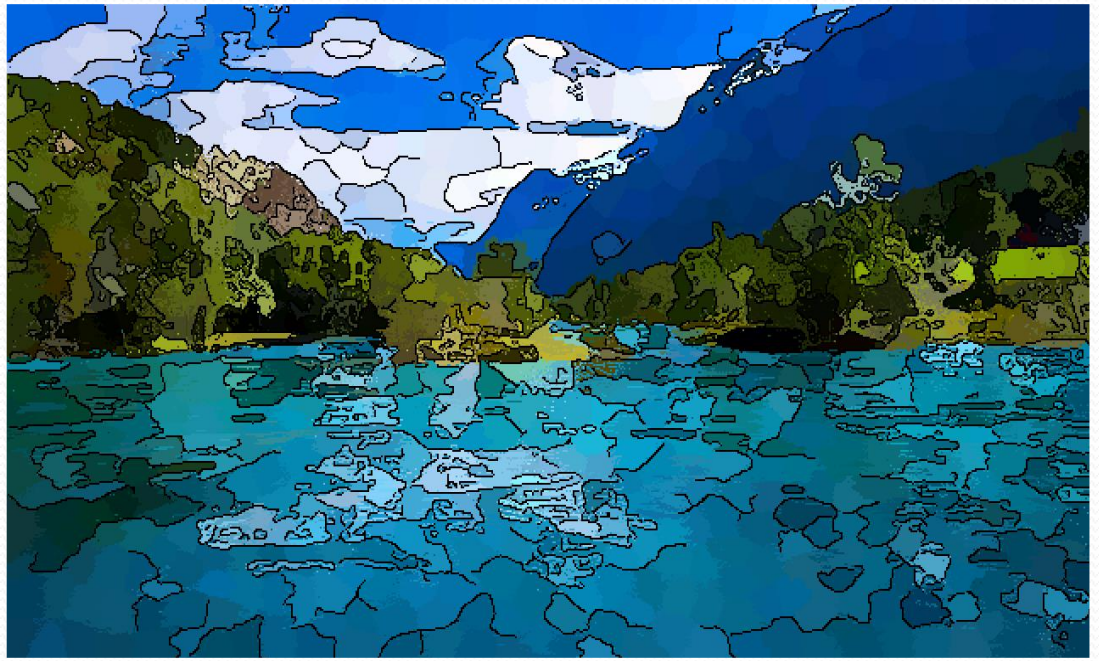
Algorithm

$$D_s = d_{lab} + \frac{m}{S} d_{xy}$$

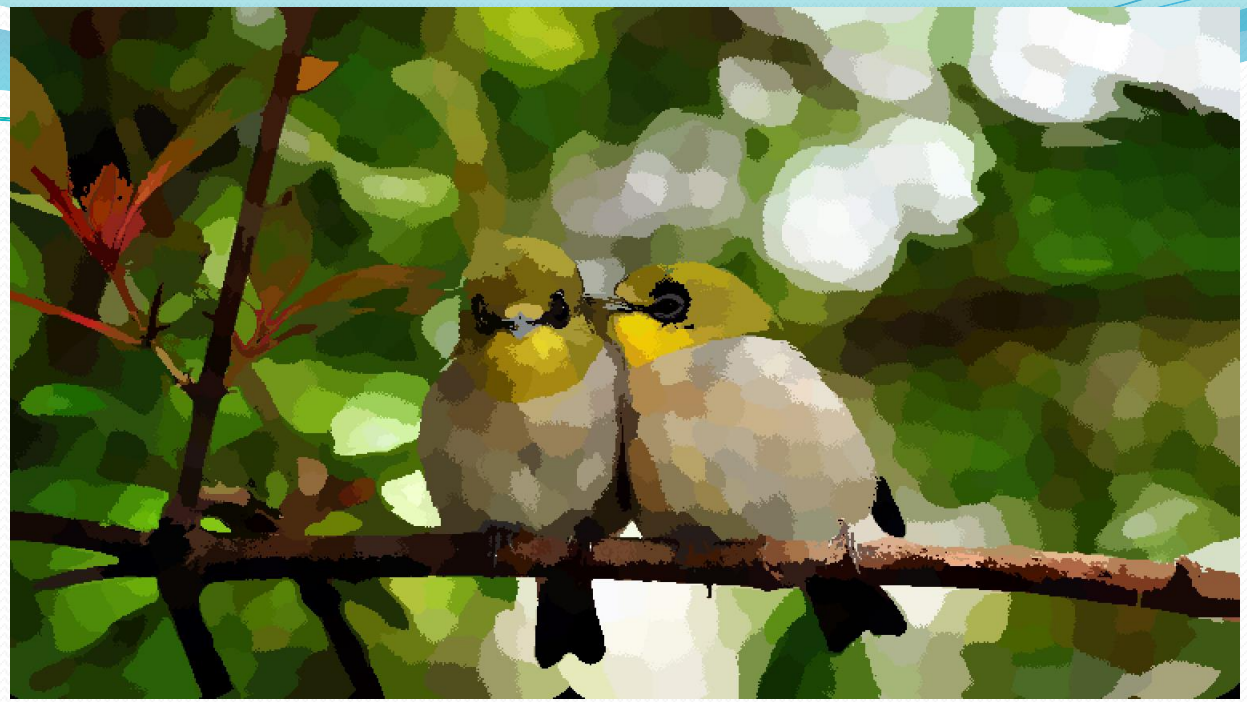
1. Convert the input image to ceilab space
2. Take input K from user and calculate S = $\sqrt{\frac{N}{K}}$
3. Create a grid with S as spacing
4. Now move the means which are on the edges
5. Next for every pixel in the image search in a neighborhood of 2s and assign that mean to that pixel
6. Now take sample mean of the pixels allotted to one mean and update the mean position
7. Goto step 5 and repeat for certain no. of iterations







$k = 1000\ m = 15$



$k = 1000\ m = 15$