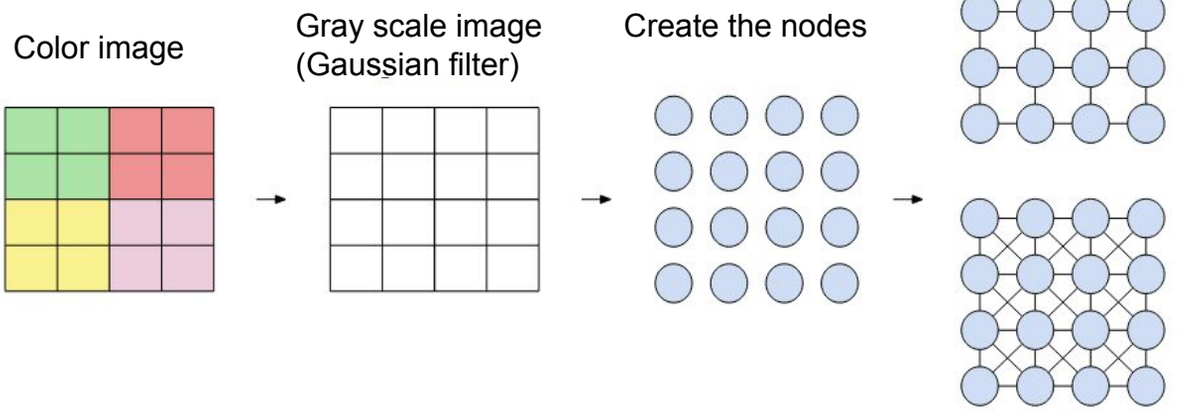
Graph-Based Image Segmentation

Paper: Efficient Graph-Based Image Segmentation
Authors: P. Felzenszwalb (MIT) and D. Huttenlocher (Cornell University)

Graph structure

How to create the graph structure

- Starts with n clusters, each cluster containing a node and each node representing a pixel
- The weight of each edge is the difference between the colors of endpoints nodes



Algorithm

- Similar to Kruskal's algorithm
  - Kruskal find the minimum spanning tree.

- The greater the k, the greater the clusters
  - If the clusters are greater, we had less final segments.

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Kruskal ( k ):
        For each edge E:
                If the ends belong to differents
                clusters :
                        If the number of clusters is
                        greater than k:
                                Merge cluster the clusters
                                of the endpoints nodes.
```

```
Graph-Based-Segmentation( k ):

        For each edge E:
                If the ends belongs to differents clusters:
                        If E->weight <= MInt(a, k):
                                Merge cluster the clusters of
                                the endpoints nodes.
```

- Starts with the edges of minor weight

Results

	Image 1	Image 2	Image 3	Image 4
Initial clusters	212 064	409 500	74 529	50 320

Image 1

Image 2

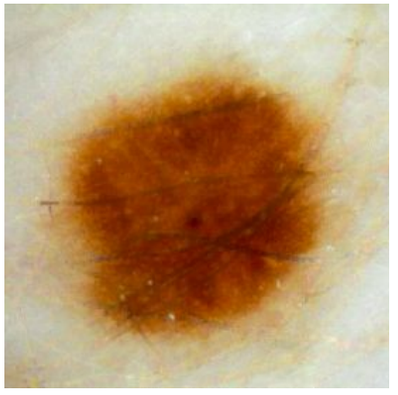
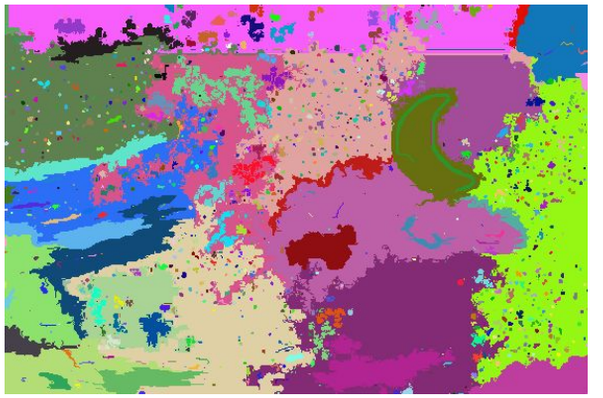


Image 3

Image 4

Results

Original image



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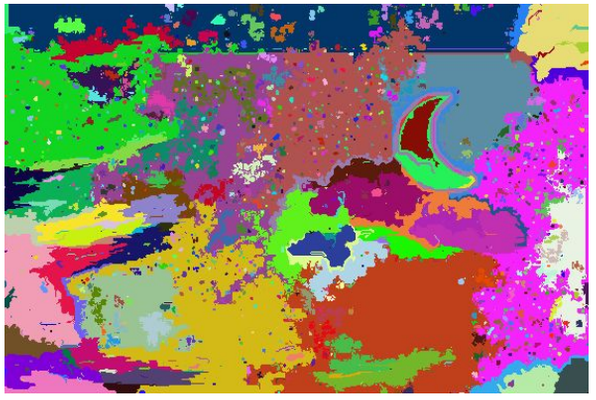

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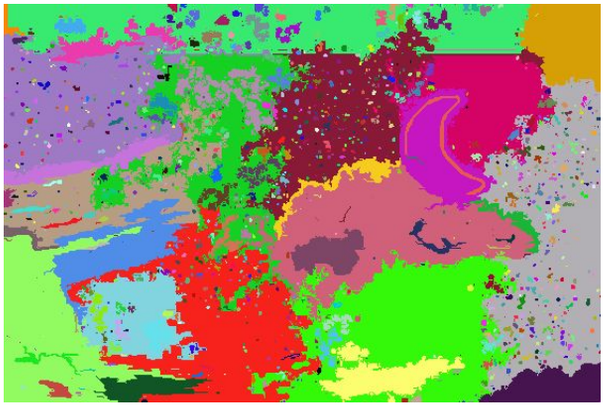

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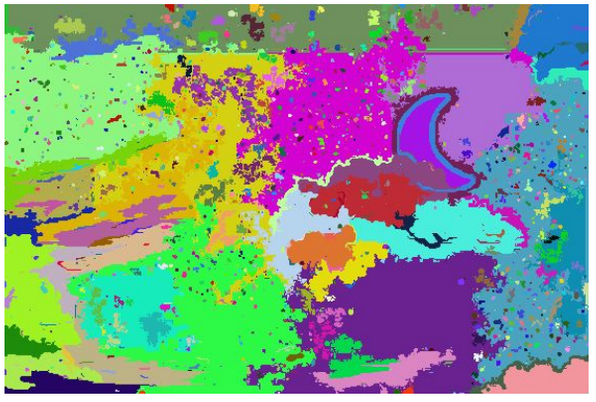

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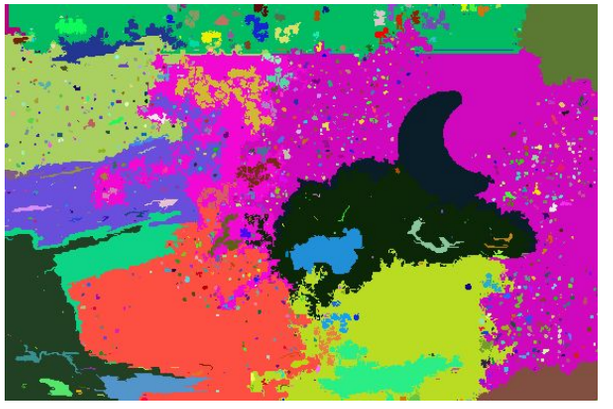

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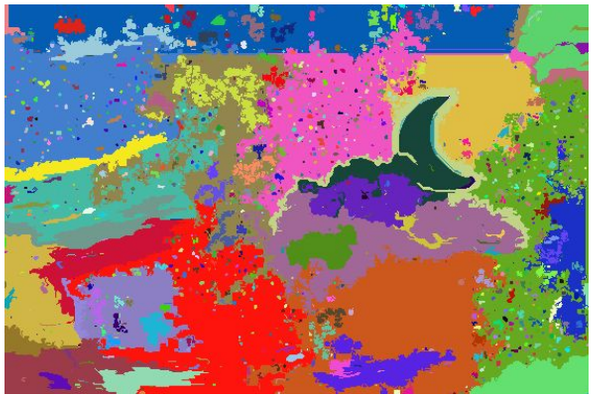

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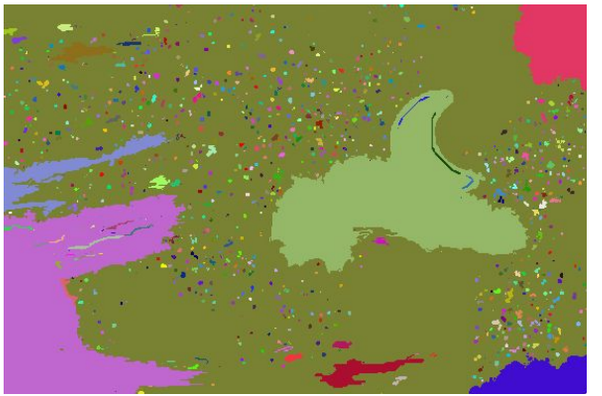

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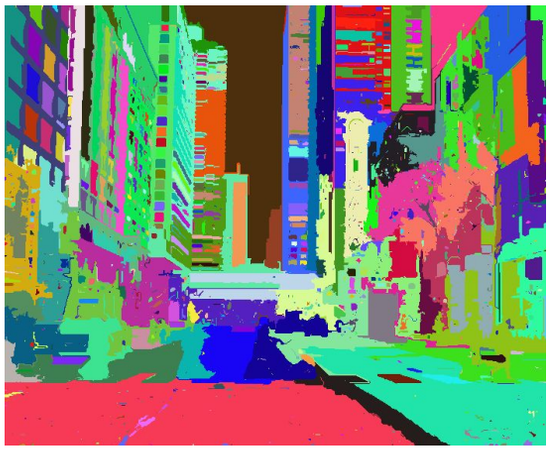
Original image



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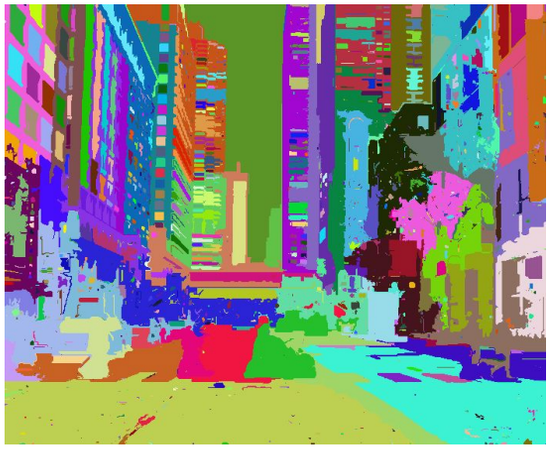

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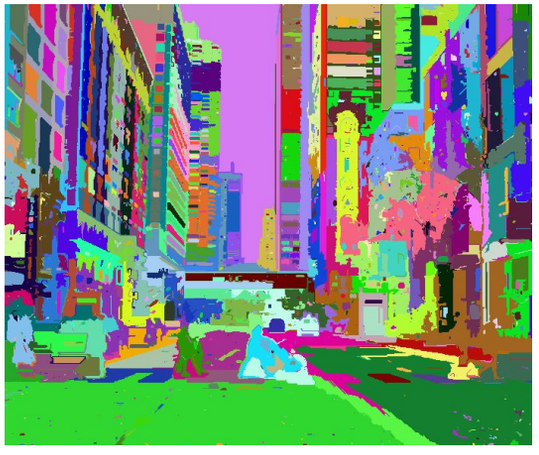

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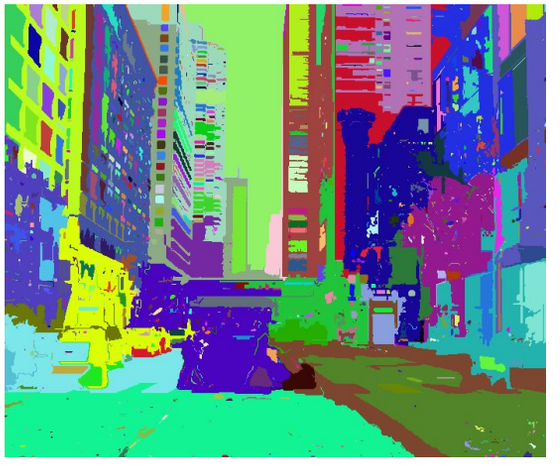

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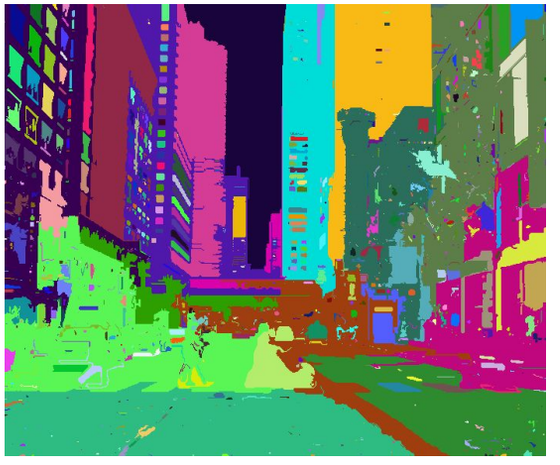

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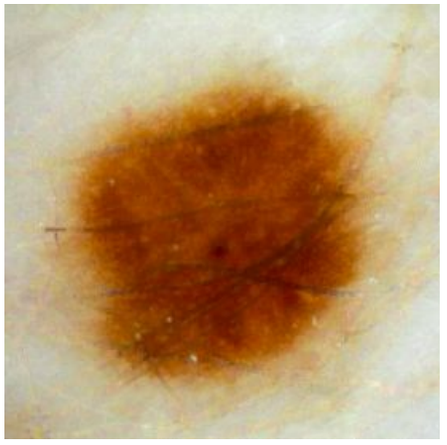

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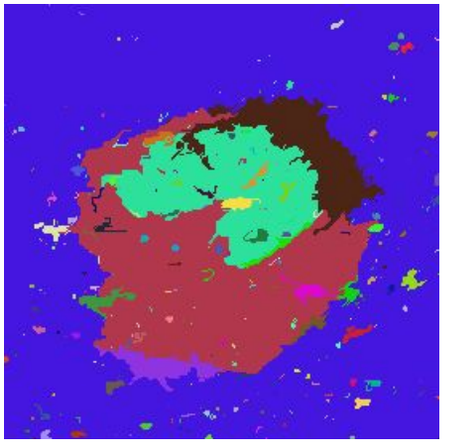

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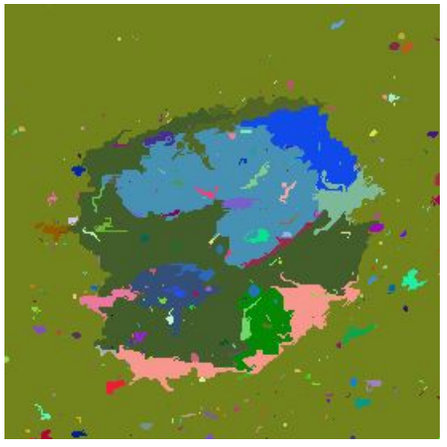

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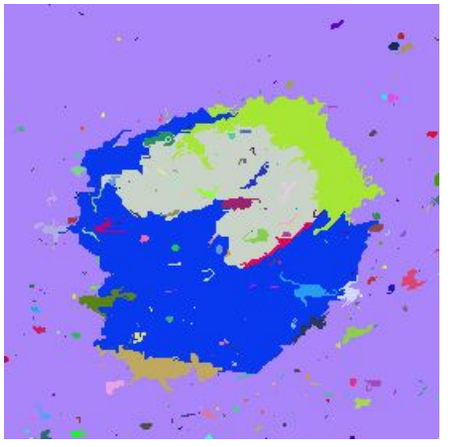

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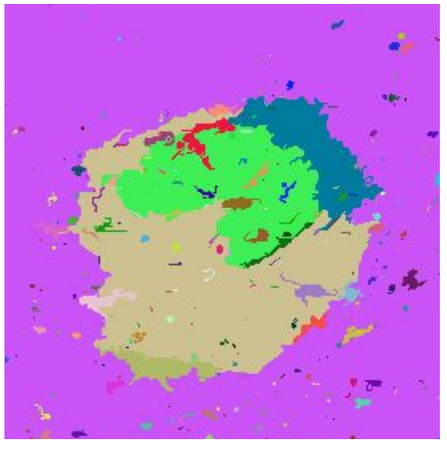

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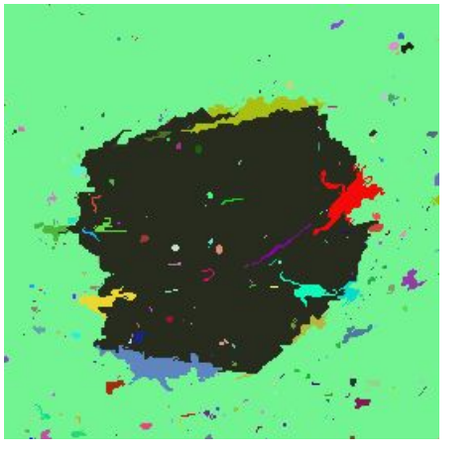

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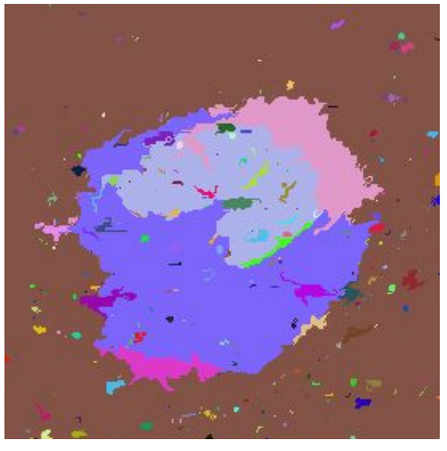

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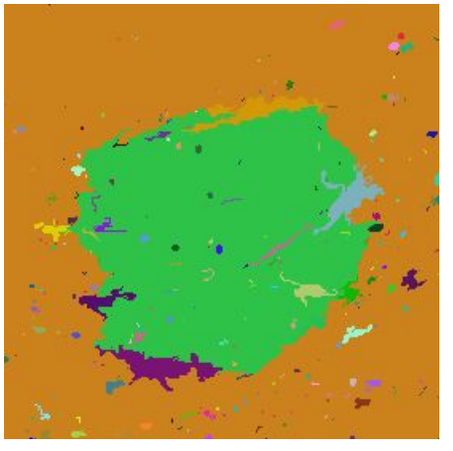
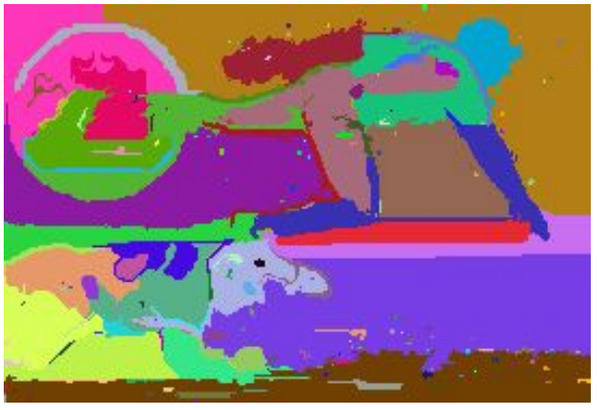


k = 20000

Original image

k = 4000



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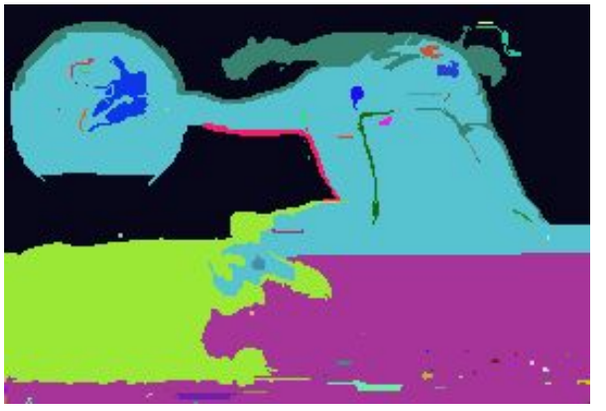

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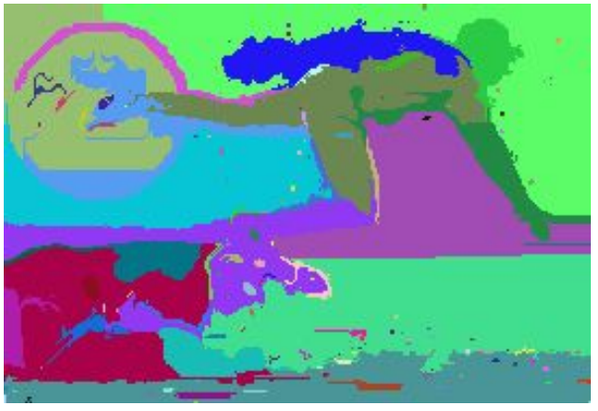

k = 3000

k = 20000

Results

	Image 1	Image 2	Image 3	Image 4
Initial clusters	212 064	409 500	74 529	50 320

Final clusters

k	Image 1	Image 2	Image 3	Image 4
500	1800	3128	346	267
750	1732	2615	328	240
1000	1647	2417	309	214
1250	1589	2222	290	188
1500	1587	2069	290	182
2000	1493	1878	298	171
3000	1468	1684	281	165
4000	1436	1501	278	132
5000	1407	1482	278	124
10000	1332	1432	260	71