

Summer Project on Machine Learning

Topic : Fuzzy C-Means Clustering

Abstract:

Classification is a technique to study and analyse data. In this unsupervised learning is an algorithm that learns pattern from unlabelled data. Clustering is a way to get the pattern. There are two types of clustering, hard clustering and soft clustering. In hard clustering, a data point can belong to any one cluster, i.e., the probability of a data point belonging to a cluster is 0 or 1. But in soft clustering, the probability belongs from 0 to 1. Suppose there are 2 clusters and probability of a data point belonging to first cluster is 0.4, then the probability of the data point belonging to the other cluster is 0.6. Because the sum of probabilities must be 1. There are various algorithms of clustering. Fuzzy C-Means is one of them. It is a soft clustering.

I have implemented Fuzzy C-Means Clustering for a image, clustering its features like, pixel location, RGB values and depth (i.e., distance of different points on the image from the camera). RGB of each pixel is stored in an array. The array RGB values of the image is as follows.

```
[[[141, 106, 91],  
  [142, 107, 92],  
  [143, 106, 90],  
  ...,  
  [128, 102, 87],  
  [128, 104, 88],  
  [129, 105, 89]],  
  
 [[139, 106, 89],  
  [140, 107, 90],  
  [142, 107, 90],  
  ...,  
  [128, 103, 83],  
  [128, 103, 85],  
  [129, 104, 86]],  
  
 [[137, 108, 87],  
  [138, 109, 88],  
  [140, 108, 86],  
  ...,  
  [127, 103, 80],  
  [127, 102, 82],  
  [128, 103, 83]],
```

```

...,

[[127, 99, 71],
 [124, 96, 68],
 [125, 97, 67],
 ...,
 [ 60, 93, 138],
 [ 58, 88, 134],
 [ 61, 91, 137]],

[[127, 96, 69],
 [125, 94, 67],
 [126, 95, 68],
 ...,
 [ 62, 92, 138],
 [ 62, 90, 136],
 [ 63, 91, 137]],

[[127, 95, 71],
 [126, 94, 70],
 [126, 95, 68],
 ...,
 [ 66, 92, 139],
 [ 65, 91, 138],
 [ 65, 91, 138]]]

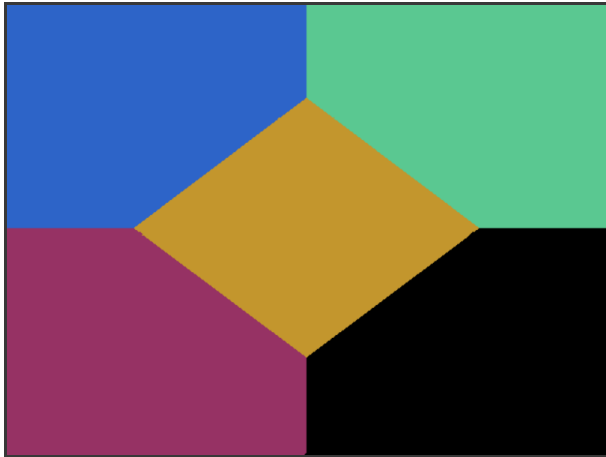
```

Visualization of the clustering of image is attached below. I have changed the number of clusters. Link of the python code is as follows:

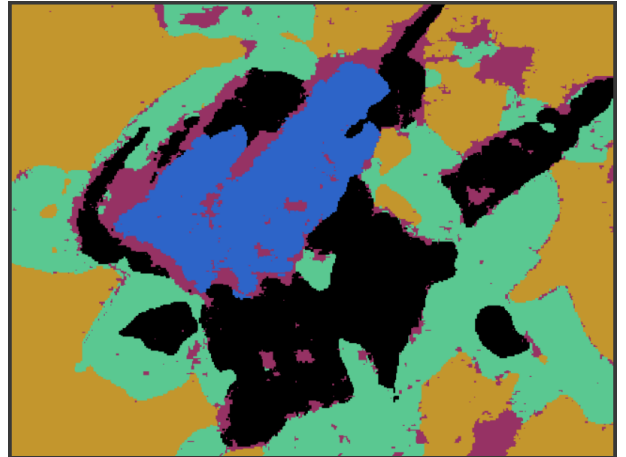
<https://colab.research.google.com/drive/1Pw61OWxL3fKQzljxuVNey7aK4JfQe4zW?usp=sharing>

No. of clusters: $n = 5$

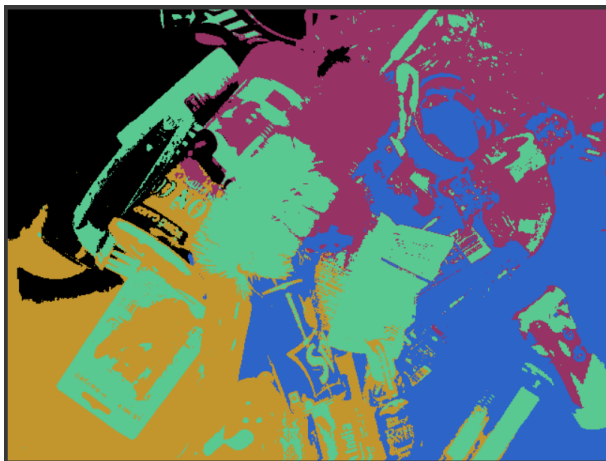
Features: Pixel Location only



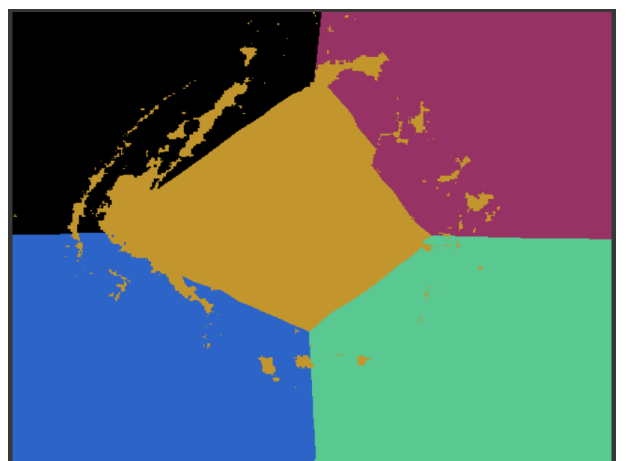
Features: Depth only



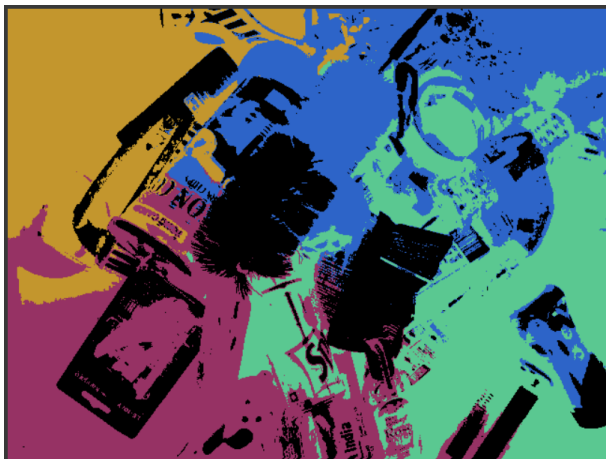
Features: Pixel Location & RGB



Features: Pixel Location & Depth

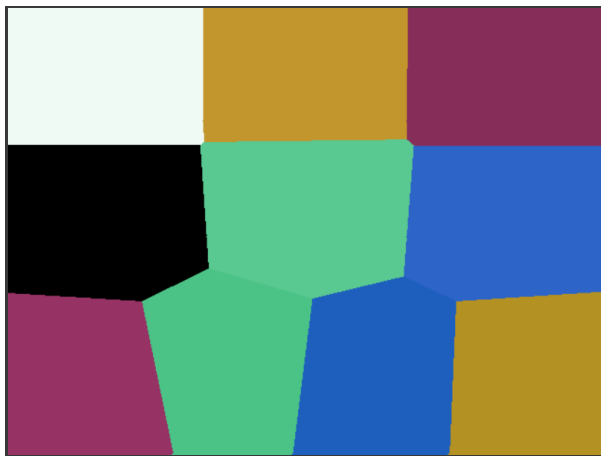


Features: Pixel Location, RGB & Depth

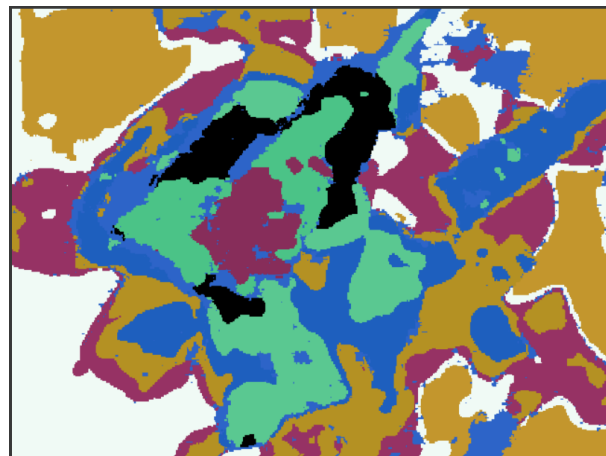


No. of clusters: $n = 10$

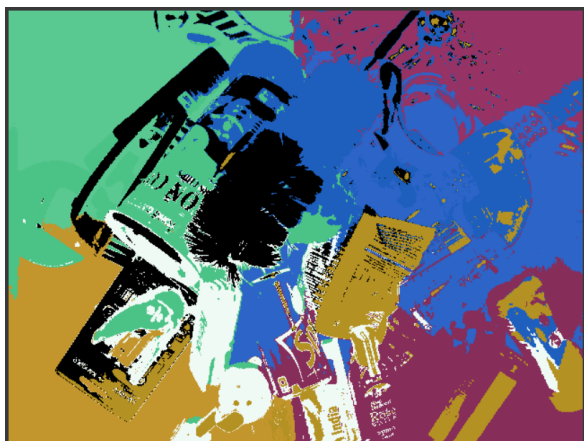
Features: Pixel Location only



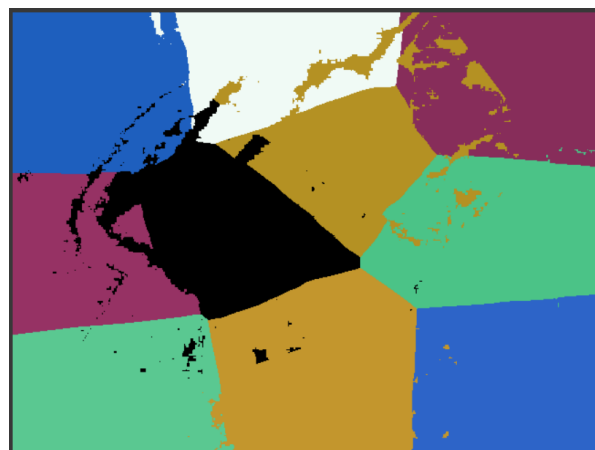
Features: Depth only



Features: Pixel Location & RGB



Features: Pixel Location & Depth



Features: Pixel Location, RGB & Depth

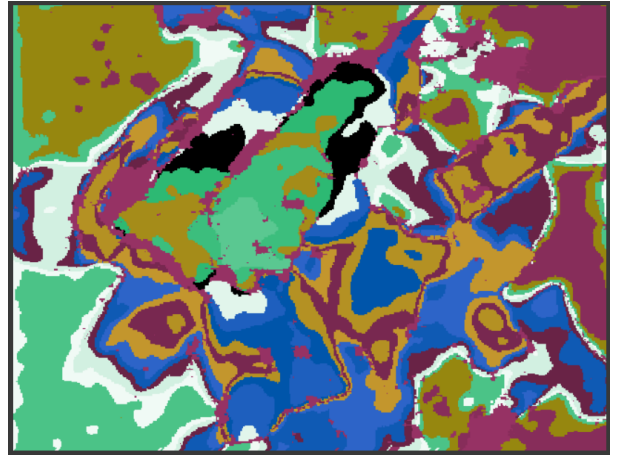


No. of clusters: $n = 20$

Features: Pixel Location only



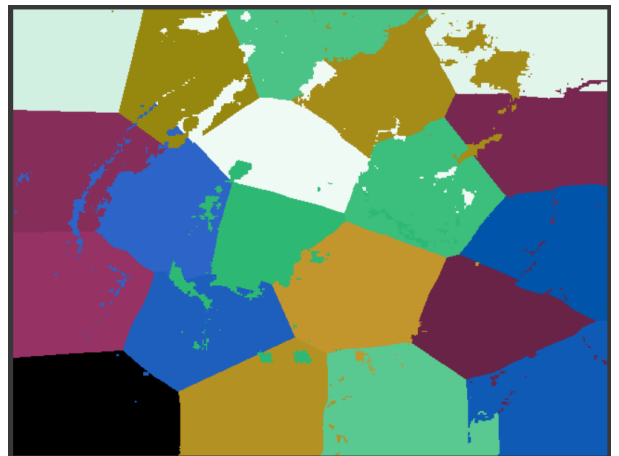
Features: Depth only



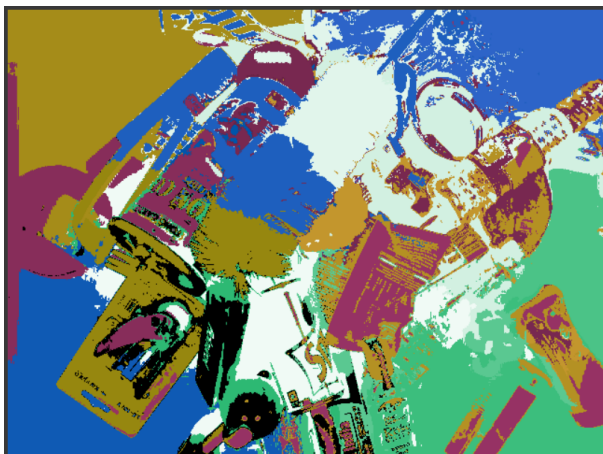
Features: Pixel Location & RGB



Features: Pixel Location & Depth

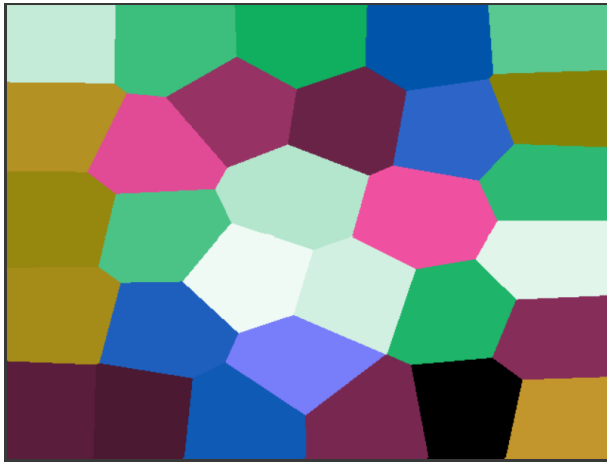


Features: Pixel Location, RGB & Depth

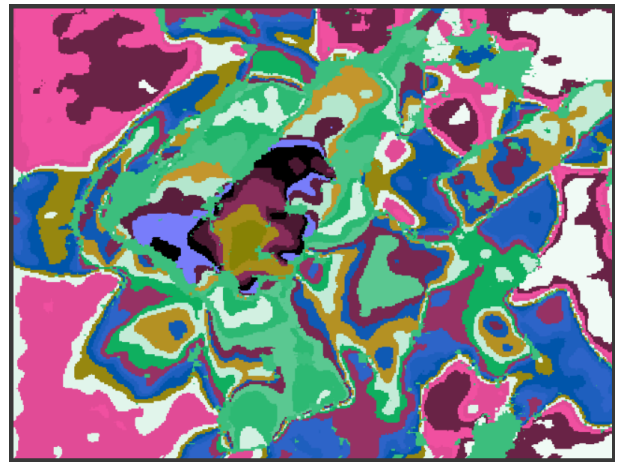


No. of clusters: $n = 30$

Features: Pixel Location only



Features: Depth only



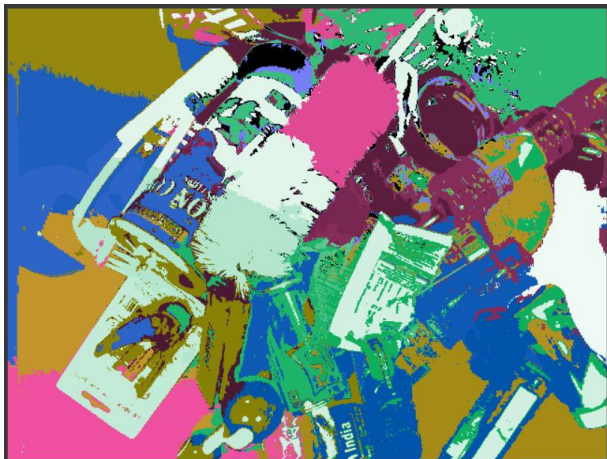
Features: Pixel Location & RGB



Features: Pixel Location & Depth

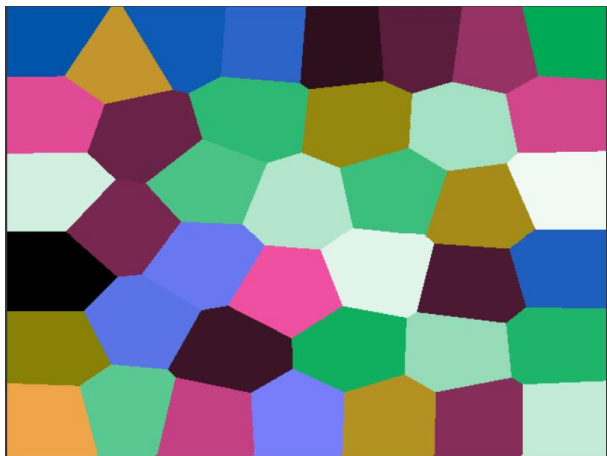


Features: Pixel Location, RGB & Depth

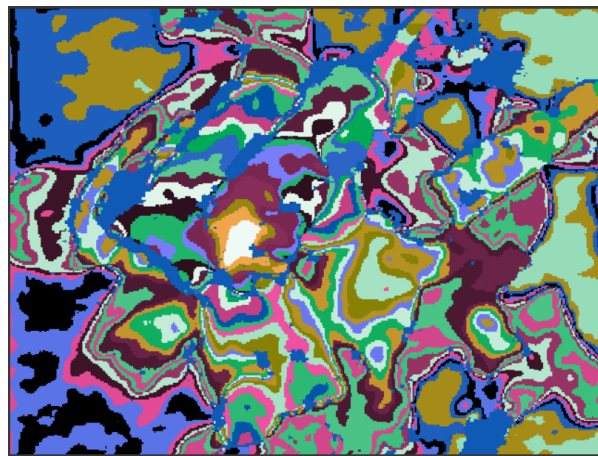


No. of clusters: $n = 40$

Features: Pixel Location only



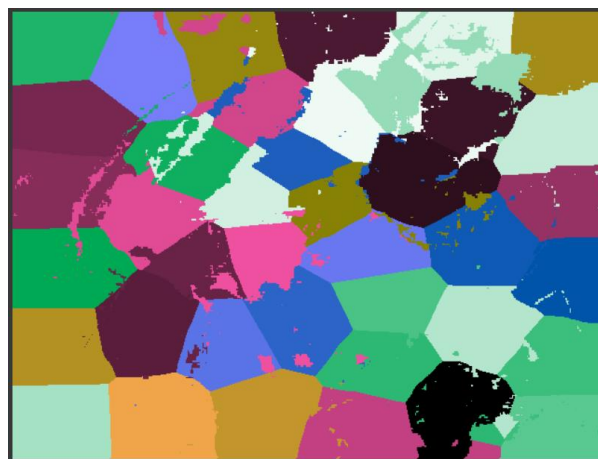
Features: Depth only



Features: Pixel Location & RGB



Features: Pixel Location & Depth



Features: Pixel Location, RGB & Depth

