Analyze the clusters and common properties found for each cluster

Applying K-means clustering (k=10) to fruit dataset.

Abhishek Kumar
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abhishekpro47@gmail.com
Bihar, India

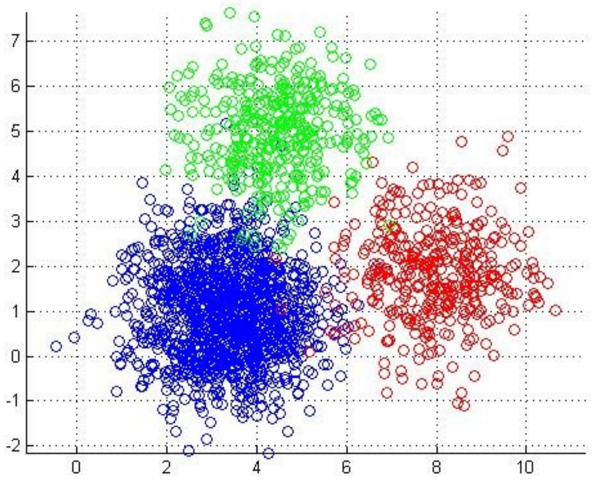
***Abstract*—The relationship among the large amount of data has become a hot research topic. It is desirable to have clustering methods to group similar data together so that, when a lot of data is needed, all data are easily found in close proximity to some search result. Here we have done preprocessing of fruits and vegetables images and used a popular method, k-means clustering, to create 10 clusters. Then we analyze the clusters and common properties found for each cluster.**

I. INTRODUCTION

Clustering is the task of dividing the data points into a number of groups such that data points in the same groups are more similar to other data points in the same group than those in other groups.
An easy abstraction for clusteng data is based on a proximity relationship. Data that are close to each other tend to share some external relationship. This relationship can be established to group the data into clusters.

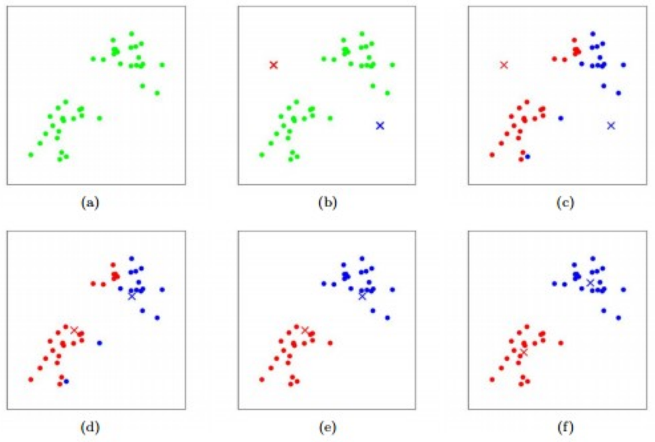
II. ALGORITHM DESCRIPTIONS

The k-means clustering algorithm is one of the popular data clustering approaches. The k-means clustering algorithm receives as input a set of points and the number k of desired centers or cluster representatives. With this input, the algorithm then gives as output a set of point sets such that each set of points have a defined center that they “belong to” that minimizes the distance to a center for all the possible choices of each set.



The algorithm works as follows:

First we intitialize k points, called means, randomly. We categorize each item to its closest mean, and we update the mean’s coordinates, which are the averages of the items categorized in that mean so far. We repeat the process for a given number of iterations and at the end, we have our clusters. The K-means algorithm defined above aims at minimizing an objective function, which in this case is the squared error function.



The objective function for the K-means clustering algorithm is the squared error function:

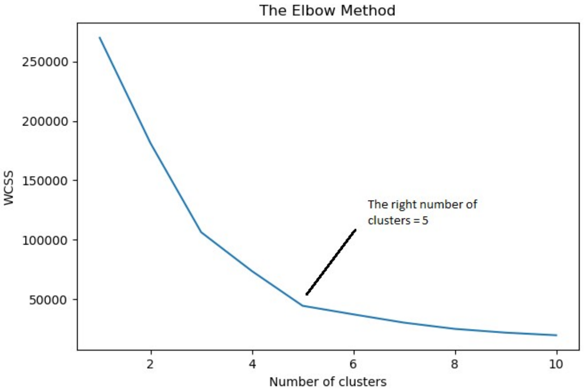
$$J = \sum_{i=1}^{k} \sum_{j=1}^{n} (||x_i - v_j||)^2 = 1$$

where,
| | **xi – vj** | | the Edistance between a point, xa centr i over all k points in the ith cluserf ncluster.

A. How to choose the optimal value of K?

For a certain class of clustering algortihms, there is a parameter commonloy referred to as K that specifies the number of clusters to detect. Other algorithms such as DBSCAN and OPICS algorithm do not require the specification of this parameter; Hierarchical Clustering avoids the problem altogether.

I we talk about K-Menas then the correct choice of K is ofter ambiguous, with interpretations depending on the shape and scale of the distribution of points in a data set and desired clustering resolution of the user. In addition, increasing K wihout penalty will always reduce the amount of error in the resulting clustering, to the exterme case of zero error if each data point is considered its own cluster (i.e, when K equals the number of data points, n). Intuitively then, the iptimal choice of K will srike a balance between maximumcompression of the data using a single cluster, and maximum accuracy by assigning each data point to its own cluster.



If an appropriate value of K is not apparent from prior knowldge of the propertise of the data set, it must be chosen somehow. There are several categories of methods for making this decision and **Elbow method** is on such method..

The basic idea behind partitioning methods, is to define clusters such that the total intra-cluster variation or in other words, total within-cluster sum of square (WCSS) is minimized. The total WCSS measures the compactness of the clustering and we want it to be as small as possible.

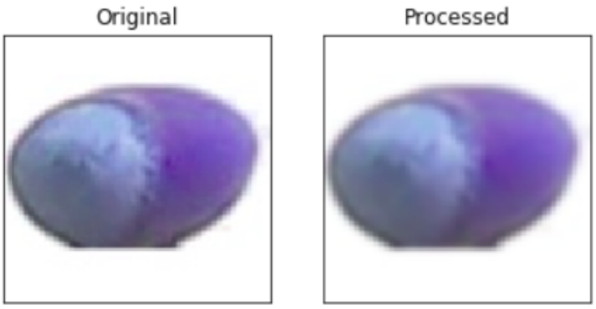
The Elbow method looks at the total WCSS as a function of the number of clusters: One should choose a number of clusters so that adding another cluster doesn’t improve much better the total WCSS.

III. DATA PREPROCESSING

Before applying K-means to our data set we will do some pre-processing so that K-means will give best result. Our data set is consist of images of 114 varieties of fruits and vegetables.

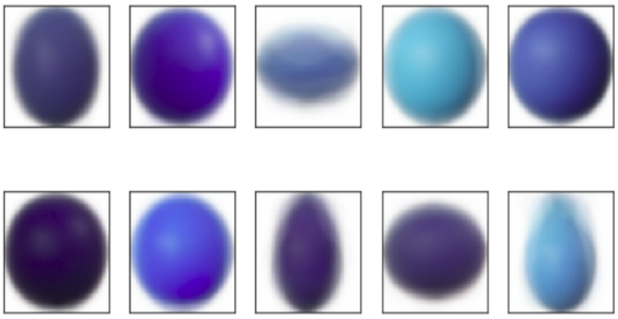
A. Removing Noise

For removing noise from the image we used Gaussian blur. Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function. It enhances image structures at different scales.



IV. RESULT

After applying Kmeans with k=10 to our data set, we get 10 centers. Images at the centers were.



It can be clearly seen that, it has done the clustering based on the shape and colors.

Let’s visulize the some images of each clusters.

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There are 1787 members in cluster 1
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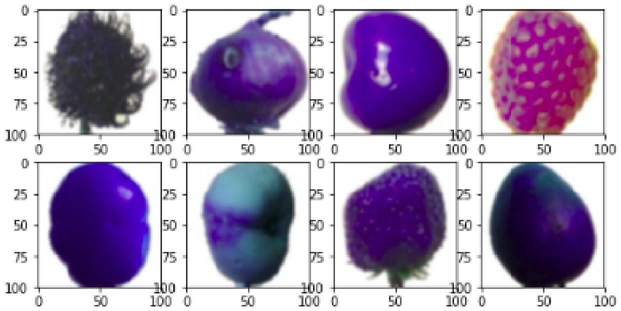

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There are 1939 members in cluster 2
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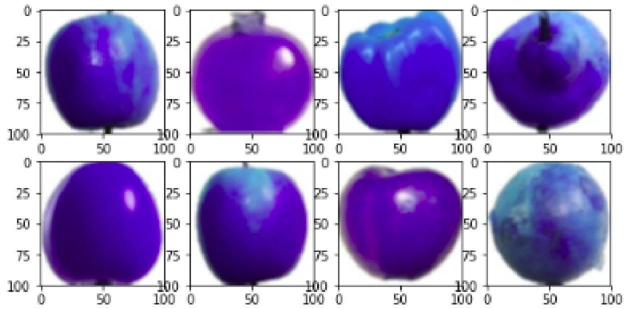

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There are 1303 members in cluster 3
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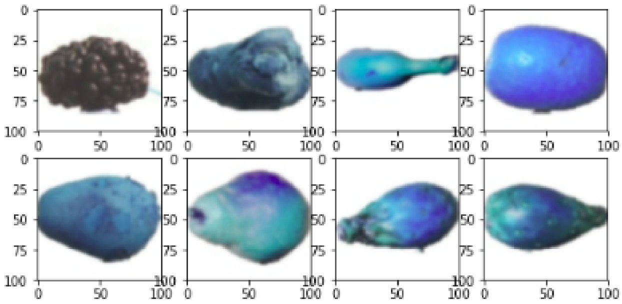

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There are 2211 members in cluster 4
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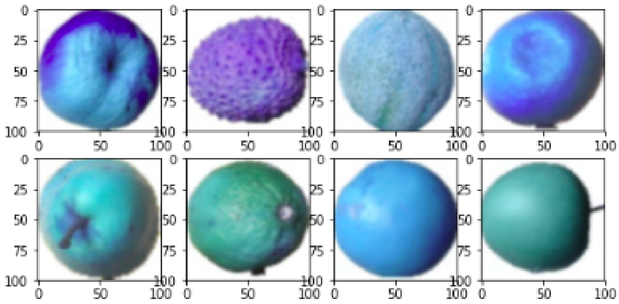

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There are 1973 members in cluster 5
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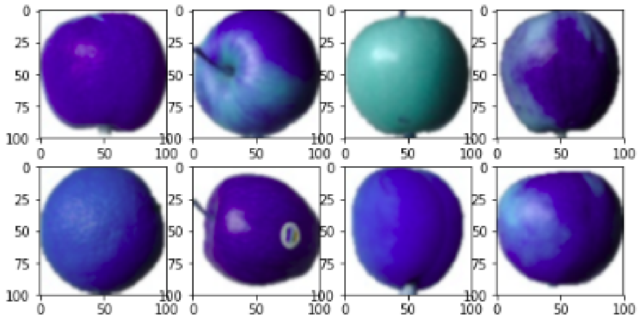

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There are 2052 members in cluster 6
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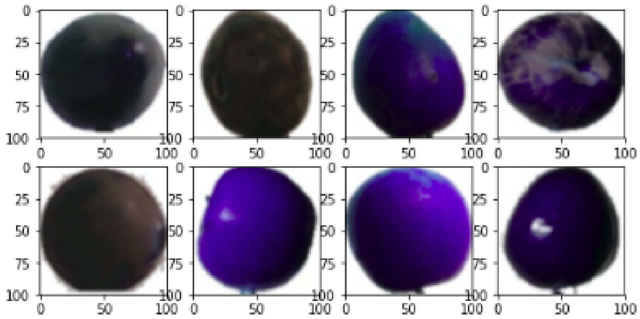

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There are 1789 members in cluster 7
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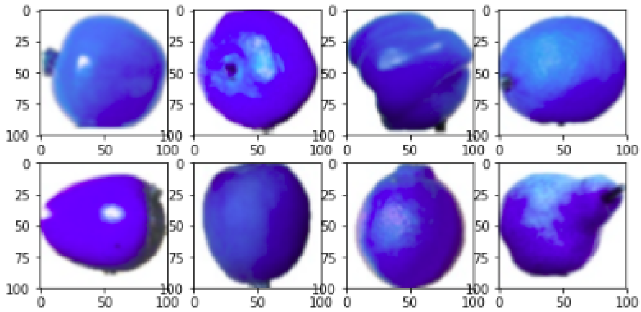

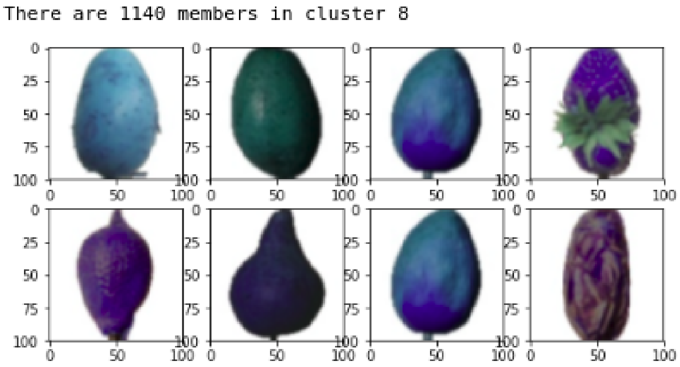

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There are 1140 members in cluster 8
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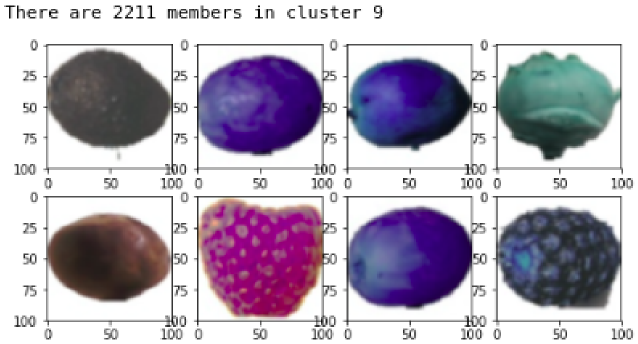

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There are 2211 members in cluster 9
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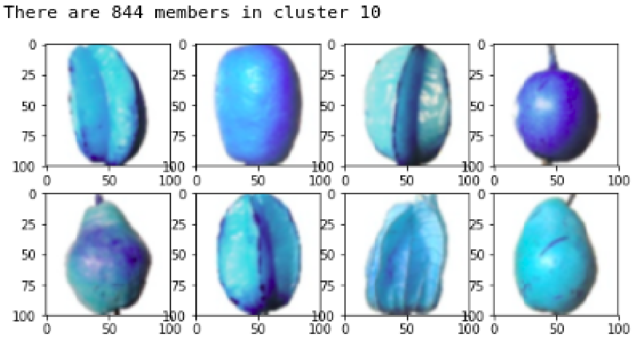

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There are 844 members in cluster 10
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V. CONCLUSION

We can further improve the clustering:by:

•Choosing optimal value of K(number of clusters).

•Merging neighboring clusters if the resulting cluster's variance is below the threshold

•Running the algorithm using different initializations of centroids.

•Standardize the data