How to solve K-Means Algorithm Numerical?

Sujan Karna · Follow

2 min read · Dec 18, 2023

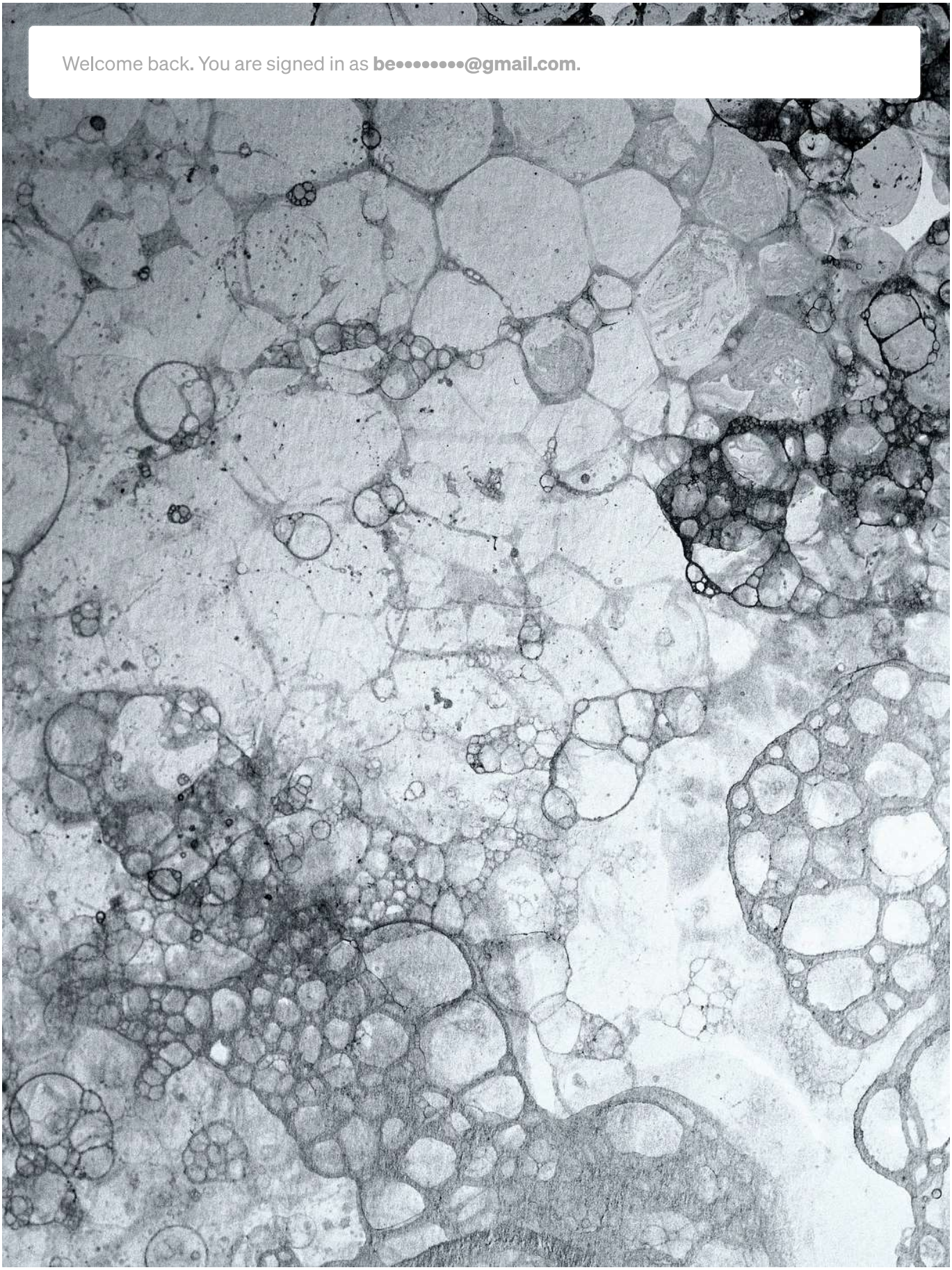


Photo by Kier in Sight Archives on Unsplash

Q. Apply K(=2)-Means algorithm over the data (185, 72), (170, 56), (168, 60)

(1

ly

choose first two objects as initial centroids.

Solution:

Given, number of clusters to be created (K) = 2 say c1 and c2,

number of iterations = 2 and

The given data points can be represented in tabular form as:

Instance	X	Y
1	185	72
2	170	56
3	168	60
4	179	68
5	182	72
6	188	77

Data Points

also, first two objects as initial centroids:

Centroid for first cluster c1 = (185, 72)

Centroid for second cluster c2 = (170, 56)

Iteration 1: Now calculating similarity by using *Euclidean distance* measure

$d(c2, 3) = \sqrt{(170-168)^2 + (56-60)^2} = \sqrt{(2)^2 + (-4)^2} = \sqrt{4 + 16} = \sqrt{20}$

Here, d(c2, 3) < d(c1, 3)

So, data point 3 belongs to c2.

$d(c1, 4) = \sqrt{(185-179)^2 + (72-68)^2} = \sqrt{(6)^2 + (4)^2} = \sqrt{36 + 16} = \sqrt{52}$

$d(c2, 4) = \sqrt{(170-179)^2 + (56-68)^2} = \sqrt{(-9)^2 + (-12)^2} = \sqrt{81 + 144} = \sqrt{225}$

Here, d(c1, 4) < d(c2, 4)

So, data point 4 belongs to c1.

$d(c1, 5) = \sqrt{(185-182)^2 + (72-72)^2} = \sqrt{(3)^2 + (0)^2} = \sqrt{9}$

$d(c2, 5) = \sqrt{(170-182)^2 + (56-72)^2} = \sqrt{(-12)^2 + (-16)^2} = \sqrt{144 + 256} = \sqrt{400}$

Here, d(c1, 5) < d(c2, 5)

So, data point 5 belongs to c1.

$d(c1, 6) = \sqrt{(185-188)^2 + (72-77)^2} = \sqrt{(-3)^2 + (-5)^2} = \sqrt{9 + 25} = \sqrt{34}$

$d(c2, 6) = \sqrt{(170-188)^2 + (56-77)^2} = \sqrt{(-18)^2 + (-21)^2} = \sqrt{324 + 441} = \sqrt{765}$

Here, d(c1, 6) < d(c2, 6)

So, data point 6 belongs to c1.

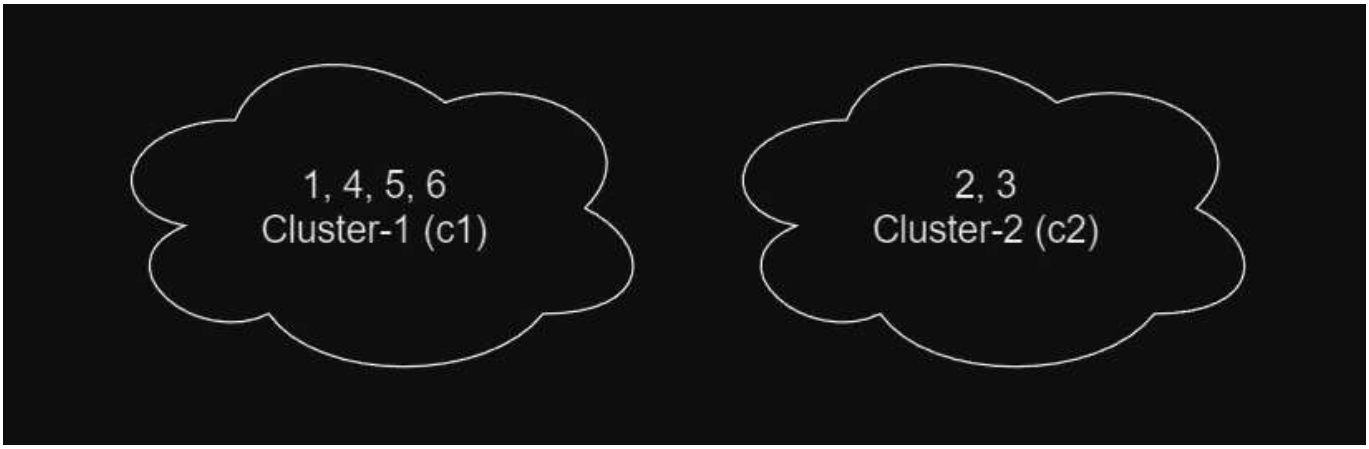
Euclidean distance calculation

Representing above information in tabular form:

Instance	X	Y	Distance(C1)	Distance(C2)	Cluster
1	185	72			c1
2	170	56			c2
3	168	60	√433	√20	c2
4	179	68	√52	√225	c1
5	182	72	√9	√400	c1
6	188	77	√34	√765	c1

Distance of each data points from cluster centroids

The resulting cluster after first iteration is:



Data points cluster

Iteration 2: Now calculating centroid for each cluster:

$$Centroid\ for\ first\ cluster\ c1 = \left(\frac{185+179+182+188}{4}, \frac{72+68+72+77}{4}\right) = (183.5, 72.25)$$

$$Centroid\ for\ second\ cluster\ c2 = \left(\frac{170+168}{2}, \frac{56+60}{2}\right) = (169, 58)$$

Calculating centroid as mean of data points

Now, again calculating similarity:

$$d(c2,1) = \sqrt{(169-185)^2 + (58-72)^2} = 21.2603$$

Here, d (c1, 1) < d (c2, 1)
So, data point 1 belongs to c1.

$$d(c1,2) = \sqrt{(183.5-170)^2 + (72.25-56)^2} = 21.1261$$
$$d(c2,2) = \sqrt{(169-170)^2 + (58-56)^2} = 2.2361$$

Here, d (c2, 2) < d (c1, 2)
So, data point 2 belongs to c2.

$$d(c1,3) = \sqrt{(183.5-168)^2 + (72.25-60)^2} = 19.7563$$
$$d(c2,3) = \sqrt{(169-168)^2 + (58-60)^2} = 2.2361$$

Here, d (c2, 3) < d (c1, 3)
So, data point 3 belongs to c2.

$$d(c1,4) = \sqrt{(183.5-179)^2 + (72.25-68)^2} = 6.1897$$
$$d(c2,4) = \sqrt{(169-179)^2 + (58-68)^2} = 14.1421$$

Here, d (c1, 4) < d (c2, 4)
So, data point 4 belongs to c1.

$$d(c1,5) = \sqrt{(183.5-182)^2 + (72.25-72)^2} = 1.5207$$
$$d(c2,5) = \sqrt{(169-182)^2 + (58-72)^2} = 19.1050$$

Here, d (c1, 5) < d (c2, 5)
So, data point 5 belongs to c1.

$$d(c1,6) = \sqrt{(183.5-188)^2 + (72.25-77)^2} = 6.5431$$
$$d(c2,6) = \sqrt{(169-188)^2 + (58-77)^2} = 26.8701$$

Here, d (c1, 6) < d (c2, 6)
So, data point 6 belongs to c1.

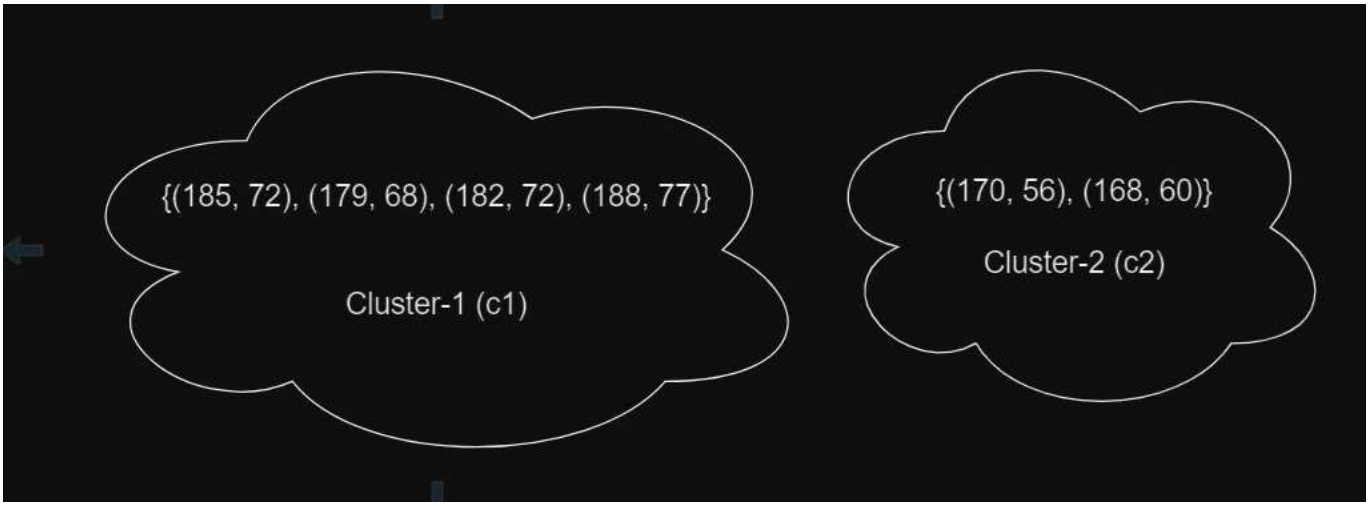
Distance calculation between data points and centroids

Representing above information in tabular form.

Instance	X	Y	Distance(C1)	Distance(C2)	Cluster
3	168	60	19.7563	2.2361	c2
4	179	68	6.1897	14.1421	c1
5	182	72	1.5207	19.105	c1
6	188	77	6.5431	26.8701	c1

Distance of each data points from cluster centroids

The resulting cluster after second iteration is:



Data points cluster

As we have already completed two iteration as asked by our question, the numerical ends here.

Since, the clustering doesn't change after second iteration, so terminate the iteration even if question doesn't say so.

Data Warehousing | Machine Learning | Data Mining | Artificial Intelligence | Clustering Algorithm

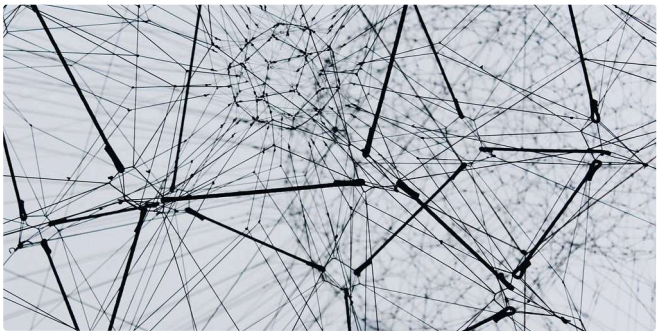
Written by Sujan Karna

Follow

33 Followers

🚀 Passionate Web Developer & Data Science Enthusiast

More from Sujan Karna



Sujan Karna

Back Propagation Algorithm - Numerical Solved

Q. Consider a multilayer feed-forward neural network given below. Let the learning rate b...

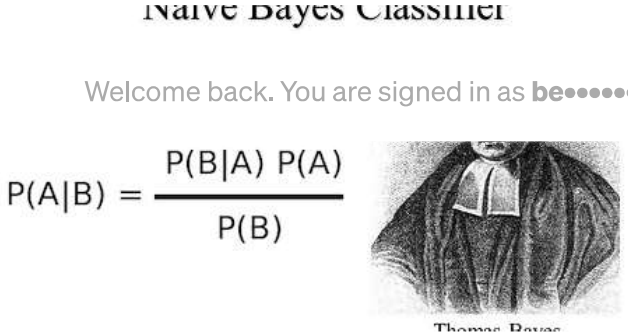
Dec 27, 2023 41 5

Sujan Karna

Density Based- DBSCAN Numerical

Q. Given the points A(3, 7), B(4, 6), C(5, 5), D(6, 4), E(7, 3), F(6, 2), G(7, 2) and H(8, 4), Find the...

Dec 20, 2023 9

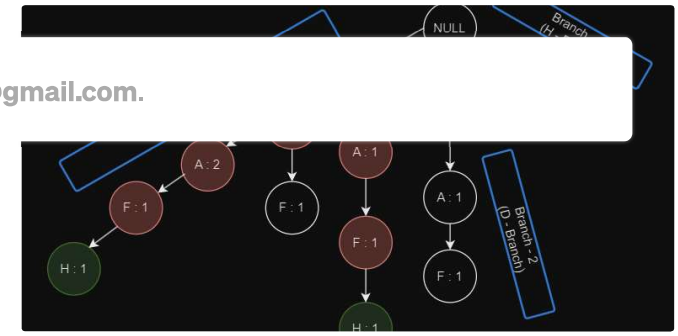


Sujan Karna

How to solve Naive Bayesian Classification -Numerical?

Q. Consider the following data set.

Jan 7 62 1



Sujan Karna

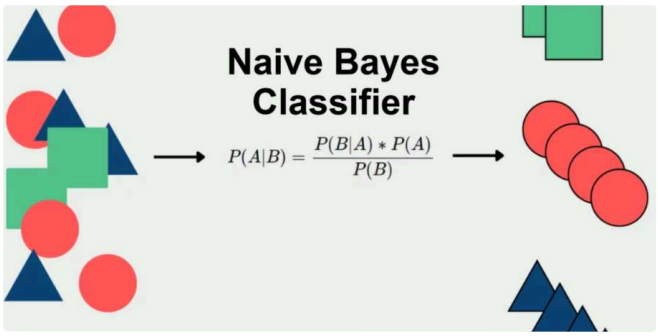
How to solve Frequent Pattern Mining-FP Growth Numerical?

Q. Generate the frequent pattern from the following data set using FP growth, where...

Jan 11 19 2

See all from Sujan Karna

Recommended from Medium



Fraidoon Omarzai

This blog covers the fundamentals of Naive Bayes with clear explanations.

Jul 20 46

Anurag

A Guide to Handling Categorical Variables in Machine Learning

Apr 10

Lists

Predictive Modeling w/ Python

20 stories · 1548 saves

Practical Guides to Machine Learning

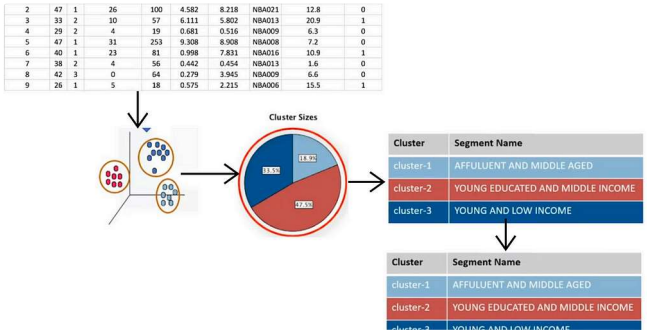
10 stories · 1877 saves

Natural Language Processing

1715 stories · 1287 saves

The New Chatbots: ChatGPT, Bard, and Beyond

12 stories · 462 saves



Avicsebooks

ML Part 5: Clustering

Clustering is a type of unsupervised machine learning technique used for grouping similar...

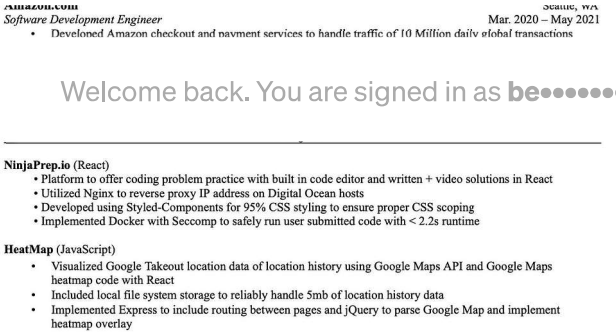
Apr 17 5

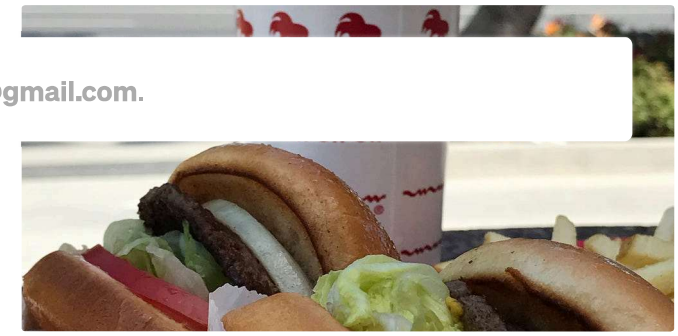
Ansa Baby in Tech & TensorFlow

Understanding the Mathematical Concepts Behind the K-Nearest...

A Complete Beginner's Guide to the Math Behind KNN

Sep 15 53 2





Alexander Nguyen in Level Up Coding

The resume that got a software engineer a $300,000 job at Google.

1-page. Well-formatted.

Jun 1 22K 431

Thomas Lewandowski

Master the Classic Question: “What Does a Dip in the Metrics Mean?”

How I answer this common data analytics and product execution interview question. With I...

Oct 2, 2022 70

See more recommendations