FUZZY CLUSTERING

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Assignment3 – Report

Introduction

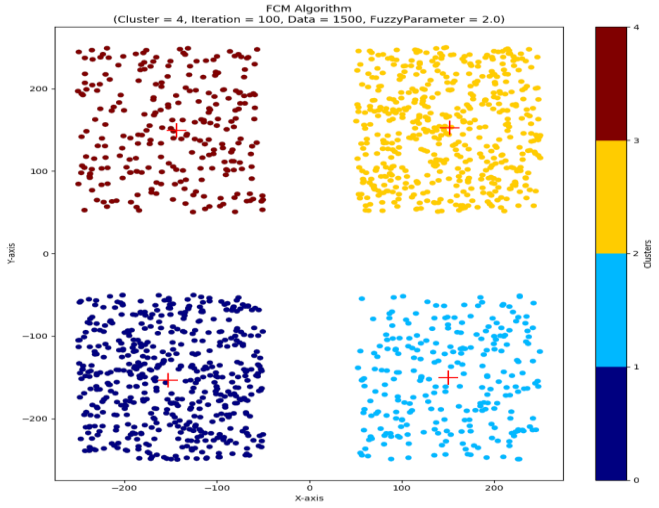
Fuzzy clustering algorithms have two popular methods: FCM and HCM. In HCM (Hard C-Means) we classify data in a crisp sense so each data is a member of just one cluster. FCM (Fuzzy C-Means) is other method that classifies data in fuzzy sets. FCM algorithm has below steps:

1. Initialize $2 \leq c < n$ (number of clusters) and U (membership matrix).Also we select a number for m` (fuzziness parameter).
2. Calculate v_i^r (*i*th cluster centers in *rth* iteration) for each step.
3. Update the membership matrix for *r*th step.
4. If r > iterations plot outputs Else r = r + 1 and return to step 2

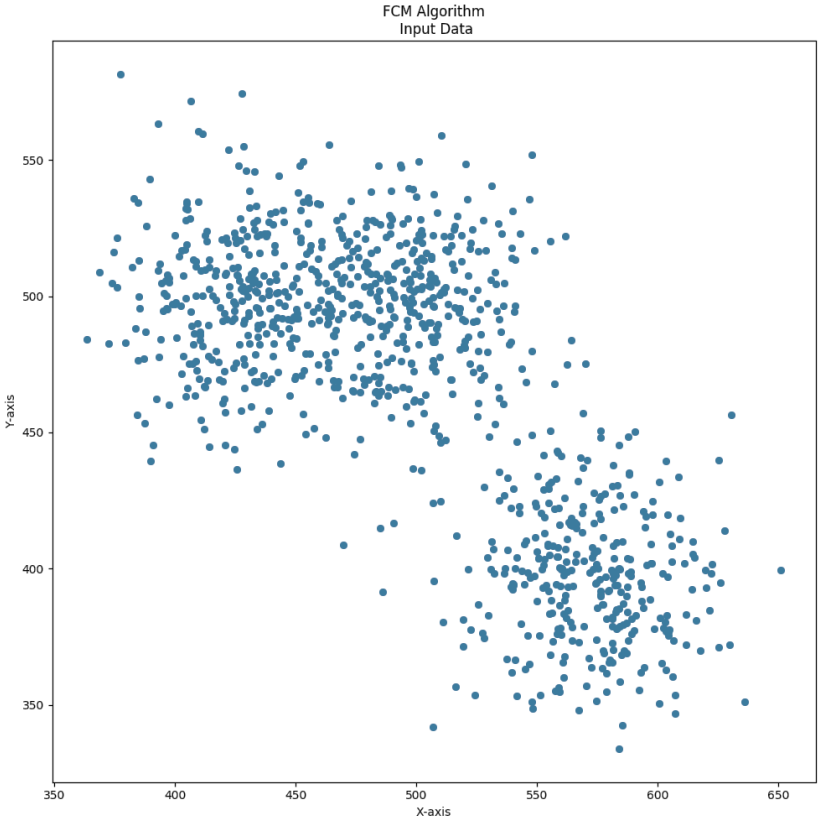
In this assignment we must implement FCM algorithm and plot outputs with *matplotlib*.

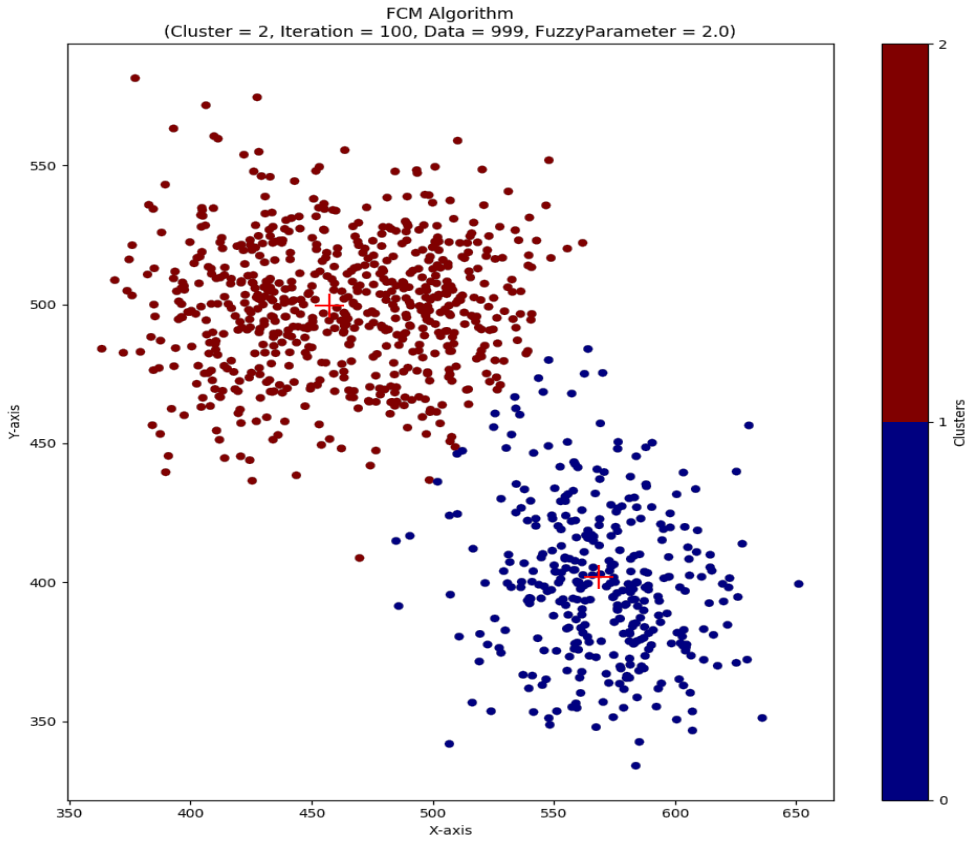
Output

In the following you can see outputs of FCM algorithm. Each test case has two plots, first plot is input data and other is clustered data.
In clustered data plots cluster centers is shown with red plus (+) and points that have same color are members of a cluster.

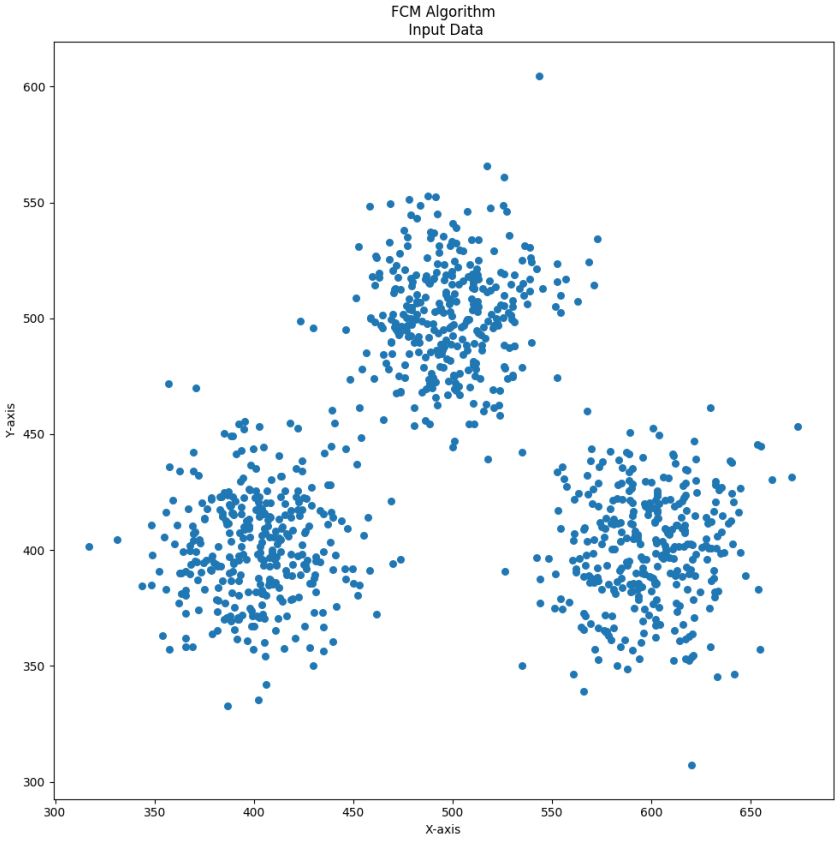


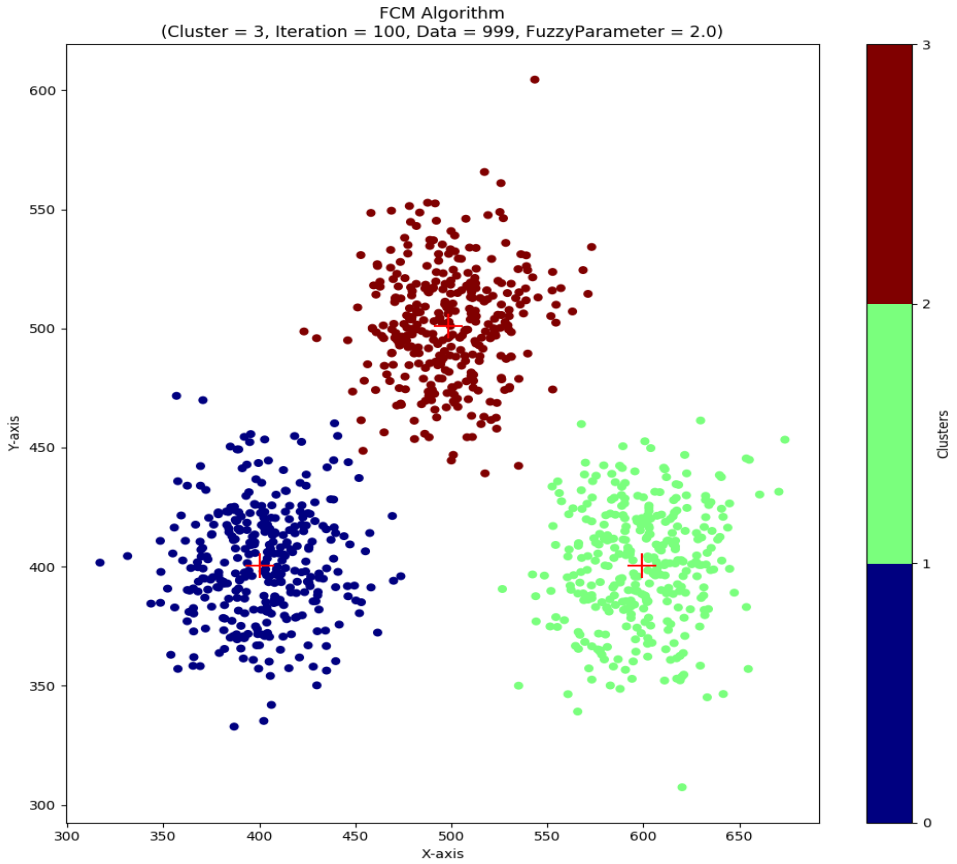
- Test case 1:


FCM Algorithm
Input Data
Y-axis
X-axis
550
500
450
400
350
350
400
450
500
550
600
650

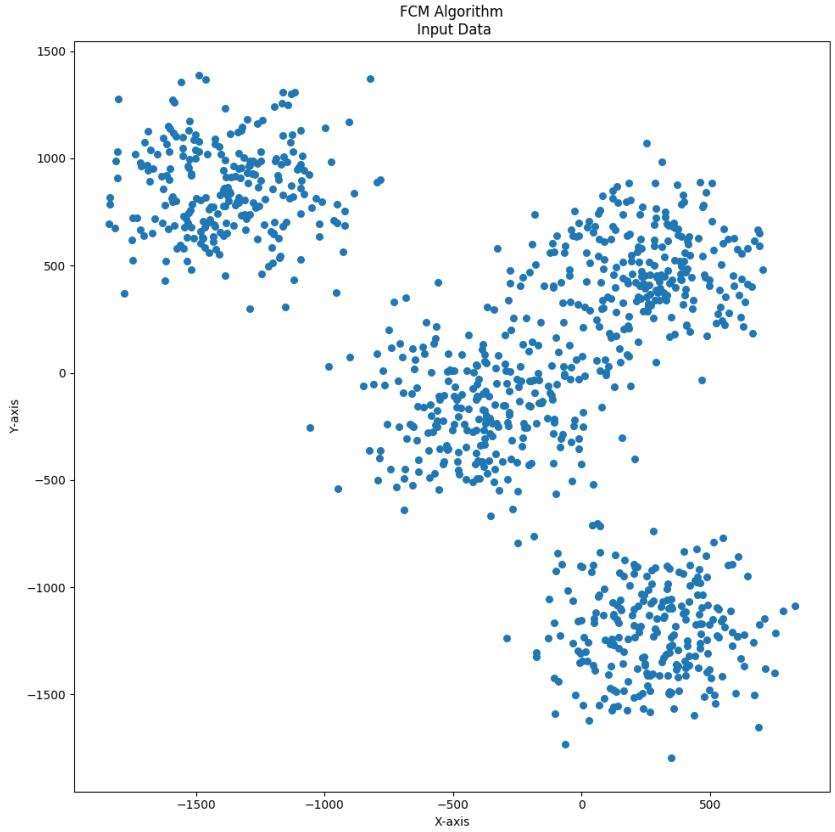

FCM Algorithm
(Cluster = 2, Iteration = 100, Data = 999, FuzzyParameter = 2.0)
Y-axis
X-axis
Clusters
2
1
0
550
500
450
400
350
350
400
450
500
550
600
650

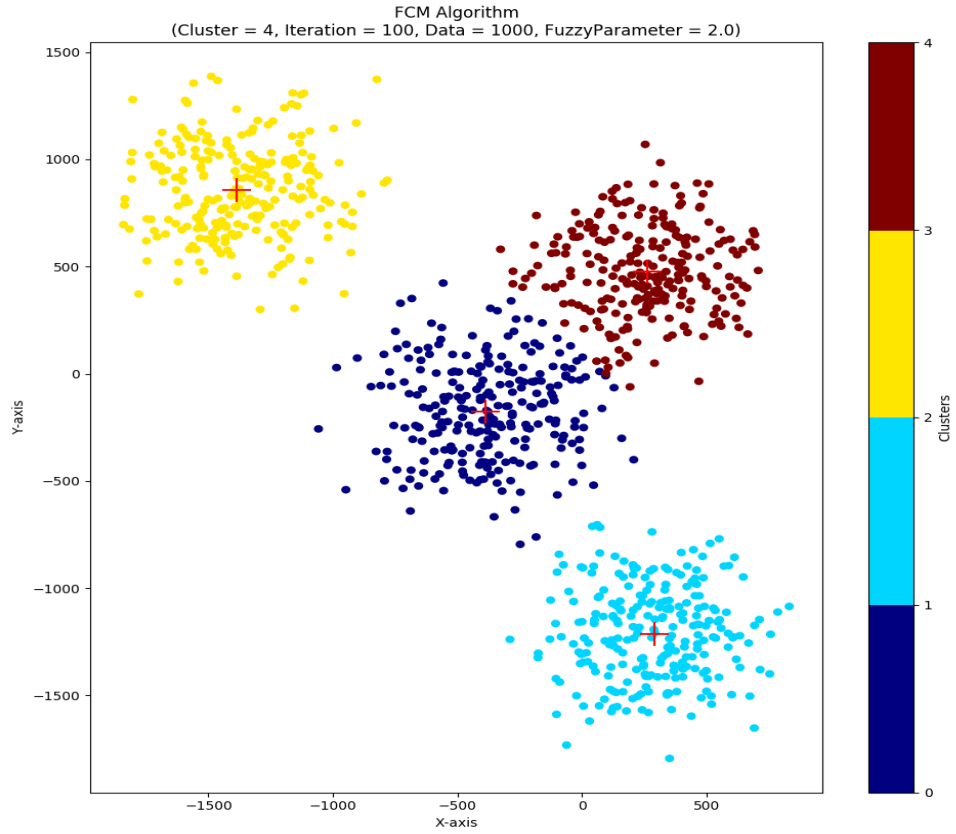
- Test case 2


FCM Algorithm
Input Data
Y-axis
X-axis
600
550
500
450
400
350
300
300
350
400
450
500
550
600
650

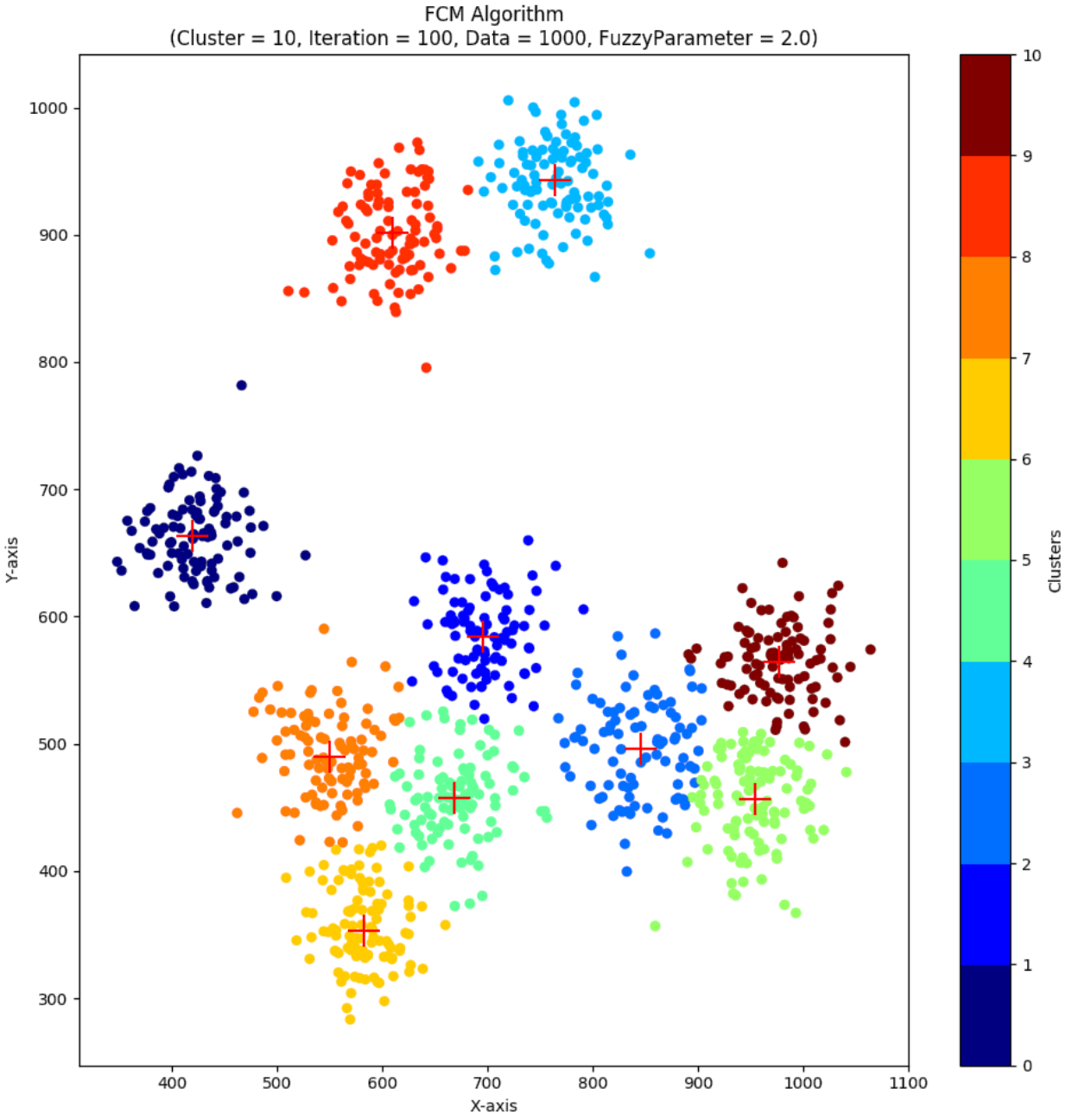

FCM Algorithm
(Cluster = 3, Iteration = 100, Data = 999, FuzzyParameter = 2.0)
Y-axis
X-axis
Clusters
600
550
500
450
400
350
300
300
350
400
450
500
550
600
650
3
2
1
0

- **Test case 3:**


FCM Algorithm
Input Data
Y-axis
X-axis
1500
1000
500
0
−500
−1000
−1500
−1500
−1000
−500
0
500


FCM Algorithm
(Cluster = 4, Iteration = 100, Data = 1000, FuzzyParameter = 2.0)
Y-axis
X-axis
Clusters
1500
1000
500
0
−500
−1000
−1500
−1500
−1000
−500
0
500
4
3
2
1
0

- **Test case 4:**


FCM Algorithm
(Cluster = 10, Iteration = 100, Data = 1000, FuzzyParameter = 2.0)
Y-axis
X-axis
Clusters
1000
900
800
700
600
500
400
300
400
500
600
700
800
900
1000
1100
10
9
8
7
6
5
4
3
2
1
0