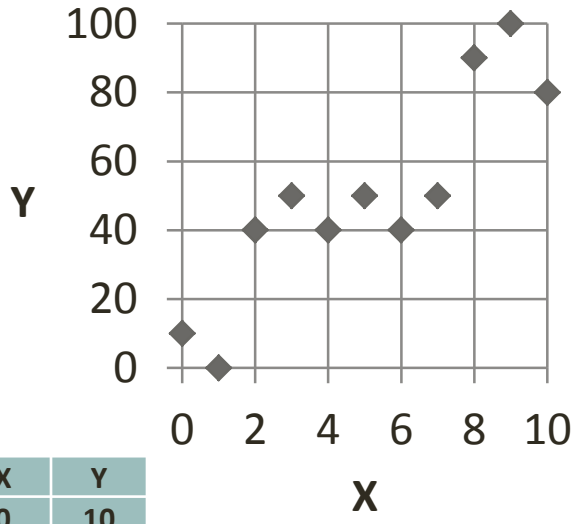
Normalization in Clustering

Normalization of a linear relationship (1)

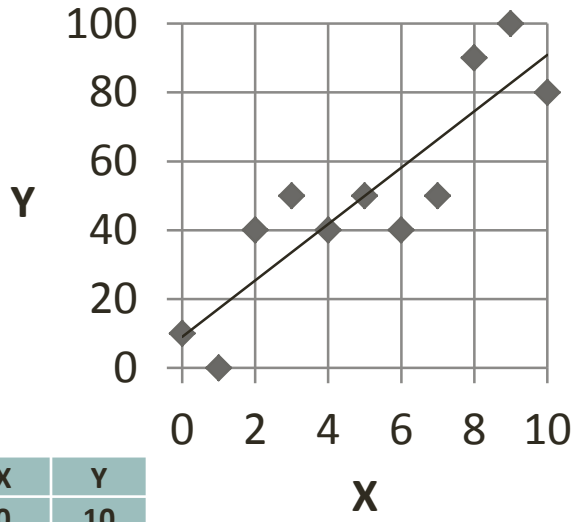
X	Y
0	10
1	0
2	40
3	50
4	40
5	50
6	40
7	50
8	90
9	100
10	80

Normalization of a linear relationship (2)



X	Y
0	10
1	0
2	40
3	50
4	40
5	50
6	40
7	50
8	90
9	100
10	80

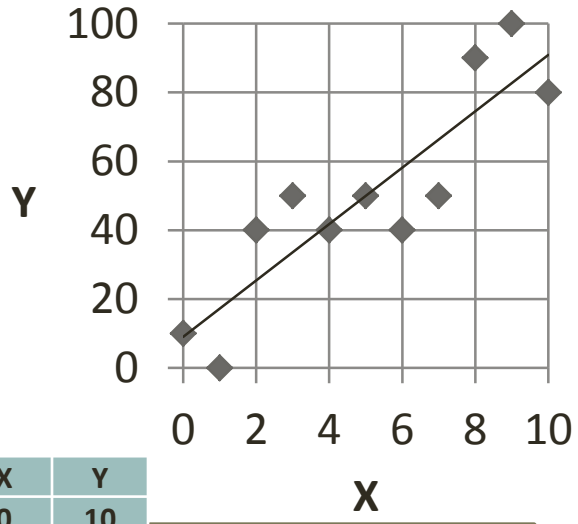
Normalization of a linear relationship (3)



X	Y
0	10
1	0
2	40
3	50
4	40
5	50
6	40
7	50
8	90
9	100
10	80

$Y = 10 + 8*X$

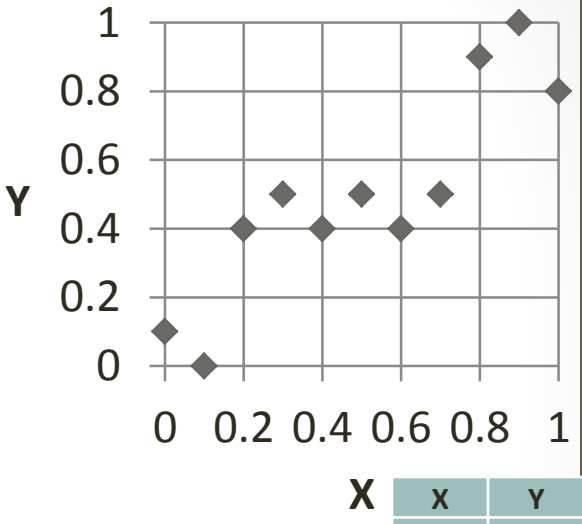
Normalization of a linear relationship (4)



X	Y
0	10
1	0
2	40
3	50
4	40
5	50
6	40
7	50
8	90
9	100
10	80

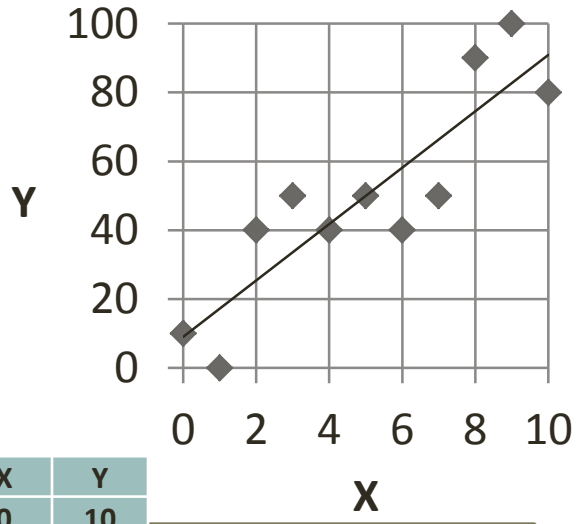
Y = 10 + 8*X

Normalize



X	Y
0	0.1
0.1	0
0.2	0.4
0.3	0.5
0.4	0.4
0.5	0.5
0.6	0.4
0.7	0.5
0.8	0.9
0.9	1
1	0.8

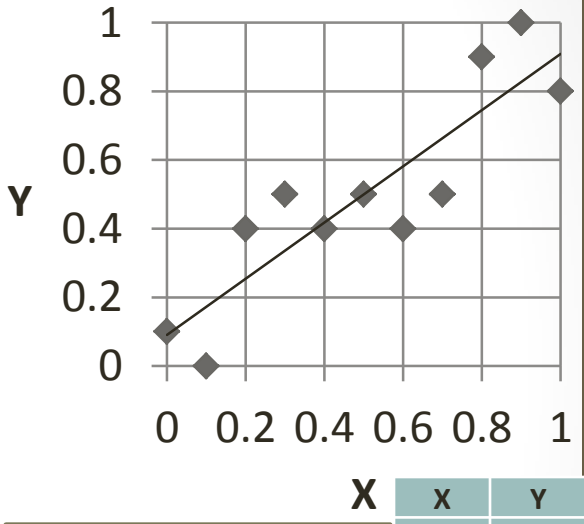
Normalization of a linear relationship (5)



X	Y
0	10
1	0
2	40
3	50
4	40
5	50
6	40
7	50
8	90
9	100
10	80

Y = 10 + 8*X

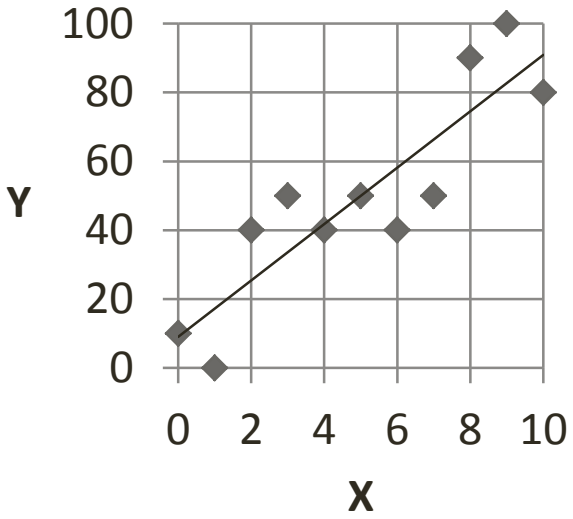
Normalize



Y = 0.1 + 0.8*X

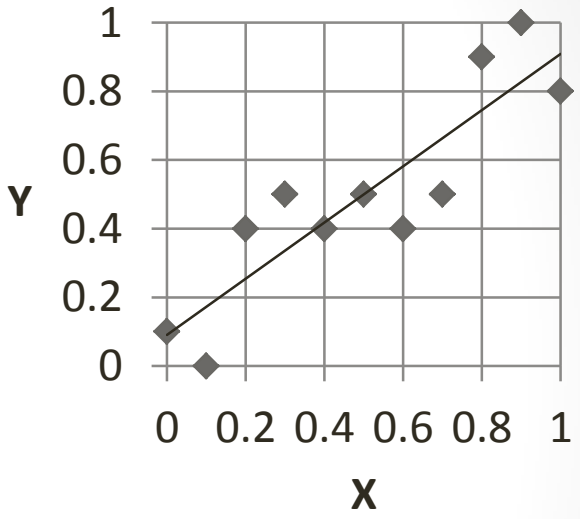
X	Y
0	0.1
0.1	0
0.2	0.4
0.3	0.5
0.4	0.4
0.5	0.5
0.6	0.4
0.7	0.5
0.8	0.9
0.9	1
1	0.8

Normalization of a linear relationship (6)



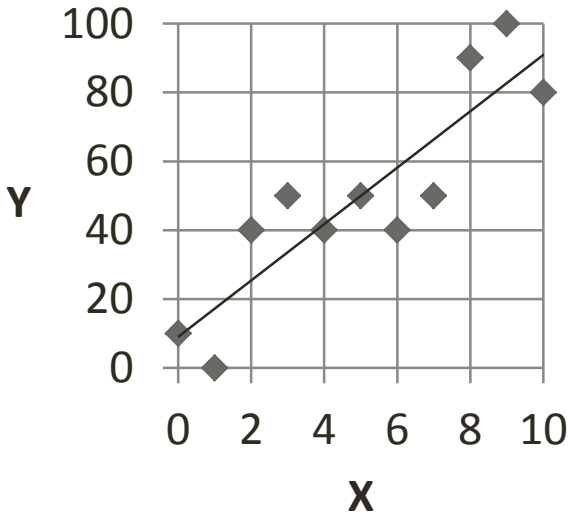
Y = 10 + 8*X

Normalize



Y = 0.1 + 0.8*X

Normalization of a linear relationship (7)



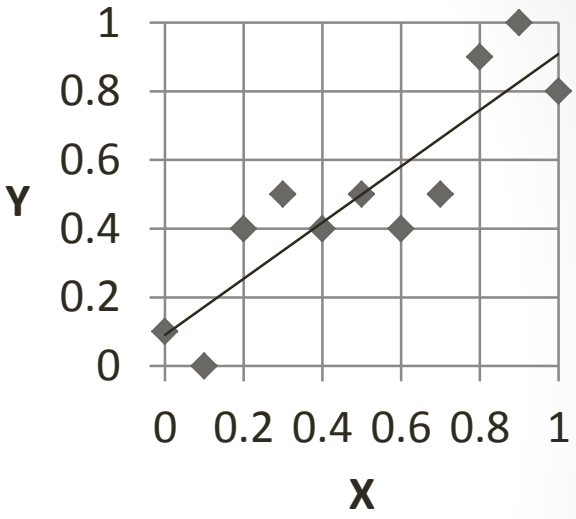
Y = 10 + 8*X

Normalize

Normalize Input
X = 2 -> X' = 0.2

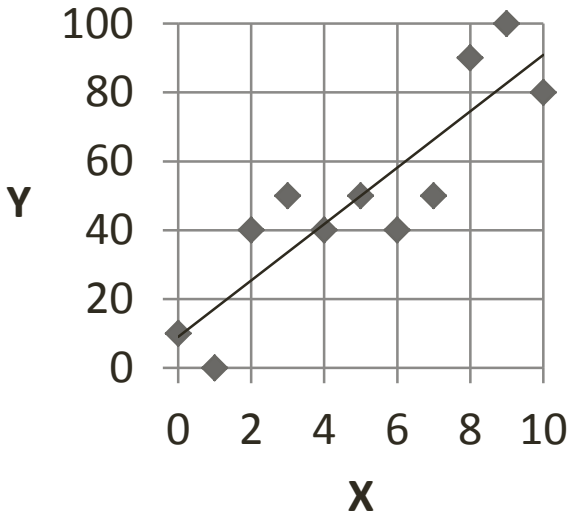
Predict Output
X' = 0.2 -> Y'= 0.26

Denormalize Output
Y'= 0.26 -> Y = 26



Y = 0.1 + 0.8*X

Normalization of a linear relationship (8)



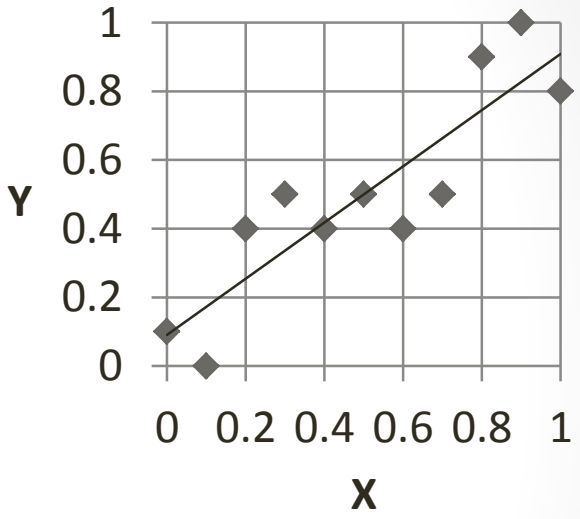
Y = 10 + 8*X

Normalize

Normalize Input
X = 2 -> X' = 0.2

Predict Output
X' = 0.2 -> Y'= 0.26

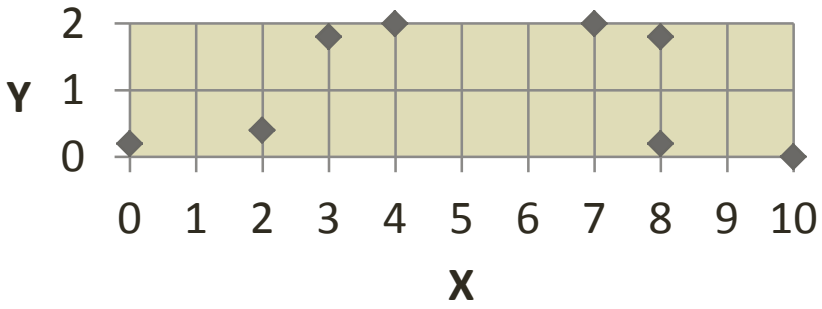
Denormalize Output
Y'= 0.26 -> Y = 26



Y = 0.1 + 0.8*X

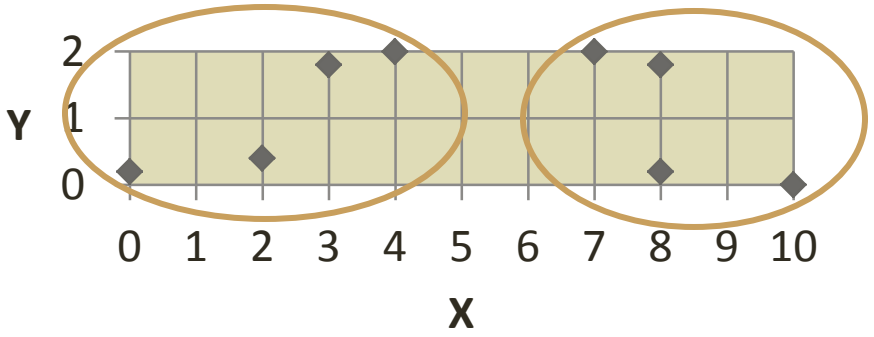
Prediction in Original Space:
X = 2 -> Y = 26

Normalization of a non-linear relationship (1)



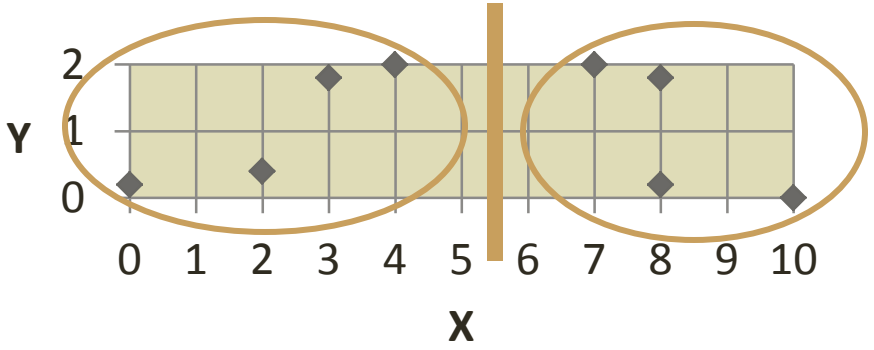
Original data in 2D:
Find 2 clusters

Normalization of a non-linear relationship (2)



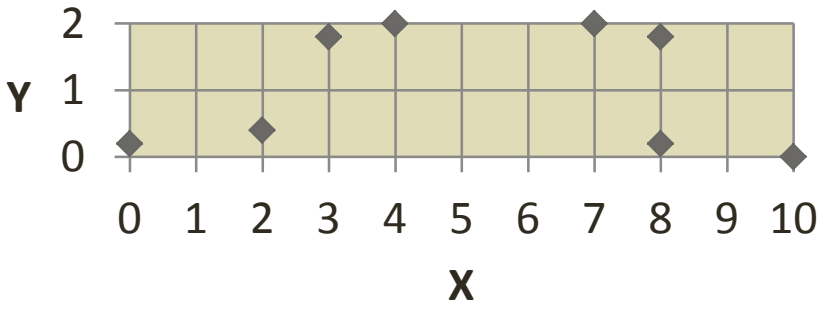
Found 2 Clusters

Normalization of a non-linear relationship (3)



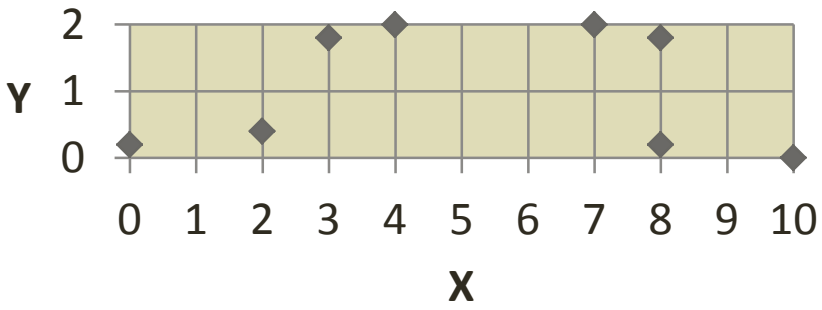
Clusters segment the image

Normalization of a non-linear relationship (4)

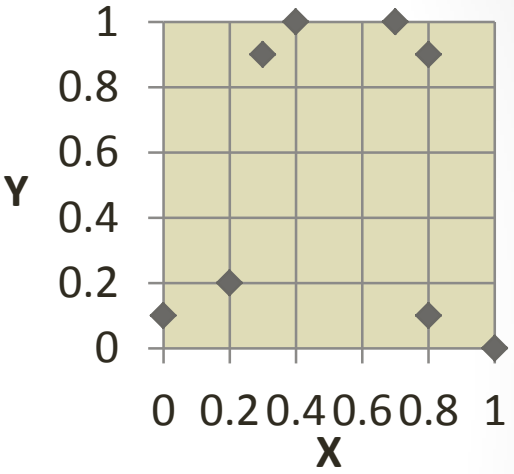


Non-normalized 2D data

Normalization of a non-linear relationship (5)



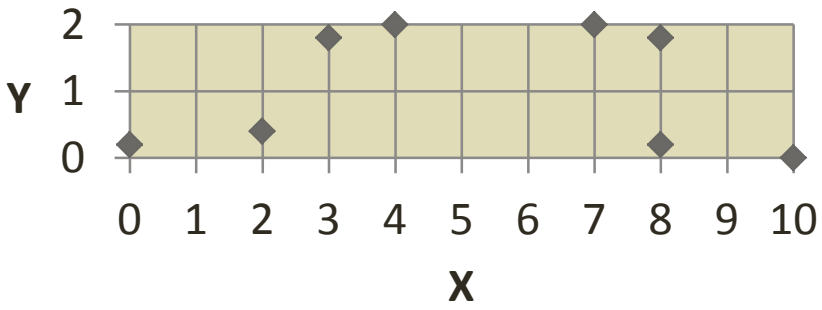
Normalize



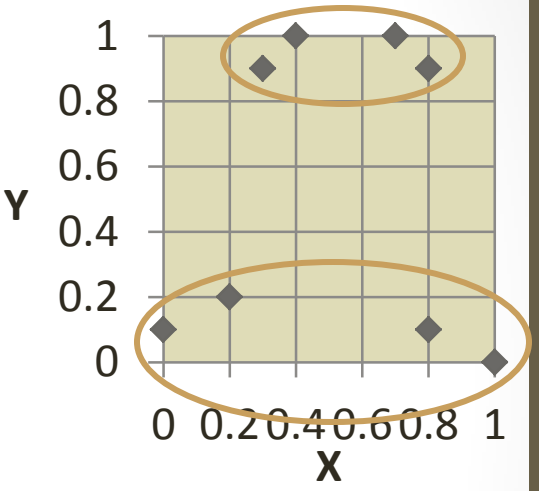
Non-normalized 2D data

Normalize the data:
Search for 2 Clusters

Normalization of a non-linear relationship (6)



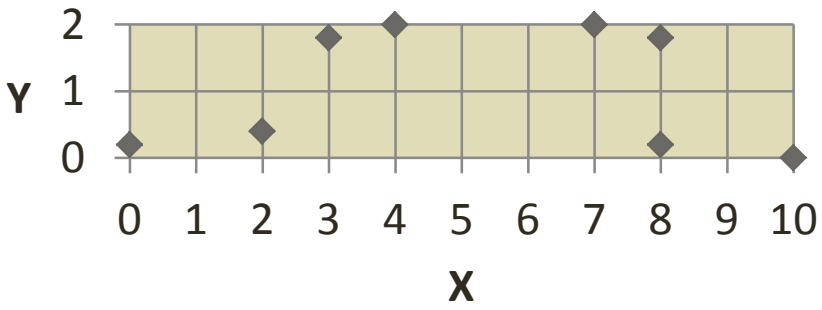
Normalize



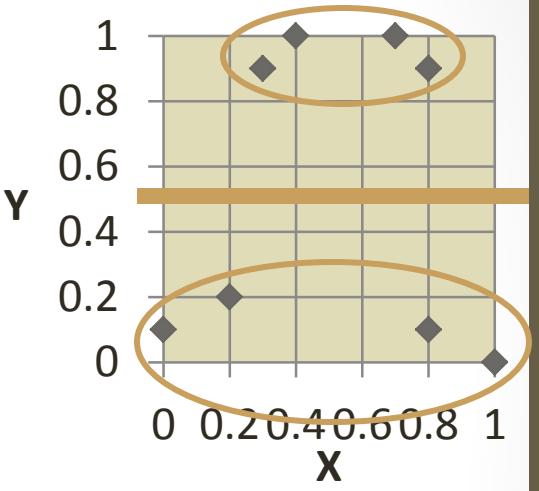
Non-normalized 2D data

Found 2 Clusters in the normalized data

Normalization of a non-linear relationship (6)



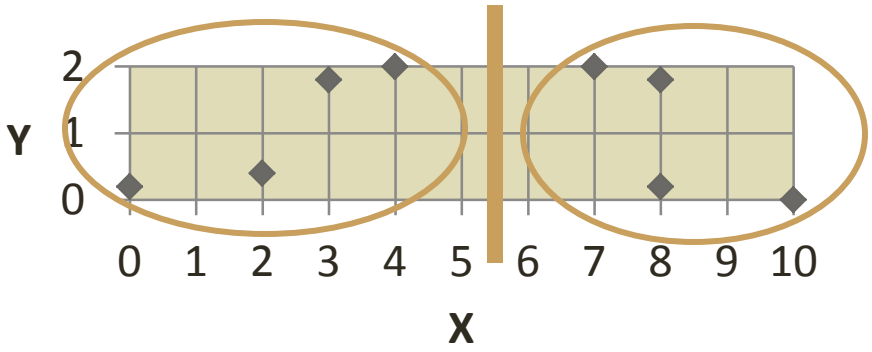
Normalize



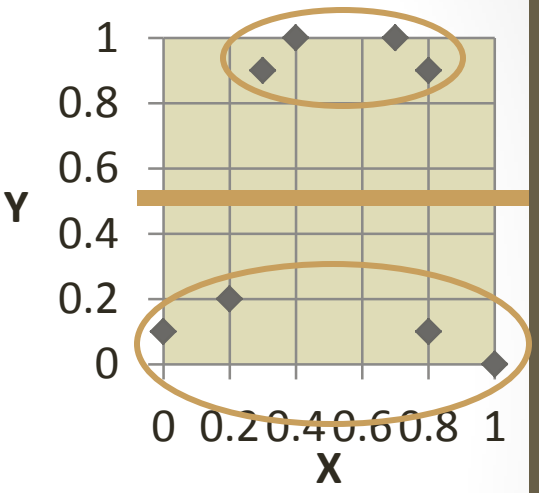
Non-normalized 2D data

Clusters Segment the Image

Normalization of a non-linear relationship (7)



Normalize



Clustering before normalization

Clustering after normalization

Normalization of Linear and Non-Linear Outcomes

- Non-linear (Normalization can change outcome):
- K-Means
- Neural Net

- Linear (Normalization should not change outcome):
- Logistic Regression
- Linear Regression
- Mixture of Gaussians

Normalization in Clustering