Carbon

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1. Load data

```
#load module data
import data
#create a dataset object and read data from file sample.txt
sample = data.DataSet()
#To read nominal data, you have to add argument ‘nominal’,
default is ‘numeric’
#Read data from ‘sample.txt’
sample.read('sample.txt', 'numeric')
#view the data
sample.x
array([[  5.,   1.,   1., ...,   3.,   1.,   1.],
       [  5.,   4.,   4., ...,   3.,   2.,   1.],
       [  3.,   1.,   1., ...,   3.,   1.,   1.],
       ...,
       [  5.,  10.,  10., ...,   8.,  10.,   2.],
       [  4.,   8.,   6., ...,  10.,   6.,   1.],
       [  4.,   8.,   8., ...,  10.,   4.,   1.]])
#view class labels
sample.y[:10]
['2', '2', '2', '2', '2', '4', '2', '2', '2', '2']
#view dataset dimension
sample.dim()
(699, 9)
#view features
sample.label
['Clump Thickness', 'Uniformity of Cell Size', 'Uniformity of
Cell Shape', 'Marginal Adhesion', 'Single Epithelial Cell Size',
'Bare Nuclei', 'Bland Chromatin', 'Normal Nucleoli', 'Mitoses']
#view subject ids
sample.key[:5]
['1000025', '1002945', '1015425', '1016277', '1017023']
#create train dataset and test dataset using 1:10 hold out
train,test = data.holdOut(sample,0.1)
```

2. kNN

This is the k nearest neighbor algorithm in python.

The algorithm only works for: numerical data and nominal class

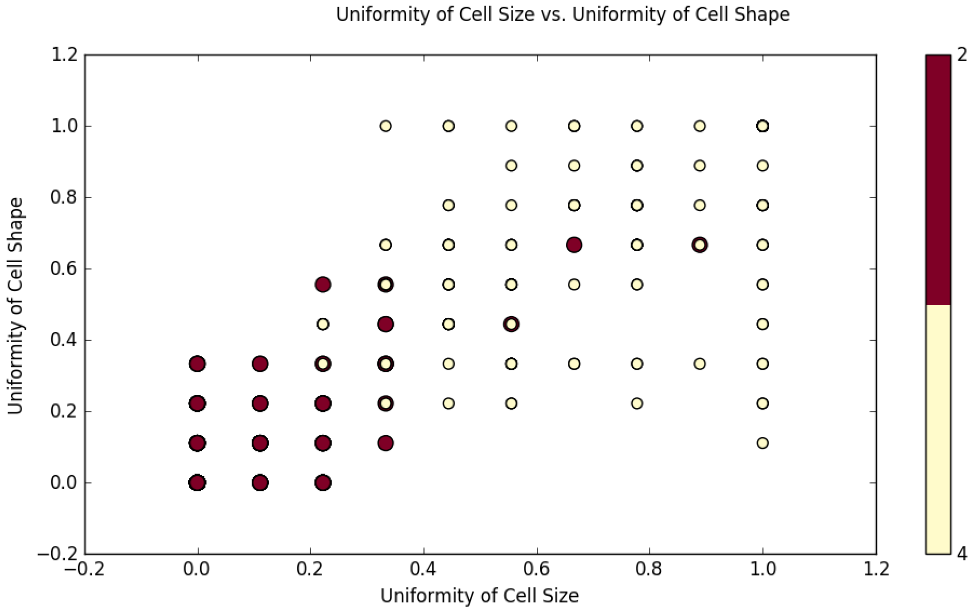
Parameters:

k: int from 1 to inf

distance: ‘euclidean’ , 'correlation'

```
#load kNN module
from supervised import kNN
#create a classifier
clf = kNN.build()
#train the classifier with train data and k=4
clf.train(train,4,dist='euclidean')
```

```
#to view the model by plot 2 features with class label
clf.view('Uniformity of Cell Size','Uniformity of Cell Shape')
```



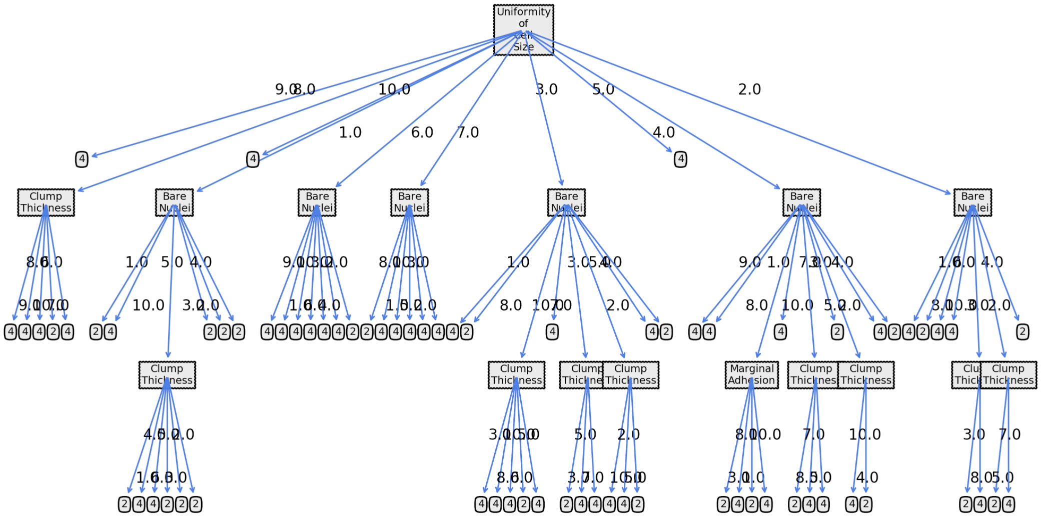
```
#to classify a new subject
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.130435
result
['2', '4', '2', '4', '2', '4', '2', '2', '2', '2', '2', '2', '2',
'2', '4', '2', '2', '2', '4', '2', '4', '4', '2', '2', '2', '4',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '4', '4', '4', '4', '4', '2', '4', '2', '2', '4', '4', '2',
'4', '4', '4', '4', '4', '4', '4', '2', '4', '2', '4', '2', '2',
'4', '2', '4', '4']
#to save the classifier in folder models/ as model.knn
clf.save('model')
#to load saved classifier
clf2 = kNN.load('model')
```

2. ID3

ID3 is an algorithm that generate classification tree based on information gains. The algorithm only works for: nominal data and nominal class

```
#convert continuous data to nominal data
train.num2nom()
test.num2nom()
train.type
'nominal'
#load ID3 module
from supervised import ID3
#create a classifier
clf = ID3.build()
```

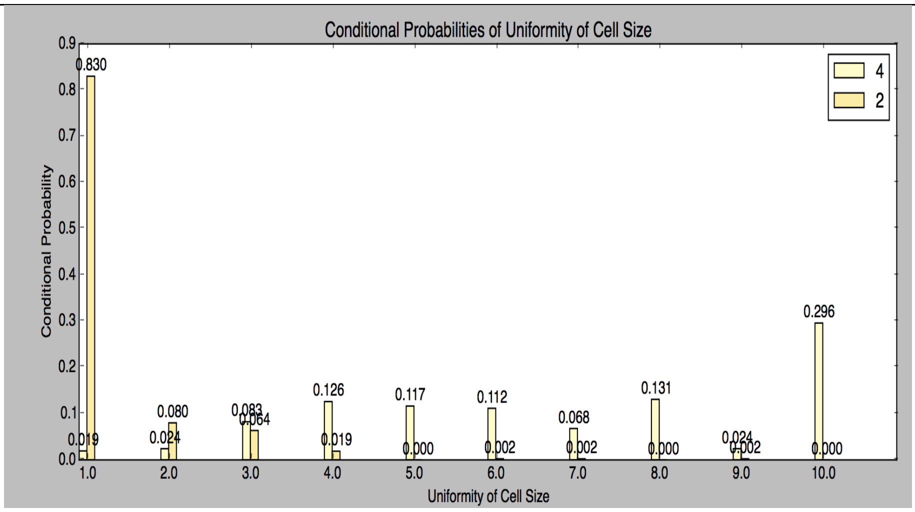
```
#train the classifier with train data to build the tree
clf.train(train)
#to view the model
clf.view()
```



```
#to classify a new subject
clf.classify(['5.0', '4.0', '4.0', '5.0', '7.0', '10.0', '3.0',
'2.0', '1.0'])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.115942
result
['2', '4', '2', '4', '2', '4', '4', '2', '2', '2', '2', '2', '4',
'2', '4', '4', '2', '2', '4', '2', '4', '4', '2', '2', '2', '4',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '2', '2', '4', '4', '4', '2', '4', '2', '2', '4', '4', '4',
'4', '4', '4', '4', '4', '2', '4', '4', '4', '2', '4', '2', '2',
'2', '2', '4', '4']
#to save the classifier in folder models/ as model.id3
clf.save('model')
#to load saved classifier
clf3 = ID3.load('model')
```

4. NB

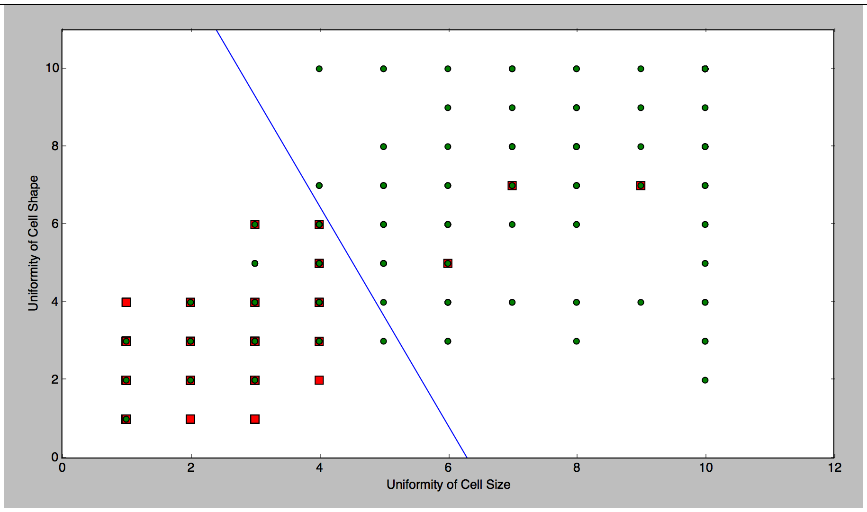
```
#load NB module
import NB
#create a classifier
clf = NB.build()
#train the classifier with train data
clf.train(train)
#to view the model
#we can view the conditional prob of a certain feature
clf.view('Uniformity of Cell Size')
```



```
#to classify a new subject
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.043478
result
['2', '4', '2', '4', '2', '4', '2', '2', '2', '2', '2', '2', '4',
'2', '4', '4', '2', '2', '4', '2', '4', '4', '2', '4', '2', '4',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '4', '4', '4', '4', '4', '2', '4', '2', '2', '4', '4', '4',
'4', '4', '4', '4', '4', '4', '4', '4', '4', '2', '4', '4', '2',
'4', '2', '4', '4']
#to save the classifier in folder models/ as model.nb
clf.save('model')
#to load saved classifier
clf4 = NB.load('model')
```

5. logReg
(Only works for bi-class problems)

```
#load logReg module
import logReg
#create a classifier
clf = logReg.build()
#train the classifier with train data
clf.train(train)
#to view the model
#we can view the model with 2 features over train dataset
#The line in the middle is the possibility of 0.5
clf.view('Uniformity of Cell Size','Uniformity of Cell
Shape',train)
```

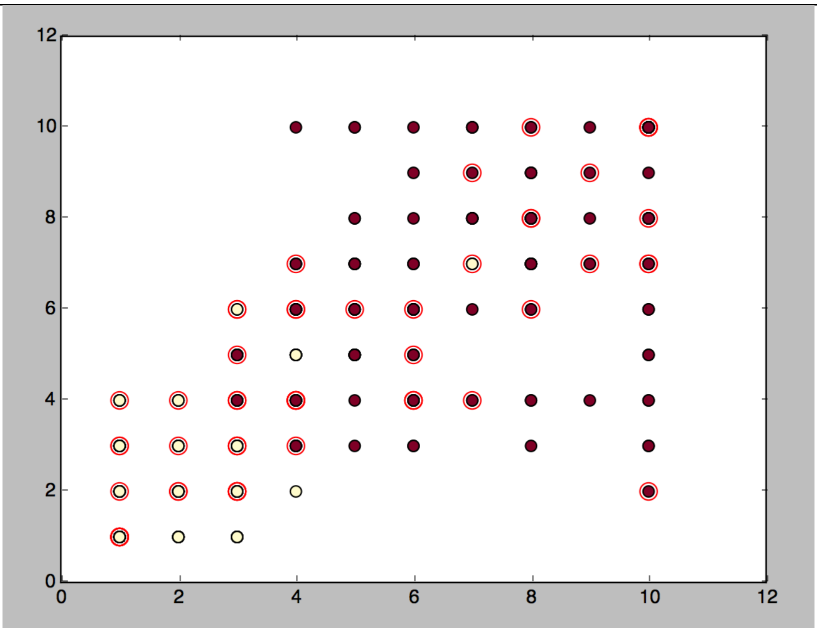


```
#to classify a new subject
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.086957
result
['2', '4', '2', '4', '2', '4', '2', '2', '2', '2', '2', '2', '2',
'2', '4', '4', '2', '2', '4', '2', '4', '4', '2', '4', '2', '4',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '4', '4', '4', '4', '4', '2', '4', '2', '2', '4', '4', '2',
'4', '4', '4', '4', '4', '4', '4', '4', '4', '2', '4', '2', '2',
'4', '2', '4', '4']
#to save the classifier in folder models/ as model.logreg
clf.save('model')
#to load saved classifier
clf5 = logReg.load('model')
```

6. SVM

(Only works for bi-class problems)

```
#load SVM module
import SVM
#create a classifier
clf = SVM.build()
#train the classifier with train data
#Here we set C to 100, tolerance to 0.001 and max iteration
number to 400. And use linear kernel.
clf.train(train,C=100,toler=0.001,maxIter=100,kTup=('lin',0))
#to view the model
#we can view the model with 2 features over train dataset
#circled points are support vectors
clf.view('Uniformity of Cell Size','Uniformity of Cell
Shape',train)
```

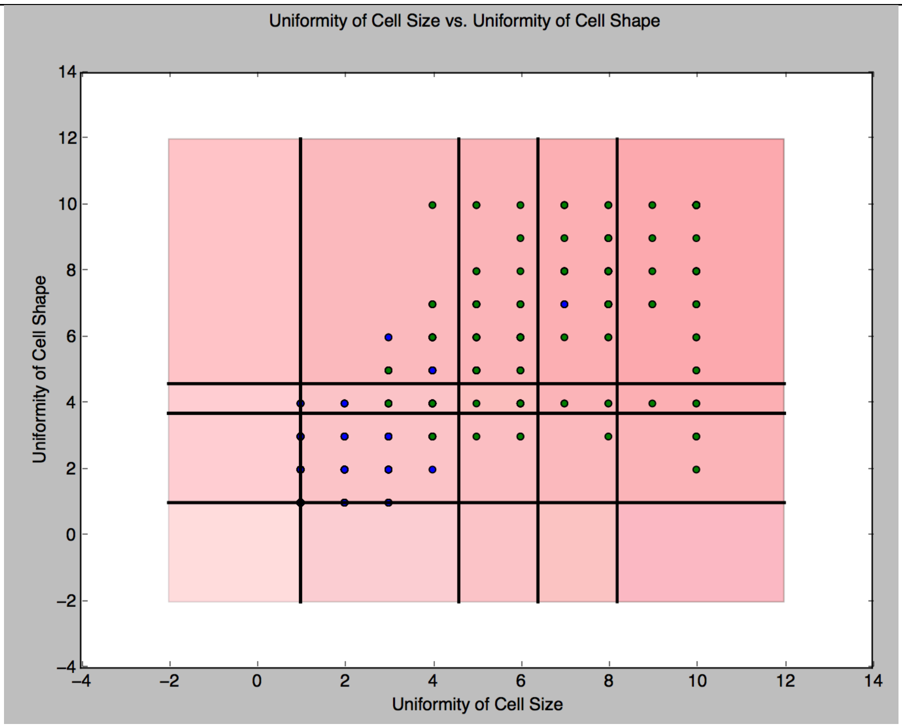


```
#to classify a new subject
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.043478
result
['2', '4', '2', '4', '2', '4', '2', '2', '2', '2', '2', '2', '4',
'2', '4', '4', '2', '2', '4', '2', '4', '4', '2', '4', '2', '4',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '4', '4', '4', '4', '4', '2', '4', '2', '2', '4', '4', '4',
'4', '4', '4', '4', '4', '4', '4', '4', '4', '2', '4', '4', '2',
'4', '2', '4', '4']
#to save the classifier in folder models/ as model.logreg
clf.save('model')
#to load saved classifier
clf6 = SVM.load('model')
```

7. AdaBoost

(Only works for bi-class problems)

```
#load Ada module
import Ada
#create a classifier
clf = Ada.build()
#train the classifier with train data
#maximum number of iteration is 50
clf.train(train,numIt=50)
#to view the model
#we can view the model with 2 features over train dataset
#circled points are support vectors
clf.view('Uniformity of Cell Size','Uniformity of Cell
Shape',train)
```



```
#to classify a new subject
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
#test the classifier with test data
#and save the predicted labels in result
result = clf.test(test)
the total error rate is: 0.130435
result
['2', '4', '2', '4', '2', '4', '2', '2', '2', '2', '2', '2', '4',
'2', '4', '2', '2', '2', '4', '2', '4', '4', '2', '4', '2', '2',
'2', '2', '2', '2', '2', '2', '4', '2', '2', '2', '4', '2', '4',
'4', '4', '4', '4', '2', '4', '2', '4', '2', '2', '4', '4', '4',
'4', '4', '4', '4', '4', '2', '4', '4', '4', '2', '4', '2', '2',
'2', '2', '4', '4']
#to save the classifier in folder models/ as model.logreg
clf.save('model')
#to load saved classifier
clf7 = Ada.load('model')
```

8. Regression

There are some regression algorithms based on linear regression. We have ‘linear’ for regular linear regression, ‘lwlr’ for locally weighted linear regression.
The algorithm only works for: numerical data and numerical classes
Parameters:

method: 'linear', 'lwlr', 'ridge'

```
#load reg module
from supervised import reg
#create a classifier
```

```
clf =reg.build()
#train the classifier with train data, and choose a method
#1.linear regression
clf.train(train, method='linear')
0.869617690359
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
result = clf.test(test)
the total error rate is: 0.173913
#2.locally weighted linear regression
clf.train(train, method='lwlr',k=10)
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
result = clf.test(test)
the total error rate is: 0.144928
#3.ridge linear regression
clf.train(train, method='ridge',l=100)
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
'4'
result = clf.test(test)
the total error rate is: 0.188406
#to view the model
#we can view the model with 2 features over train dataset
clf.view('Uniformity of Cell Size','Uniformity of Cell
Shape',train)
#to save the classifier in folder models/ as model.logreg
clf.save('model')
#to load saved classifier
clf7 = Ada.load('model')
```

```
#fast start
import data
sample = data.DataSet()
sample.read('sample.txt')
train,test = data.holdOut(sample,0.1)
from imp import reload

reload(reg)
clf = reg.build()
clf.train(train,method='lwlr')
clf.classify([5, 4, 4, 5, 7, 10, 3, 2, 1])
clf.view('Uniformity of Cell Size','Uniformity of Cell
Shape',train)
```