modified_final

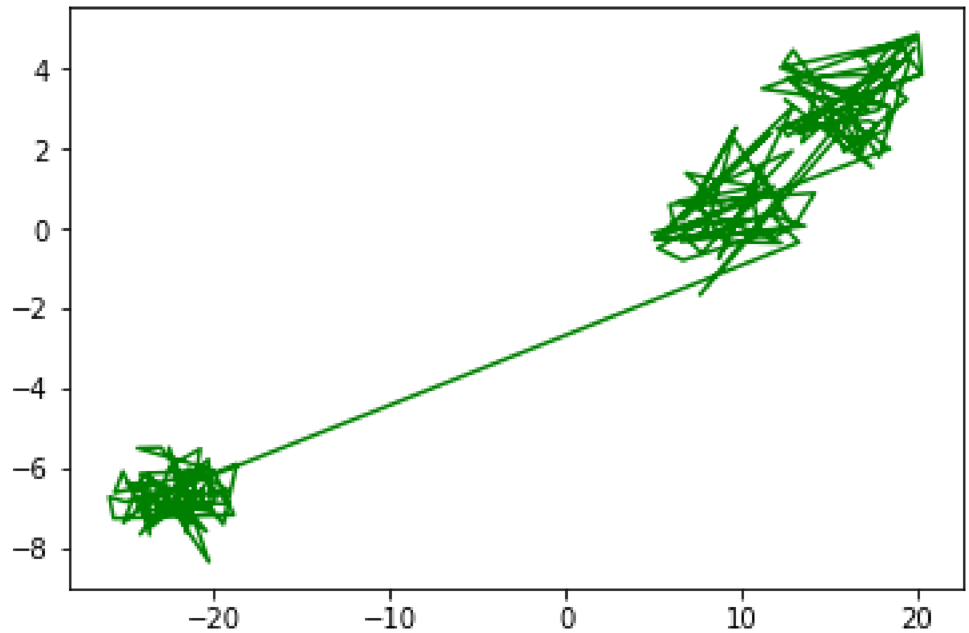
May 6, 2018

```
In [30]: %pylab inline
```

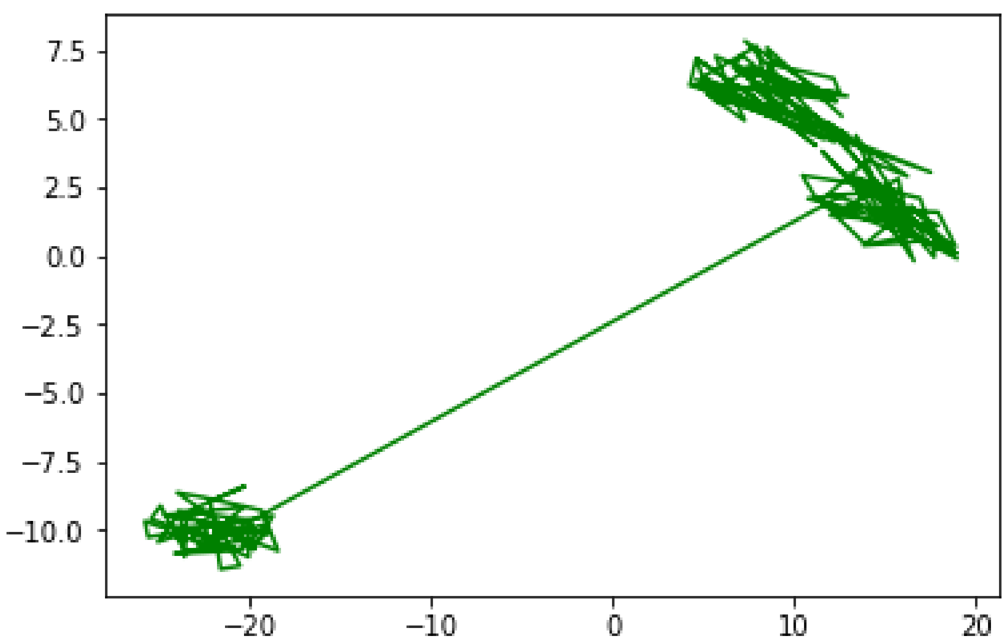
```
Populating the interactive namespace from numpy and matplotlib
```

```
In [4]: from sklearn.manifold import TSNE

In [5]: # Loading the iris datset
        from sklearn.datasets import load_iris
        iris = load_iris()

In [8]: iris.keys()

Out[8]: dict_keys(['data', 'target', 'target_names', 'DESCR', 'feature_names'])

In [9]: iris.target_names

Out[9]: array(['setosa', 'versicolor', 'virginica'], dtype='<U10')

In [10]: iris.feature_names

Out[10]: ['sepal length (cm)',
          'sepal width (cm)',
          'petal length (cm)',
          'petal width (cm)']

In [11]: iris.target

Out[11]: array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
                1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
                1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
                2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
                2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2])

In [28]: from sklearn.manifold import TSNE
         X = np.array([[0, 0, 0], [0, 1, 1], [1, 0, 1], [1, 1, 1]])
         # X_embedded = TSNE(n_components=2).fit_transform(iris.data)
         X_embedded = TSNE(learning_rate = 100).fit_transform(iris.data)
         X_embedded.shape
```

```
Out[28]: (150, 2)

In [29]: plt.plot( X_embedded[:,0], X_embedded[:,1] , 'g')

Out[29]: [<matplotlib.lines.Line2D at 0x166b2f28358>]
```

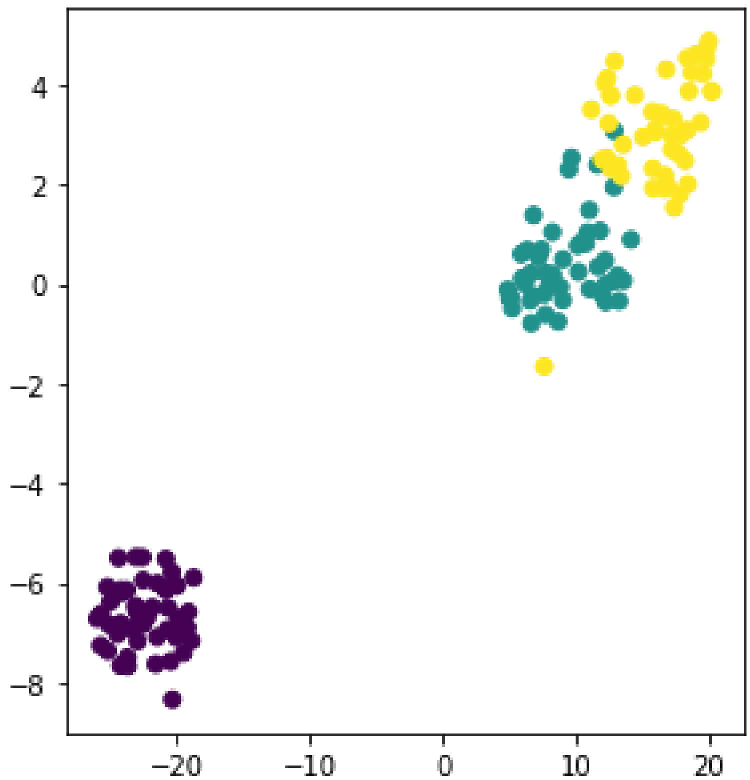



```
In [26]: plt.plot( X_embedded[:,0], X_embedded[:,1] , 'g')

Out[26]: [<matplotlib.lines.Line2D at 0x166b2ec8438>]
```



```
In [38]: figure(figsize = (10,5) )
         subplot(121)
         scatter(X_embedded[:,0], X_embedded[:,1], c = iris.target  )
```

```
Out[38]: <matplotlib.collections.PathCollection at 0x166b326beb8>
```




```
In [46]: x_min = X_embedded[:,0].min()
```

```
In [47]: x_max = X_embedded[:,0].max()
```

```
In [48]: y_min = X_embedded[:,1].min()
         y_max = X_embedded[:,1].max()
```

```
In [49]: Limts = [ [ x_min , x_max] , [y_min, y_max] ]
```

```
In [50]: Limts
```

```
Out[50]: [[-25.9487, 20.243372], [-8.339147, 4.883639]]
```

In [89]:
```
def find_good_size(Limits,windowSize):
    x_min = Limits[0][0]
    x_max = Limits[0][1]
    y_min = Limits[1][0]
    y_max = Limits[1][1]
    from math import floor , ceil
    # Clean the matrix
    x_min = floor(x_min)
    x_max = ceil(x_max)
    y_min = floor(y_min)
    y_max = ceil(y_max)

    # Printing the cleaend up values.
    print(x_min,x_max,y_min, y_max)

    # Fitting the size to handle the windows
    a = (x_max - x_min) % windowSize
    b = (y_max - y_min) % windowSize

    if ( (x_max + a) % windowSize == 0):
        x_max = x_max + a
    else:
        x_max = x_max + (windowSize - a)

    if ( (y_max + b) % windowSize == 0):
        y_max = y_max + b
    else:
        y_max = y_max + (windowSize - b)

    print("You Can use this matrix now.")
    print("X_min=",x_min)
    print("X_max=",x_max)
    print("Y_min=",y_min)
    print("Y_max=",y_max)
    print("And the Matrix Shape:", (x_max - x_min) , " * ", (y_max - y_min))
    return [[x_min,x_max],[y_min,y_max]]
```

In [90]:
```
find_good_size(Limts,1)
```

```
-26 21 -9 5
You Can use this matrix now.
X_min= -26
X_max= 21
Y_min= -9
Y_max= 5
And the Matrix Shape: 47  *  14
```

Out[90]: [[-26, 21], [-9, 5]]

In [66]:
```
find_good_size(Limts,10)
```

```
-26 21 -9 5
You Can use this matrix now.
X_min= -26
X_max= 24
Y_min= -9
Y_max= 11
And the Matrix Shape: 50  *  20
```

Out[66]: [[-26, 24], [-9, 11]]

In [91]:
```
def tell_windows(Limts,windowSize):
    g = find_good_size(Limts,windowSize)
    # Going Row Wise:
    count = 0
    for i in range(g[0][0],g[0][1],windowSize):
        for j in range(g[1][0],g[1][1],windowSize):
            count += 1
            print("<Window:",count,">","X:[", i, ",", i +windowSize , "]" , "Y:[", j,
    print("Total Count:",count)
    ans = (g[0][1]-g[0][0])*(g[1][1]-g[1][0]) // (windowSize ** 2)
    print("Expected Count:",ans)
    print("OKAY:", count == ans )
```

In [93]:
```
tell_windows([[0,3],[0,3]],1)
```

```
0 3 0 3
You Can use this matrix now.
X_min= 0
X_max= 3
Y_min= 0
Y_max= 3
And the Matrix Shape: 3  *  3
<Window: 1 > X:[ 0 , 1 ] Y:[ 0 , 1 ]
<Window: 2 > X:[ 0 , 1 ] Y:[ 1 , 2 ]
<Window: 3 > X:[ 0 , 1 ] Y:[ 2 , 3 ]
<Window: 4 > X:[ 1 , 2 ] Y:[ 0 , 1 ]
<Window: 5 > X:[ 1 , 2 ] Y:[ 1 , 2 ]
<Window: 6 > X:[ 1 , 2 ] Y:[ 2 , 3 ]
<Window: 7 > X:[ 2 , 3 ] Y:[ 0 , 1 ]
<Window: 8 > X:[ 2 , 3 ] Y:[ 1 , 2 ]
<Window: 9 > X:[ 2 , 3 ] Y:[ 2 , 3 ]
Total Count: 9
Expected Count: 9
OKAY: True
```

```
In [94]: tell_windows([[0,3],[0,3]],3)

0 3 0 3
You Can use this matrix now.
X_min= 0
X_max= 3
Y_min= 0
Y_max= 3
And the Matrix Shape: 3  *  3
<Window: 1 > X:[ 0 , 3 ] Y:[ 0 , 3 ]
Total Count: 1
Expected Count: 1
OKAY: True


In [95]: tell_windows([[0,3],[0,3]],5)

0 3 0 3
You Can use this matrix now.
X_min= 0
X_max= 5
Y_min= 0
Y_max= 5
And the Matrix Shape: 5  *  5
<Window: 1 > X:[ 0 , 5 ] Y:[ 0 , 5 ]
Total Count: 1
Expected Count: 1
OKAY: True


In [77]: Limts

Out[77]: [[-25.9487, 20.243372], [-8.339147, 4.883639]]

In [103]: # Okay So now We have a function which finds the windows we just now need to calcula
          def calEntropy(window,label):
              'Takes: [x_min, x_max],[y_min, y_max]'
              'returns entropy of the window'
              x_min, x_max , y_min, y_max = window
              # Set up entropy to be zero
              en = 0
              from math import log
              c = [0,0,0]
              # Calculate the number of samples in this window.
              # X_embedded stores the data.
              for i in range(150):
                  cx = X_embedded[i][0]
                  cy = X_embedded[i][1]
                  if x_min <= cx <=x_max and y_min <= cy <= y_max:
```

```
            print("Found a sample of class:",label[i])
            c[label[i]] += 1
    t = c[0] + c[1] + c[2]
    for i in c:
        if i!= 0:
            en += - ( i/t * log(i/t) )
    print("Found Entropy:",en)
    return en
```

```
In [109]: def tell_windows(Limts,windowSize,target):
              g = find_good_size(Limts,windowSize)
              # Going Row Wise:
              total_ent = 0
              count = 0
              for i in range(g[0][0],g[0][1],windowSize):
                  for j in range(g[1][0],g[1][1],windowSize):
                      count += 1
                      print("<Window:",count,">","X:[", i, ",", i +windowSize , "]" , "Y:[", j
                      total_ent += calEntropy([i,windowSize+i, j, windowSize+j], target)
              print("Total Count:",count)
              ans = (g[0][1]-g[0][0])*(g[1][1]-g[1][0]) // (windowSize ** 2)
              print("Expected Count:",ans)
              print("OKAY:", count == ans )
              print("-----Done----",total_ent)
              return total_ent
```

```
In [113]: def add_noise(percentage):
              'Adds the given percentage of noise to the iris data and returns the new data'
              # Original
              target = [0 for i in range(50)] + [ 1 for i in range(50)] + [ 2 for i in range(5
              # 0   - 50   : class 0
              # 50 - 100   : class 1
              # 100 - 150  : class 2
              # We will change the labels in a class label randomly
              import random
              # Offset for percentage => (window size)* precentage
              offset = 50 * percentage // 100
              for i in range(0, 0 + offset ):
                  target[i] = random.choice([1,2])
              for i in range(50, 50 + offset):
                  target[i] = random.choice([0,2])
              for i in range(100,100 + offset):
                  target[i] = random.choice([0,1])

              # Got the new labeled data
              # Now we can plot the tsne with this.
              #print("Plotting the data with Noise => ", percentage , " %")
              figure( figsize = (20,10))
```

```
            subplot(242)
            scatter(X_embedded[:,0], X_embedded[:,1], c = target)
            print("Done!")
            return target
```

In [115]:
```
def main(windowSize, noise):
            return tell_windows(Limts,windowSize,add_noise(noise))
```

In [ ]:
```
xxxx = []
yyyy = []
for i in range(0,100,10):
    xxxx.append(i)
    yyyy.append(main(3,i))
```

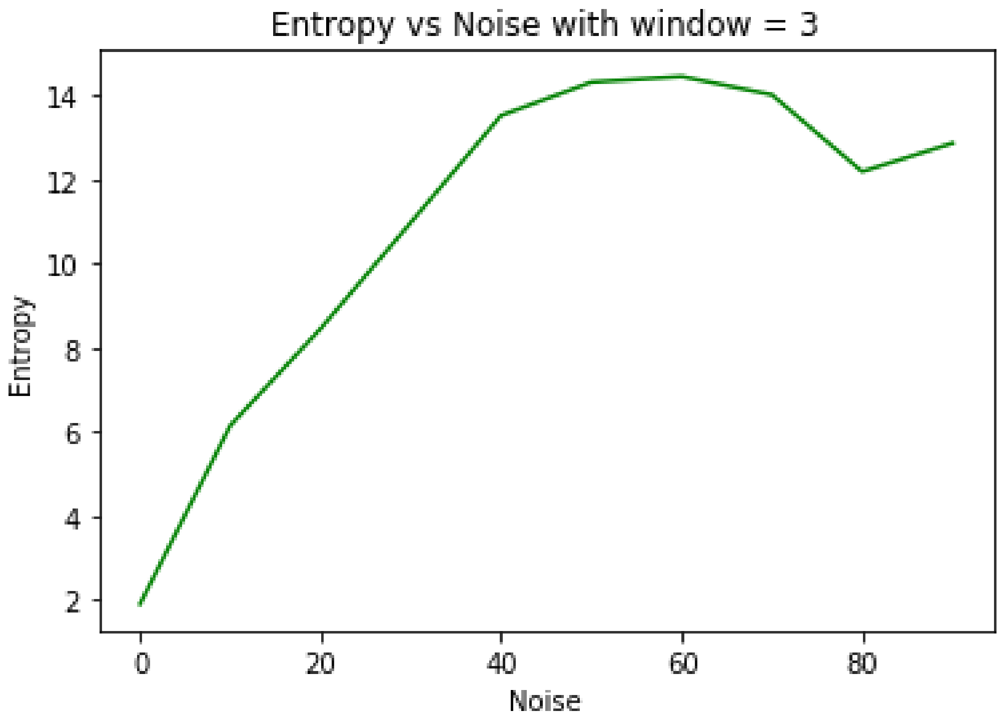
In [118]:
```
xxxx
```

Out[118]:
```
[0, 10, 20, 30, 40, 50, 60, 70, 80, 90]
```

In [119]:
```
yyyy
```

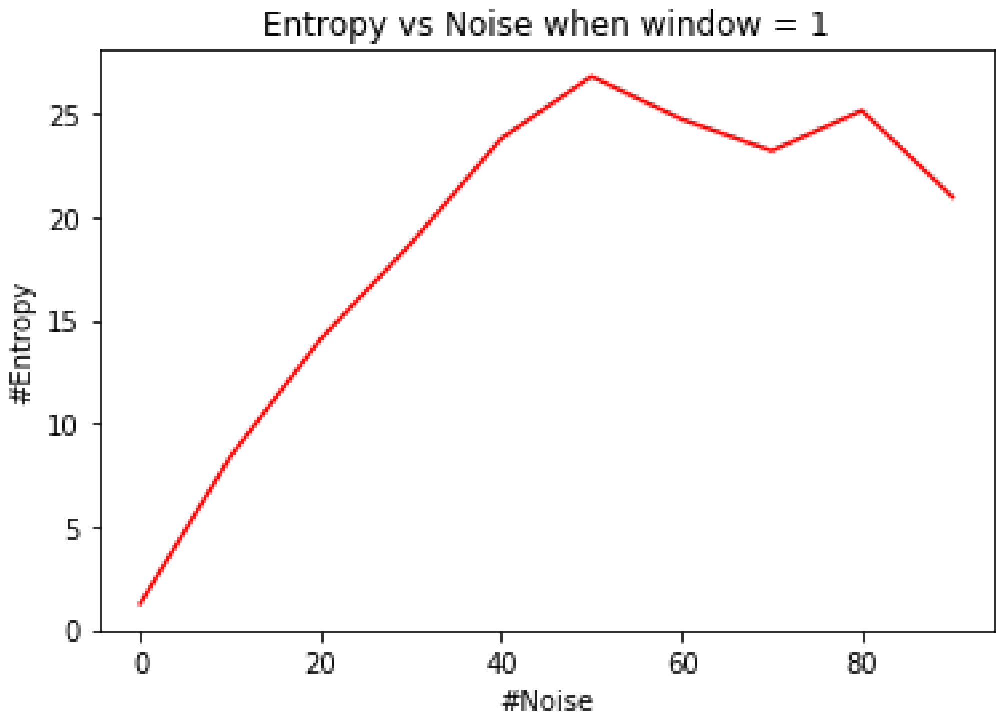
Out[119]:
```
[1.9059782130166705,
 5.833869503703472,
 8.146882998185937,
 10.507330121040468,
 13.927450011307299,
 14.301825684532538,
 12.619612365784652,
 15.087570013154586,
 13.689747163330022,
 13.465812334559693]
```

In [120]:
```
plt.plot(x,y,'g')
plt.xlabel('Noise')
plt.ylabel('Entropy')
plt.title('Entropy vs Noise with window = 3')
plt.show()
```




```
In [ ]: xxxx = []
        yyyy = []
        for i in range(0,100,10):
            xxxx.append(i)
            yyyy.append(main(1,i))
```

```
In [122]: plt.plot(xxxx,yyyy,'r')
          plt.xlabel('#Noise')
          plt.ylabel('#Entropy')
          plt.title('Entropy vs Noise when window = 1')
          plt.show()
```




```
In [126]: dataSet
```

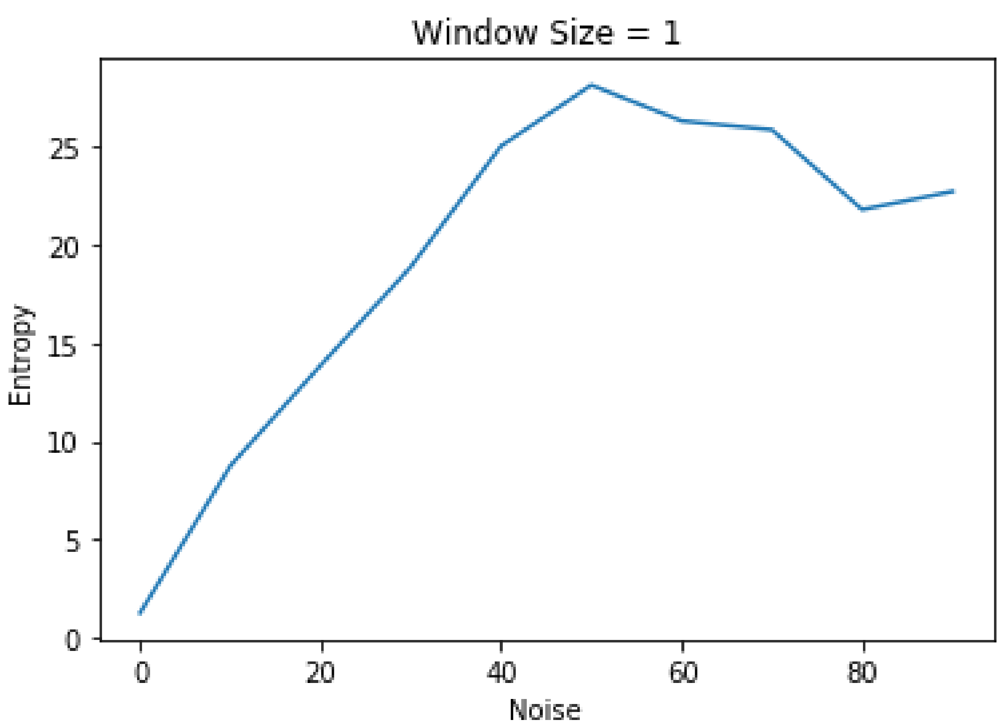
```
Out[126]: [[[], []],
           [[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
            [1.2554823251787535,
             8.73851878067532,
             13.853681503172105,
             18.878635726235473,
             25.02940503282032,
             28.127269243771856,
             26.30719326841124,
             25.858124148322695,
             21.792007983531576,
             22.716655925390782]],
           [[], []],
           [[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
            [1.9059782130166705,
             5.906832364815045,
             8.501479237313205,
             10.879963858860972,
             14.168158576926993,
             14.028571586277163,
             14.32908036737314,
             13.426159812900783,
```

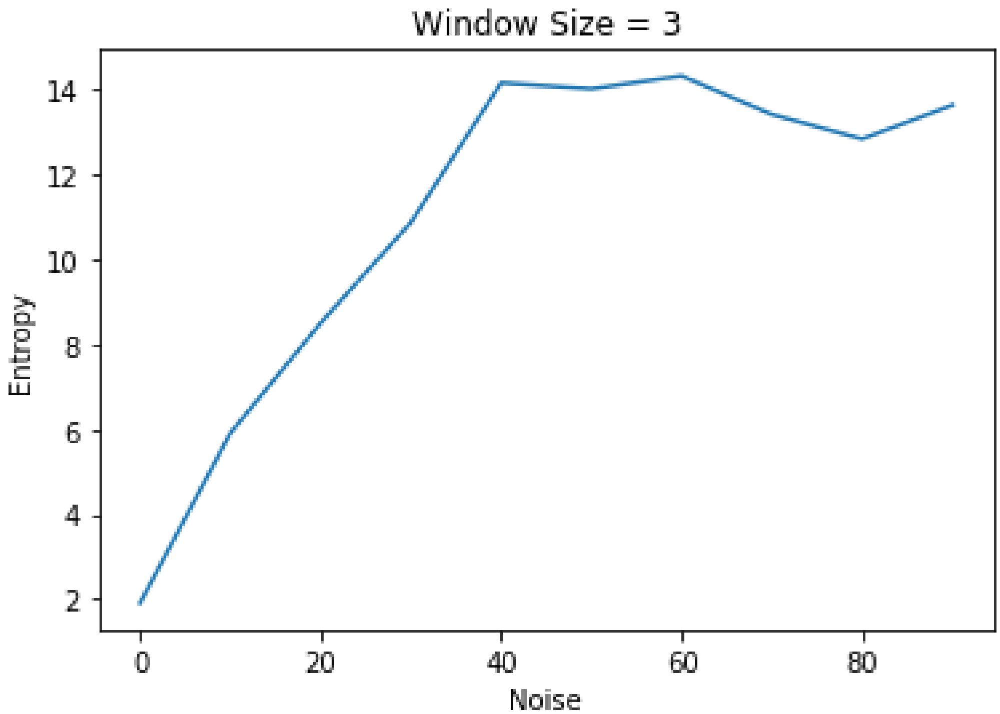
```
  12.847992308871694,
  13.64677921343577]],
[[], []],
[[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
 [0.8377336454040922,
  3.1059009623027247,
  4.348245698116212,
  6.66788264811653,
  7.452498242994488,
  7.6894883073824065,
  7.321481995767062,
  7.438085109160104,
  6.891550087350982,
  7.177780753797773]]]
```

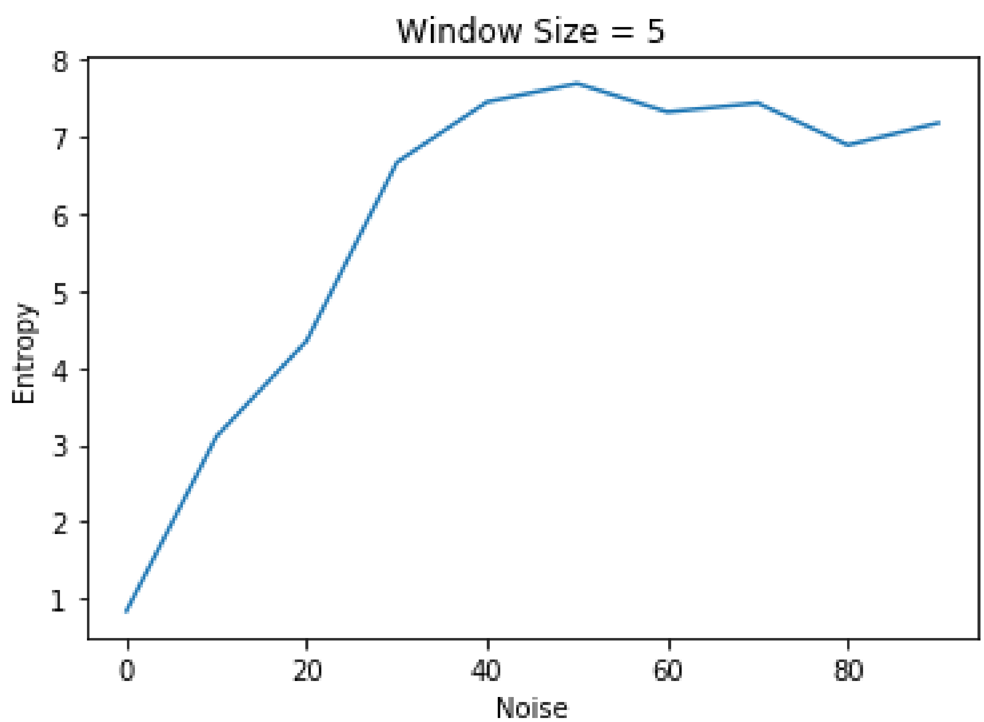
```
In [131]: print("The final plots are")
          def plotter(i):
              plt.plot(dataSet[i][0],dataSet[i][1])
              plt.title('Window Size = ' + str(i))
              plt.xlabel('Noise')
              plt.ylabel('Entropy')
```

```
The final plots are
```

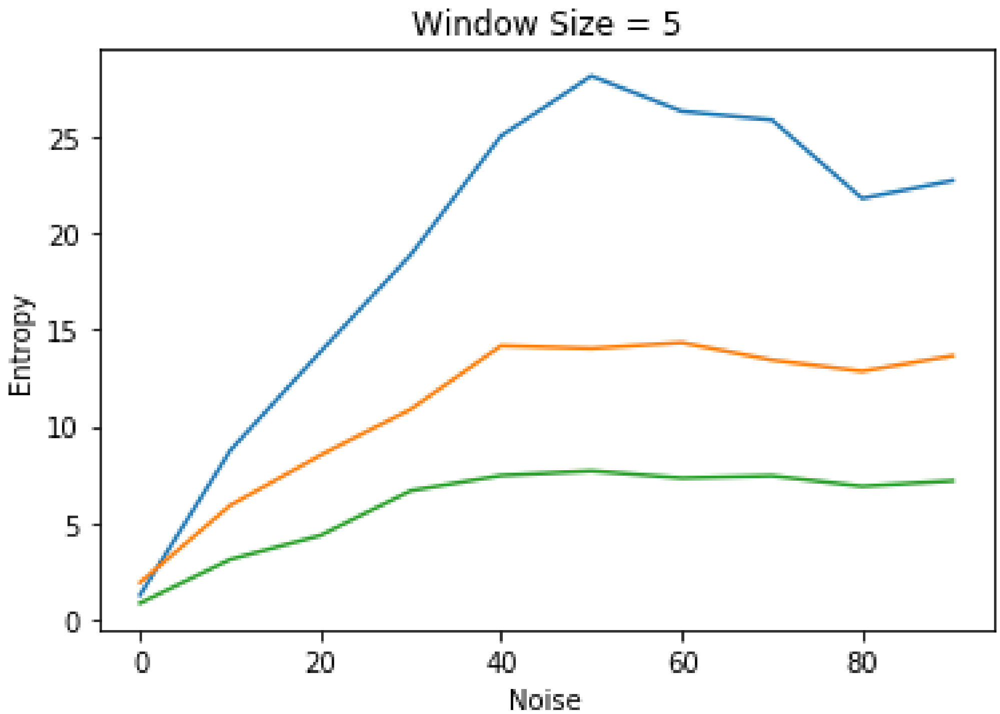
```
In [130]: plotter(1)
          plotter(3)
          plotter(5)
```




Window Size = 3
Entropy
Noise
14
12
10
8
6
4
2
0
20
40
60
80


Window Size = 5
Entropy
Noise
8
7
6
5
4
3
2
1
0
20
40
60
80

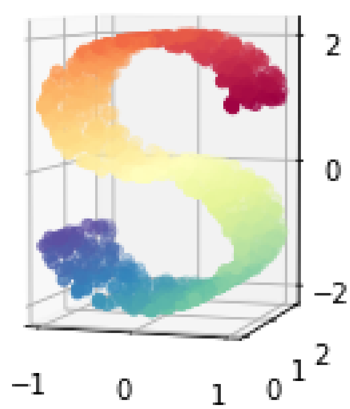
```
In [132]: plotter(1)
          plotter(3)
          plotter(5)
          plt.show()
```




```
In [133]: # Done !

In [2]: from sklearn.datasets import make_s_curve

In [3]: data  = make_s_curve(1000)

In [4]: X , color = data

In [15]: color

Out[15]: array([ 4.62590248, -0.74717365, -0.8089283 ,  0.64600174, -1.00856807,
               -1.35994855,  0.30382899,  0.85694722,  1.09691957,  2.86387081,
               -2.43520539,  3.10044656,  0.53626378,  1.54424571, -1.73270459,
                2.8778216 , -3.07983758,  3.61810578,  2.6289297 , -0.19716788,
                2.73497637,  0.86716022, -1.24633255, -2.9416969 ,  0.85888346,
                3.69539385, -4.0929808 ,  0.99843329,  3.48273766, -2.24468944,
```

```
       -0.95683651, -2.12659622, -3.298821  , -1.17963896, -4.34202165,
        2.62842537, -2.13055023,  3.3530965 , -0.64357187,  0.07174887,
        4.13946263, -1.77985322, -3.23064293, -2.75697064, -3.61175332,
       -3.91048314, -3.292621  , -2.96919097, -1.75862586,  2.99718299,
       -1.92288939,  0.07895313,  1.65438796, -2.80766226, -4.67137716,
       -0.61427325, -1.06844967, -1.28020641, -1.50579134, -1.14350657,
       -2.15996905,  2.53145053, -4.56041779, -4.70760096, -2.71422103,
       -1.53439067, -1.05214014,  3.78771644, -0.12673047, -2.602792  ,
       -4.20325067,  1.62435824, -3.87119547, -4.48670075,  3.27418419,
        0.72213804, -4.21665516, -0.28512067, -2.88054798, -1.50001098,
        0.16021828, -1.1338392 ,  1.59326306,  0.79422103, -0.29942079,
        2.71402278, -2.25376839,  0.30884624, -1.57079085, -2.50465556,
        3.59327631,  0.56553859,  1.69692782,  3.03870457, -3.24425237,
        3.81761412, -4.06810105, -4.620459  , -2.56511165,  3.97996538])
```

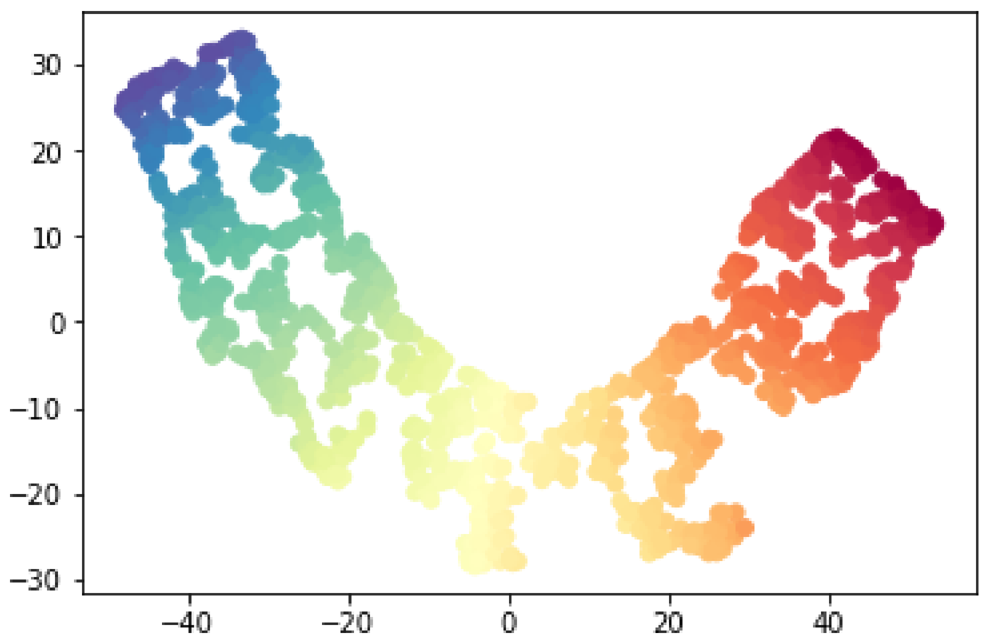
In [6]:
```
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import pyplot as plt
from matplotlib.ticker import NullFormatter
Axes3D

fig = plt.figure( figsize = (15, 8))
ax = fig.add_subplot(251, projection = '3d')
ax.scatter( X[:,0] , X[:,1], X[:,2], c=color, cmap = plt.cm.Spectral)
ax.view_init(4,-72)
```



In [7]:
```
# The shape of the data is as shown above
# Now we apply the tsne on this reduced dataset
from sklearn import manifold
```

```
tsne = manifold.TSNE(n_components = 2)
Y = tsne.fit_transform(X)

print("done")
ax = fig.add_subplot(2,5,10)
plt.scatter(Y[:,0],Y[:,1], c=color, cmap = plt.cm.Spectral)
ax.xaxis.set_major_formatter(NullFormatter())
ax.yaxis.set_major_formatter(NullFormatter())
plt.axis('tight')
plt.show()
```

```
done
```



In [21]:
```
# Now applying the window and the weights
color
```

Out[21]:
```
array([ 4.62590248, -0.74717365, -0.8089283 ,  0.64600174, -1.00856807,
       -1.35994855,  0.30382899,  0.85694722,  1.09691957,  2.86387081,
       -2.43520539,  3.10044656,  0.53626378,  1.54424571, -1.73270459,
        2.8778216 , -3.07983758,  3.61810578,  2.6289297 , -0.19716788,
        2.73497637,  0.86716022, -1.24633255, -2.9416969 ,  0.85888346,
        3.69539385, -4.0929808 ,  0.99843329,  3.48273766, -2.24468944,
       -0.95683651, -2.12659622, -3.298821  , -1.17963896, -4.34202165,
        2.62842537, -2.13055023,  3.3530965 , -0.64357187,  0.07174887,
        4.13946263, -1.77985322, -3.23064293, -2.75697064, -3.61175332,
```

```
        -3.91048314, -3.292621  , -2.96919097, -1.75862586,  2.99718299,
        -1.92288939,  0.07895313,  1.65438796, -2.80766226, -4.67137716,
        -0.61427325, -1.06844967, -1.28020641, -1.50579134, -1.14350657,
        -2.15996905,  2.53145053, -4.56041779, -4.70760096, -2.71422103,
        -1.53439067, -1.05214014,  3.78771644, -0.12673047, -2.602792  ,
        -4.20325067,  1.62435824, -3.87119547, -4.48670075,  3.27418419,
         0.72213804, -4.21665516, -0.28512067, -2.88054798, -1.50001098,
         0.16021828, -1.1338392 ,  1.59326306,  0.79422103, -0.29942079,
         2.71402278, -2.25376839,  0.30884624, -1.57079085, -2.50465556,
         3.59327631,  0.56553859,  1.69692782,  3.03870457, -3.24425237,
         3.81761412, -4.06810105, -4.620459  , -2.56511165,  3.97996538])
```

```
In [8]: def modified_class_getter(color):
            from math import ceil
            new_color = []
            for i in color:
                new_color.append(ceil(i))
            return new_color
```

```
In [9]: n_color = modified_class_getter(color)
```

```
In [10]: def find_good_size(Limits,windowSize):
             x_min = Limits[0][0]
             x_max = Limits[0][1]
             y_min = Limits[1][0]
             y_max = Limits[1][1]
             from math import floor , ceil
             # Clean the matrix
             x_min = floor(x_min)
             x_max = ceil(x_max)
             y_min = floor(y_min)
             y_max = ceil(y_max)

             # Printing the cleaend up values.
             print(x_min,x_max,y_min, y_max)

             # Fitting the size to handle the windows
             a = (x_max - x_min) % windowSize
             b = (y_max - y_min) % windowSize

             if ( (x_max + a) % windowSize == 0):
                 x_max = x_max + a
             else:
                 x_max = x_max + (windowSize - a)

             if ( (y_max + b) % windowSize == 0):
                 y_max = y_max + b
             else:
```

```
            y_max = y_max + (windowSize - b)

        print("You Can use this matrix now.")
        print("X_min=",x_min)
        print("X_max=",x_max)
        print("Y_min=",y_min)
        print("Y_max=",y_max)
        print("And the Matrix Shape:", (x_max - x_min) , " * ", (y_max - y_min))
        return [[x_min,x_max],[y_min,y_max]]
```

```
In [11]: X_embedded = Y
         x_min = X_embedded[:,0].min()
         x_max = X_embedded[:,0].max()
         y_min = X_embedded[:,1].min()
         y_max = X_embedded[:,1].max()
```

```
In [12]: Lmts = [[x_min,x_max], [y_min, y_max]]
```

```
In [13]: Lmts
```

```
Out[13]: [[-48.031948, 53.174355], [-28.483036, 33.060825]]
```

```
In [14]: def tell_windows(Limts,windowSize):
             g = find_good_size(Limts,windowSize)
             # Going Row Wise:
             count = 0
             for i in range(g[0][0],g[0][1],windowSize):
                 for j in range(g[1][0],g[1][1],windowSize):
                     count += 1
                     print("<Window:",count,">","X:[", i, ",", i +windowSize , "]" , "Y:[", j,
             print("Total Count:",count)
             ans = (g[0][1]-g[0][0])*(g[1][1]-g[1][0]) // (windowSize ** 2)
             print("Expected Count:",ans)
             print("OKAY:", count == ans )
```

```
In [15]: # Okay So now We have a function which finds the windows we just now need to calculat
         def calEntropy(window,label):
             'Takes: [x_min, x_max],[y_min, y_max]'
             'returns entropy of the window'
             x_min, x_max , y_min, y_max = window
             # Set up entropy to be zero
             en = 0
             from math import log
             c = [0,0,0]
             # Calculate the number of samples in this window.
             # X_embedded stores the data.
             for i in range(150):
                 cx = X_embedded[i][0]
```

```
            cy = X_embedded[i][1]
            if x_min <= cx <=x_max and y_min <= cy <= y_max:
                print("Found a sample of class:",label[i])
                c[label[i]] += 1
        t = c[0] + c[1] + c[2]
        for i in c:
            if i!= 0:
                en += - ( i/t * log(i/t) )
        print("Found Entropy:",en)
        return en
```

```
In [16]: def tell_windows(Limts,windowSize,target):
             g = find_good_size(Limts,windowSize)
             # Going Row Wise:
             total_ent = 0
             count = 0
             for i in range(g[0][0],g[0][1],windowSize):
                 for j in range(g[1][0],g[1][1],windowSize):
                     count += 1
                     print("<Window:",count,">","X:[", i, ",", i +windowSize , "]" , "Y:[", j,
                     total_ent += calEntropy([i,windowSize+i, j, windowSize+j], target)
             print("Total Count:",count)
             ans = (g[0][1]-g[0][0])*(g[1][1]-g[1][0]) // (windowSize ** 2)
             print("Expected Count:",ans)
             print("OKAY:", count == ans )
             print("-----Done----",total_ent)
             return total_ent
```

```
In [17]: def add_noise(percentage):
             'Adds the given percentage of noise to the iris data and returns the new data'
             # Original
             target = [0 for i in range(50)] + [ 1 for i in range(50)] + [ 2 for i in range(50
             # 0   - 50   : class 0
             # 50 - 100   : class 1
             # 100 - 150  : class 2
             # We will change the labels in a class label randomly
             import random
             # Offset for percentage => (window size)* precentage
             offset = 50 * percentage // 100
             for i in range(0, 0 + offset ):
                 target[i] = random.choice([1,2])
             for i in range(50, 50 + offset):
                 target[i] = random.choice([0,2])
             for i in range(100,100 + offset):
                 target[i] = random.choice([0,1])

             # Got the new labeled data
             # Now we can plot the tsne with this.
```

```
        #print("Plotting the data with Noise => ", percentage , " %")
        figure( figsize = (20,10))
        subplot(242)
        scatter(X_embedded[:,0], X_embedded[:,1], c = target)
        print("Done!")
        return target
```

In [18]:
```
def main(windowSize, noise):
    return tell_windows(Limts,windowSize,add_noise(noise))
```

In [19]:
```
# Sort the class
dataTp = [ [ n_color[i], X_embedded[i] ] for i in range(len(n_color)) ]
```

In [20]:
```
print("There are ",len(dataTp)," Samples")
```

```
There are  1000  Samples
```

In [21]:
```
dataTp = sorted(dataTp , key = lambda x : x[0])
```

In [22]:
```
set(n_color)
```

Out[22]:
```
{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5}
```

In [23]:
```
counts  = { -4:0, -3:0, -2:0, -1:0, 0:0, 1:0, 2:0, 3:0, 4:0, 5:0}
```

In [24]:
```
for i in dataTp:
    counts[i[0]] += 1
print("Thre are these many samples:")
print(counts)
```

```
Thre are these many samples:
{-4: 70, -3: 95, -2: 112, -1: 116, 0: 103, 1: 115, 2: 100, 3: 118, 4: 95, 5: 76}
```

In [25]:
```
dataTp[0]
```

Out[25]:
```
[-4, array([40.960987, 20.730944], dtype=float32)]
```

In [26]:
```
# Data tp Sample is of the form class and then the data setting the limit = 70
counts = { i:0 for i in [-4,-3,-2,-1,0,1,2,3,4,5] }
```

In [27]:
```
X_embedded = []
for i in dataTp:
    if counts[i[0]] <70:
        counts[i[0]] += 1
        X_embedded.append(i[1])
print(len(X_embedded))
```

700

In [74]:
```
# Now we have 700 samples with proper classes
# Now we are ready to do add noise and others.
def add_noise(percentage):
    'Adds the given percentage of noise to the iris data and returns the new data'
    # Original
    target = []
    for j in [-4,-3,-2,-1,0,1,2,3,4,5]:
        target += [ j for i in range(70) ]

    # 0   - 70   : class -4
    # 70 - 140   : class -3
    # 100 - 150  : class 2
    # We will change the labels in a class label randomly
    import random
    # Offset for percentage => (window size)* precentage
    offset = 70 * percentage // 100
    for i in range(0, 0 + offset ):
        target[i] = random.choice([-3,-2,-1,0,1,2,3,4,5])
    for i in range(70,70 + offset):
        target[i] = random.choice([-4,-2,-1,0,1,2,3,4,5])
    for i in range(140,140 + offset):
        target[i] = random.choice([-4,-3,-1,0,1,2,3,4,5])
    for i in range(210,210 + offset):
        target[i] = random.choice([-4,-3,-2,0,1,2,3,4,5])
    for i in range(280,280 + offset):
        target[i] = random.choice([-4,-3,-2,-1,1,2,3,4,5])
    for i in range(350,350 + offset):
        target[i] = random.choice([-4,-3,-2,-1,0,2,3,4,5])
    for i in range(420,420 + offset):
        target[i] = random.choice([-4,-3,-2,-1,0,1,3,4,5])
    for i in range(490,490 + offset):
        target[i] = random.choice([-4,-3,-2,-1,0,1,2,4,5])
    for i in range(560,560 + offset):
        target[i] = random.choice([-4,-3,-2,-1,0,1,2,3,5])
    for i in range(630,630 + offset):
        target[i] = random.choice([-4,-3,-2,-1,0,1,2,3,4])

    # Got the new labeled data
    # Now we can plot the tsne with this.
    #print("Plotting the data with Noise => ", percentage , " %")
    print("done")
    ax = fig.add_subplot(2,5,10)
    target = np.array(target)
    plt.scatter(X_embedded[:,0],X_embedded[:,1], c=target, cmap = plt.cm.Spectral)
    ax.xaxis.set_major_formatter(NullFormatter())
```

```
            ax.yaxis.set_major_formatter(NullFormatter())
            plt.axis('tight')
            plt.show()
            return target
```

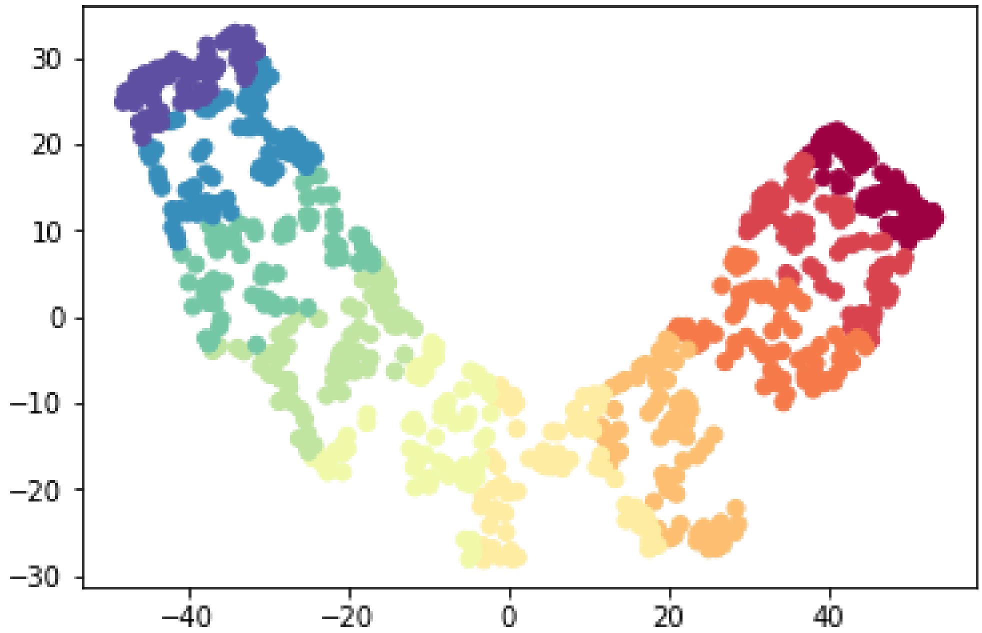
In [40]:

In [56]:
```
X_embedded = np.array(X_embedded)
```

In [57]:
```
add_noise(0)
```

```
done
```

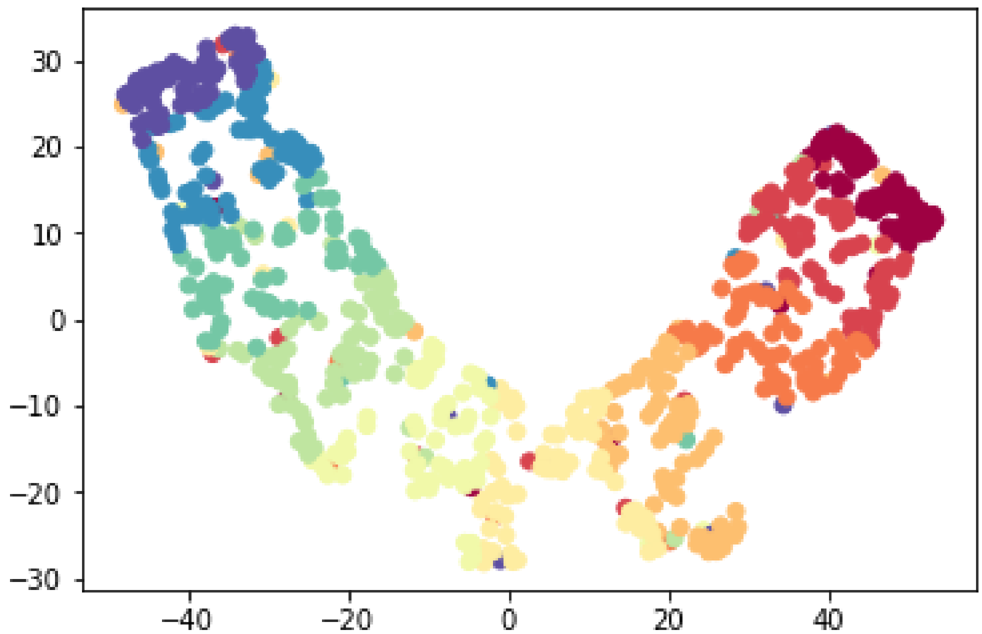
```
C:\Users\Admin\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py:106: MatplotlibDepre
  warnings.warn(message, mplDeprecation, stacklevel=1)
```



In [58]:
```
add_noise(10)
```

```
done
```

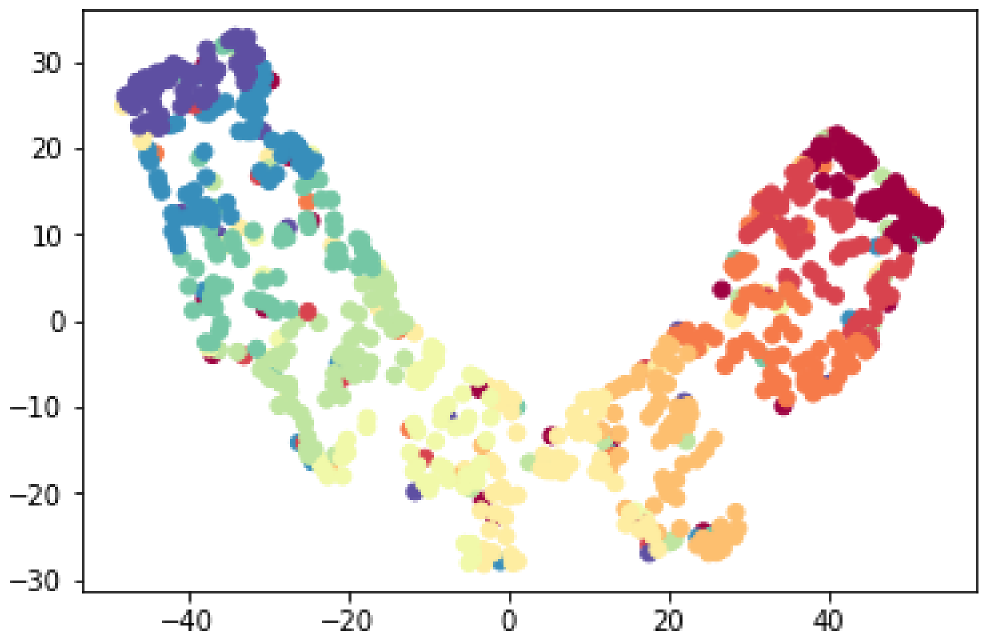
```
C:\Users\Admin\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py:106: MatplotlibDepre
  warnings.warn(message, mplDeprecation, stacklevel=1)
```




```
In [59]: add_noise(20)
```

```
done
```

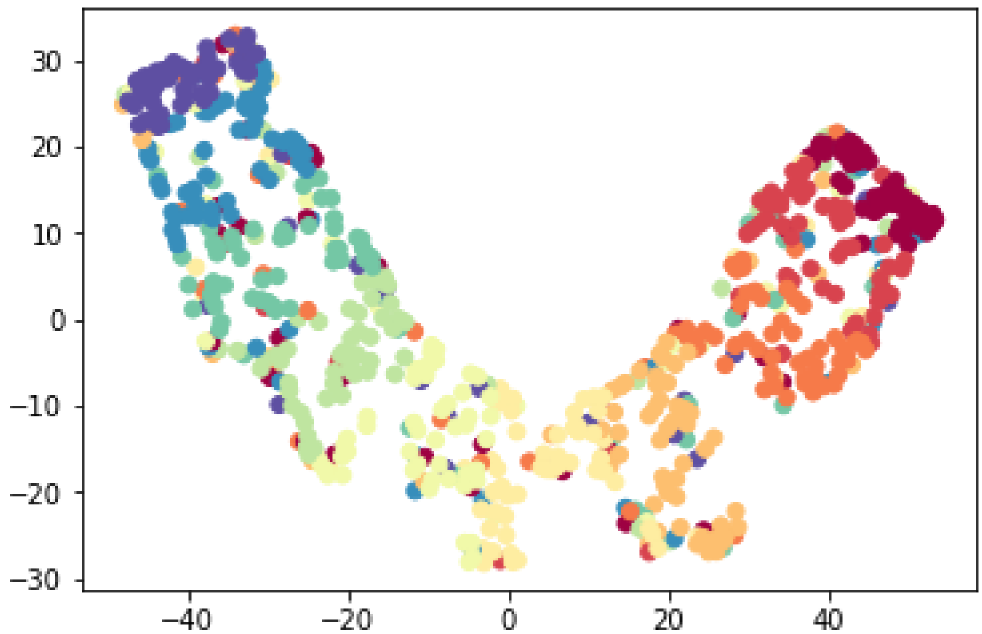
```
C:\Users\Admin\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py:106: MatplotlibDepre
  warnings.warn(message, mplDeprecation, stacklevel=1)
```



```
In [60]: add_noise(30)
```

```
done
```

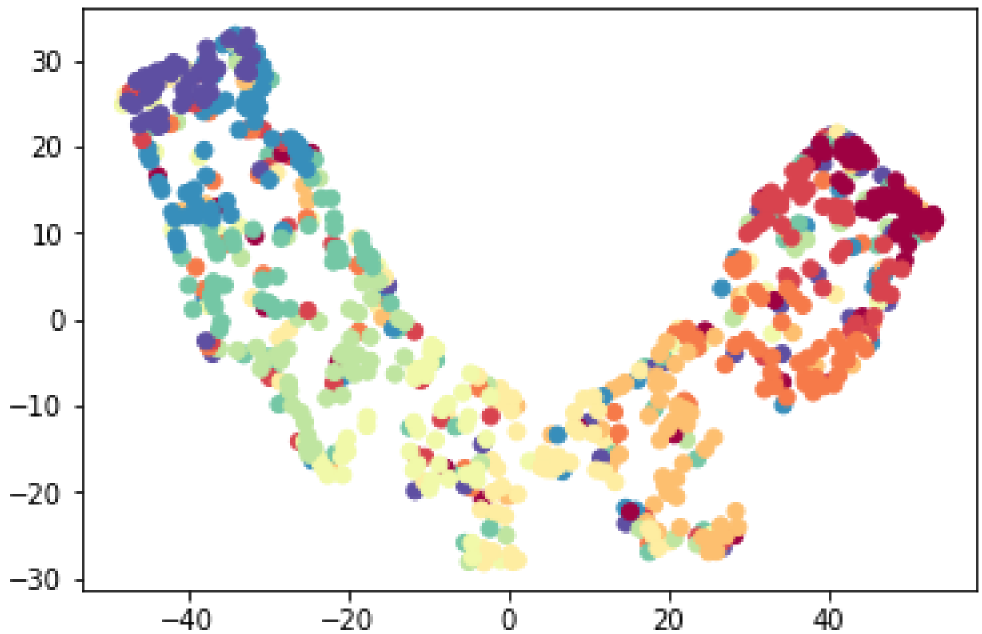
```
C:\Users\Admin\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py:106: MatplotlibDepre
  warnings.warn(message, mplDeprecation, stacklevel=1)
```




```
In [61]: add_noise(40)
```

```
done
```

```
C:\Users\Admin\Anaconda3\lib\site-packages\matplotlib\cbook\deprecation.py:106: MatplotlibDepre
  warnings.warn(message, mplDeprecation, stacklevel=1)
```



In [91]:
```
# Okay So now We have a function which finds the windows we just now need to calculat
def calEntropy(window,label):
    'Takes: [x_min, x_max],[y_min, y_max]'
    'returns entropy of the window'
    x_min, x_max , y_min, y_max = window
    # Set up entropy to be zero
    en = 0
    from math import log
    c = { i:0 for i in [-4,-3,-2,-1,0,1,2,3,4,5] }
    # Calculate the number of samples in this window.
    # X_embedded stores the data.
    for i in range(700):
        cx = X_embedded[i][0]
        cy = X_embedded[i][1]
        if x_min <= cx <=x_max and y_min <= cy <= y_max:
            #print("Found a sample of class:",label[i])
            c[label[i]] += 1

    t = 0
    for i in c.keys():
        t += int(c[i])

    for i in c.keys():
        if int(c[i])!= 0:
            en += - ( int(c[i])/t * log(int(c[i])/t) )
```

```
        #print("Found Entropy:",en)
        return en
```

In [87]:
```
def tell_windows(Limts,windowSize,target):
        g = find_good_size(Limts,windowSize)
        # Going Row Wise:
        total_ent = 0
        count = 0
        for i in range(g[0][0],g[0][1],windowSize):
            for j in range(g[1][0],g[1][1],windowSize):
                count += 1
                #print("<Window:",count,">","X:[", i, ",", i +windowSize , "]" , "Y:[", j
                total_ent += calEntropy([i,windowSize+i, j, windowSize+j], target)
        #print("Total Count:",count)
        ans = (g[0][1]-g[0][0])*(g[1][1]-g[1][0]) // (windowSize ** 2)
        #print("Expected Count:",ans)
        #print("OKAY:", count == ans )
        #print("-----Done----",total_ent)
        return total_ent
```

In [88]:
```
def main(windowSize, noise):
        return tell_windows(Limts,windowSize,add_noise(noise))
```

In [65]:
```
Lmts
```

Out[65]:
```
[[-48.031948, 53.174355], [-28.483036, 33.060825]]
```

In [72]:
```
Limts = Lmts
```

In [92]:
```
dataSet
```

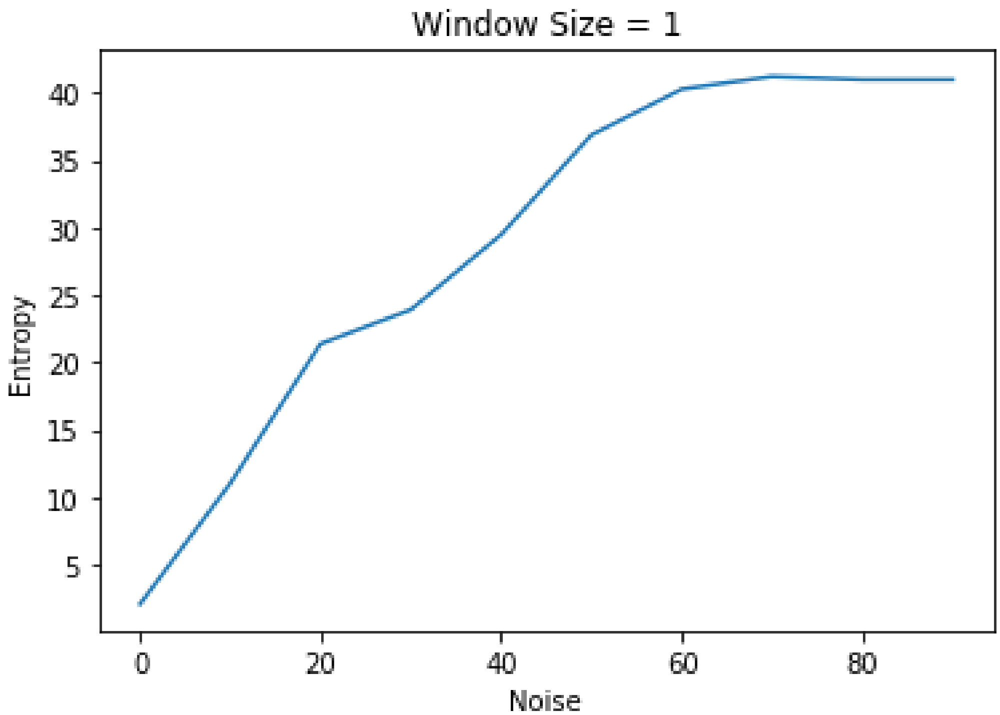
Out[92]:
```
[[[], []],
 [[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
  [2.0794415416798357,
   11.033721876693992,
   21.37429657282803,
   23.915836234881155,
   29.461013679360704,
   36.85458360533346,
   40.263686495868065,
   41.18788273661466,
   40.95683367642801,
   40.95683367642802]],
 [[], []],
 [[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
  [12.44922627641623,
   46.765920055979294,
   77.24751631302429,
   103.43133685985369,
```

```
           125.60496988531948,
           140.61027681519454,
           157.45304808506714,
           168.10682945010552,
           181.2481269982931,
           178.23363123188722]],
         [[], []],
         [[0, 10, 20, 30, 40, 50, 60, 70, 80, 90],
          [17.315633091953128,
           41.659616809907135,
           63.85058119180347,
           84.05788278821896,
           100.50704206493229,
           119.2805014956314,
           126.26870497670065,
           143.16694891445556,
           146.23172365771217,
           145.81993389711383]]]
```

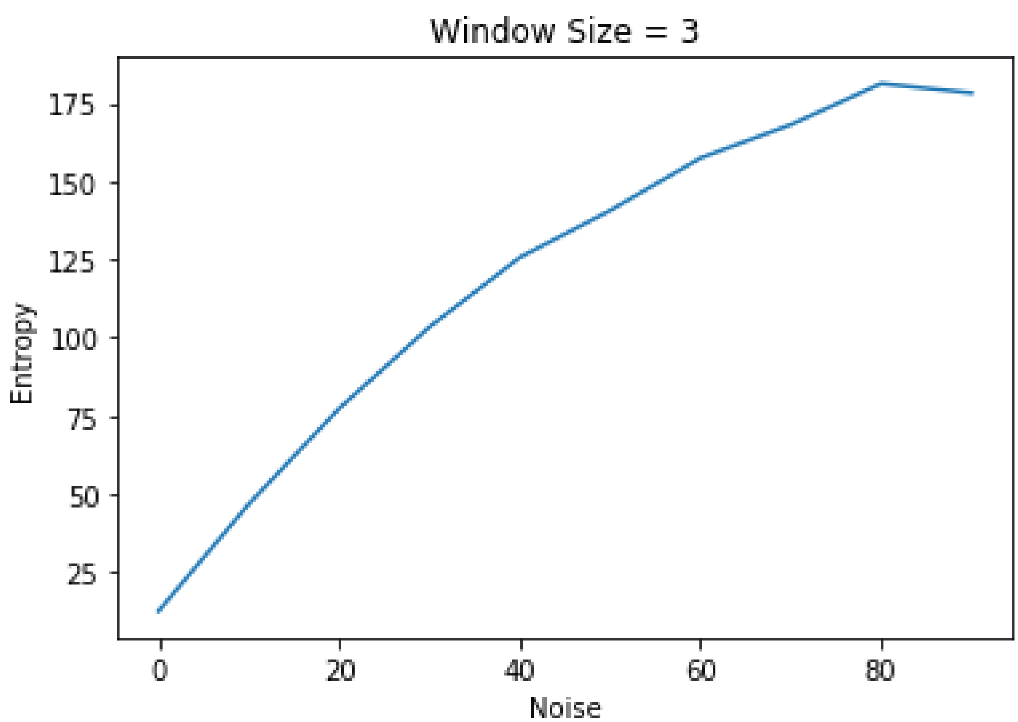
```
In [93]: print("The final plots are")
         def plotter(i):
             plt.plot(dataSet[i][0],dataSet[i][1])
             plt.title('Window Size = ' + str(i))
             plt.xlabel('Noise')
             plt.ylabel('Entropy')
```

```
The final plots are
```

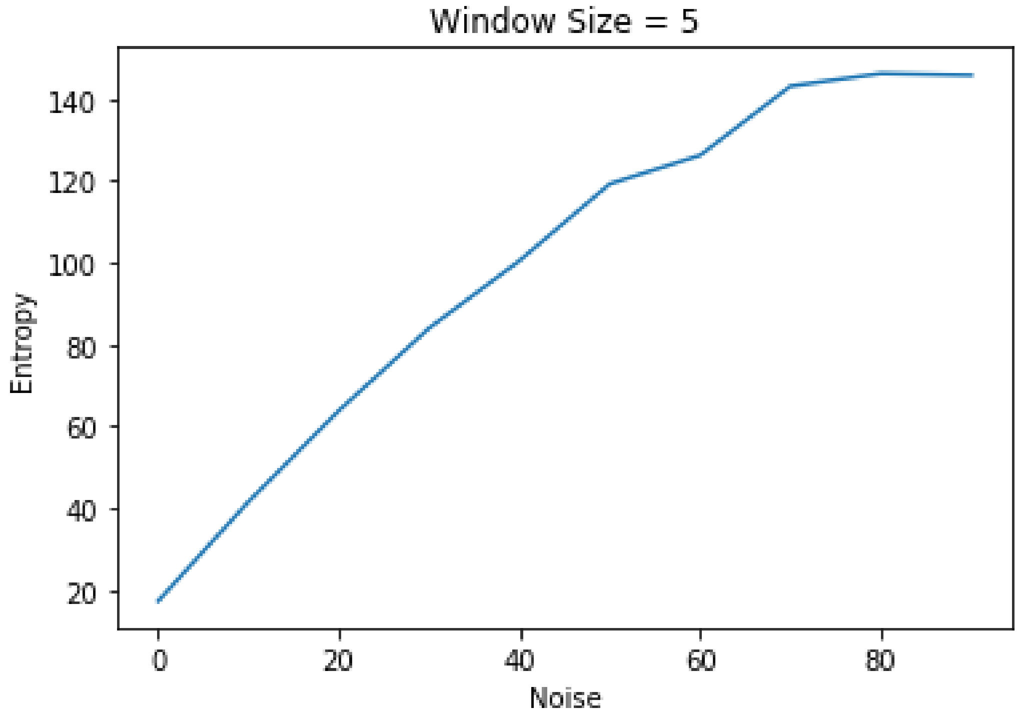
```
In [94]: plotter(1)
```



In [95]: plotter(3)



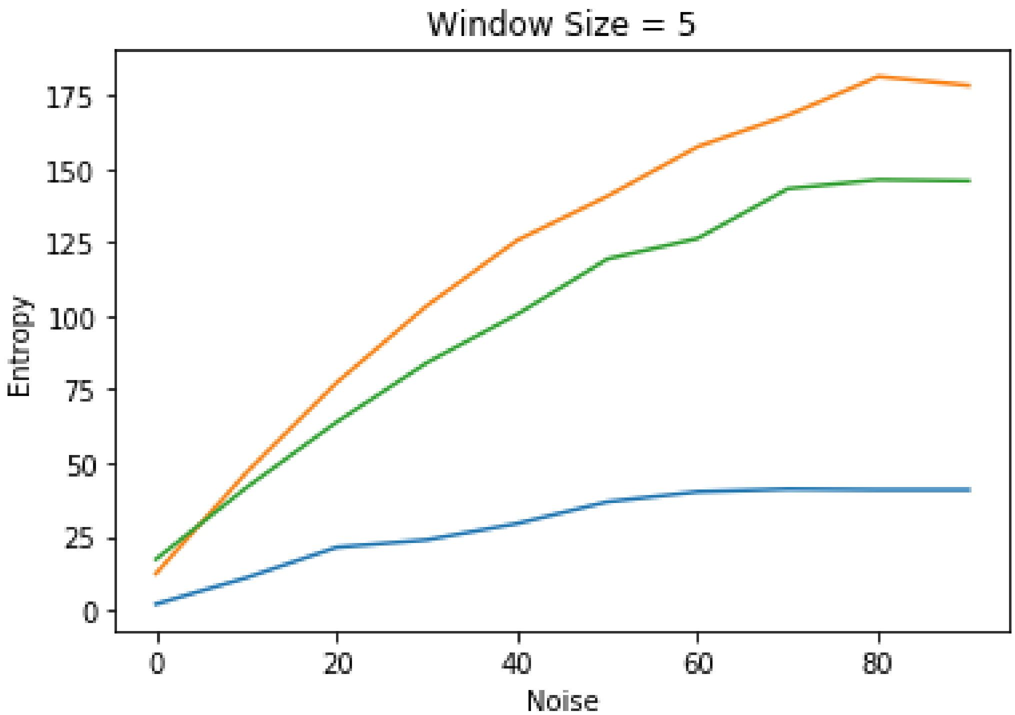
In [96]: plotter(5)



In [99]:
```
print("The final plots are")
def plotter(i):
    plt.plot(dataSet[i][0],dataSet[i][1])
    plt.title('Window Size = ' + str(i))
    plt.xlabel('Noise')
    plt.ylabel('Entropy')
```

```
The final plots are
```

In [101]:
```
plotter(1)
plotter(3)
plotter(5)
plt.show()
```


Window Size = 5
Entropy
Noise
175
150
125
100
75
50
25
0
0
20
40
60
80

```
In [ ]: # Done !
```