LA03_Ex1_GausHist

April 28, 2018

1 Team Members

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1.5 Task 1

Use NumPy function to draw random samples from a normal (Gaussian) distribution. - Create a set of 2000 samples using NumPy function. This data set should be distributed as a Gaussian with mean=0 and standard deviation (std)=0.2 - For the created data set verify the mean and the variance - Display/plot the histogram of the samples, along with the probability density function using matplotlib.pyplot and np functions

```
In [15]: import numpy as np
         import matplotlib.pyplot as plt
         import matplotlib.mlab as mlab
         from scipy import stats
         from sklearn.neighbors import KernelDensity
         %matplotlib inline
```

```
In [2]: #Creation of samples
        mean = 0
        std_dev = 0.2,
        size = 2000
        samples = np.random.normal(mean,std_dev,size=size)
```

```
In [3]: #Verification of mean
        np.mean(samples)
```

```
Out[3]: -0.00054996879354017429
```

```
In [4]: #Verification of variance
        variance = np.var(samples)
        variance
```

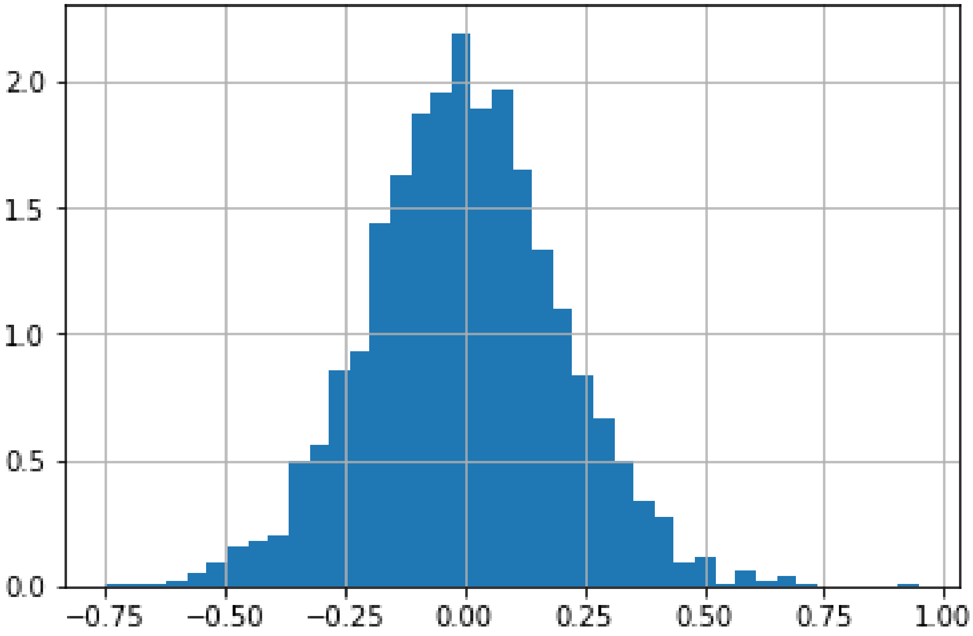
```
Out[4]: 0.040728806864517693
```

```
In [5]: #Verification of standard deviation
        sd = np.sqrt(variance)
        sd
```

```
Out[5]: 0.20181379255273335
```

```
In [6]: #Histogram plot
        plt.grid(True)
        _= plt.hist(samples, normed=1, bins=40)
```

```
/home/ramesh/anaconda2/lib/python2.7/site-packages/matplotlib/axes/_axes.py:6462: UserWarning: T
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

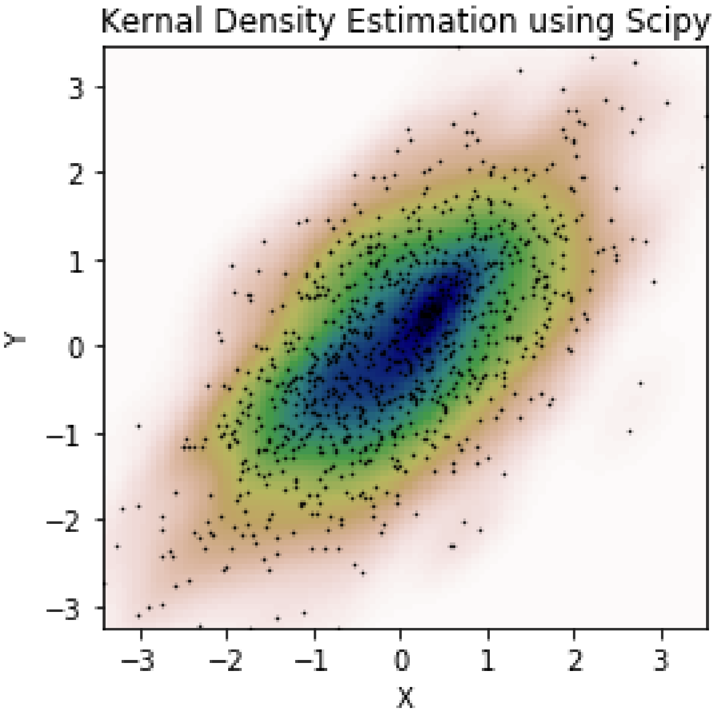


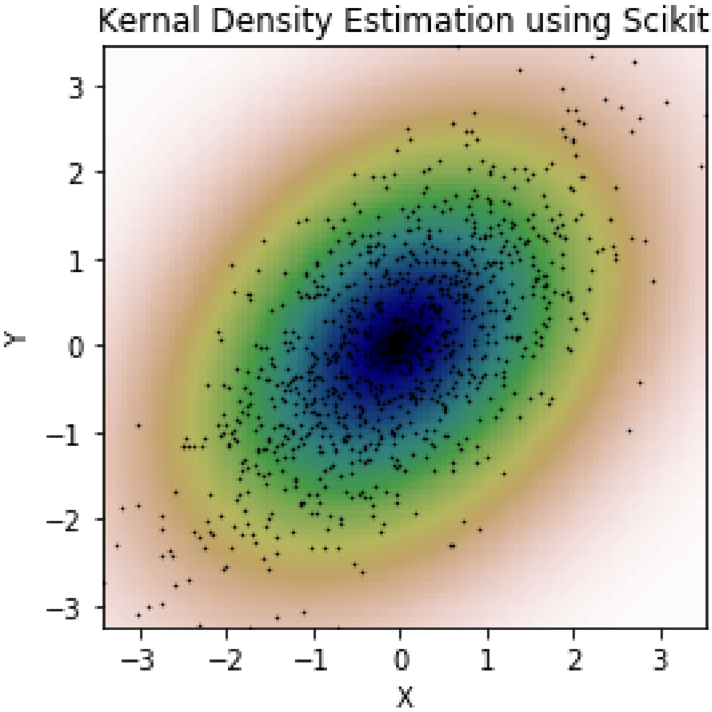
1.6 Task 2

Two-dimensional kernel density estimate: comparing scikit-learn and scipy

```
In [14]: # Generate two dimensional data


          def kde_Scipy(m1, m2):

              xmin = m1.min()
              xmax = m1.max()
              ymin = m2.min()
              ymax = m2.max()
```

```
    #perform a kernal density estimate on the data
    X, Y = np.mgrid[xmin:xmax:100j, ymin:ymax:100j]
    positions = np.vstack([X.ravel(), Y.ravel()])
    values = np.vstack([m1, m2])
    kernel = stats.gaussian_kde(values)
    Z = np.reshape(kernel(positions).T, X.shape)

    fig, ax = plt.subplots()
    ax.imshow(np.rot90(Z), cmap=plt.cm.gist_earth_r,extent=[xmin, xmax, ymin, ymax])
    ax.plot(m1, m2, 'k.', markersize=1)
    ax.set_xlim([xmin, xmax])
    ax.set_ylim([ymin, ymax])
    ax.set_title("Kernal Density Estimation using Scipy")
    ax.set_xlabel("X")
    ax.set_ylabel("Y")

    plt.show()

def kde_scikit(m1, m2):

    XY = np.vstack([m1,m2])
#     d = XY.shape[0]
#     n = XY.shape[1]

    kde = KernelDensity(kernel='gaussian').fit(XY.T)


    xmin = m1.min()
    xmax = m1.max()
    ymin = m2.min()
    ymax = m2.max()

    X, Y = np.mgrid[xmin:xmax:100j, ymin:ymax:100j]
    positions = np.vstack([X.ravel(), Y.ravel()])

    Z = np.reshape(np.exp(kde.score_samples(positions.T)), X.shape)
    fig, ax = plt.subplots()
    ax.imshow(np.rot90(Z), cmap=plt.cm.gist_earth_r,extent=[xmin, xmax, ymin, ymax])

    ax.plot(m1, m2, 'k.', markersize=1)
    ax.set_xlim([xmin, xmax])
    ax.set_ylim([ymin, ymax])
    ax.set_title("Kernal Density Estimation using Scikit")
    ax.set_xlabel("X")
    ax.set_ylabel("Y")

def generate_measurements():
    # Generate two dimensional data
    N1 = np.random.normal(scale=1.0,size=1000)
    N2 = np.random.normal(scale=0.5, size=1000)
    # generate coupled measurements
    x = N1 + N2
    y = N1 - N2

    return x, y

m1, m2 = generate_measurements()
kde_Scipy(m1, m2)
kde_scikit(m1, m2)
```




Kernal Density Estimation using Scikit
3
2
1
0
−1
−2
−3
Y
−3
−2
−1
0
1
2
3
X