Exercise Feature Extraction_short

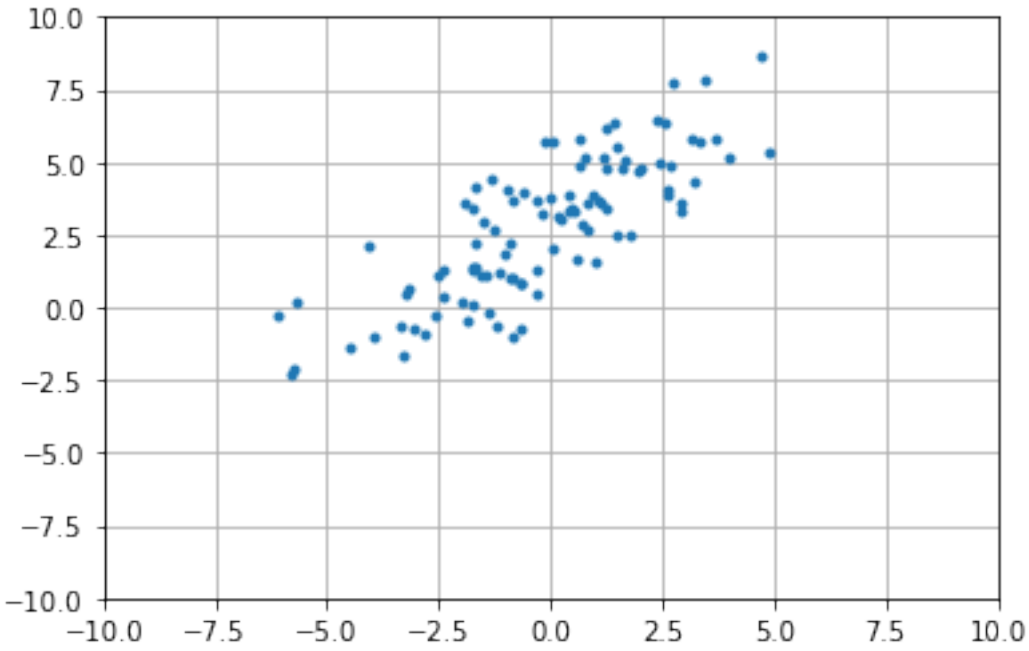
June 29, 2019

1 Assignment 1 - Normalizing Continuous Features

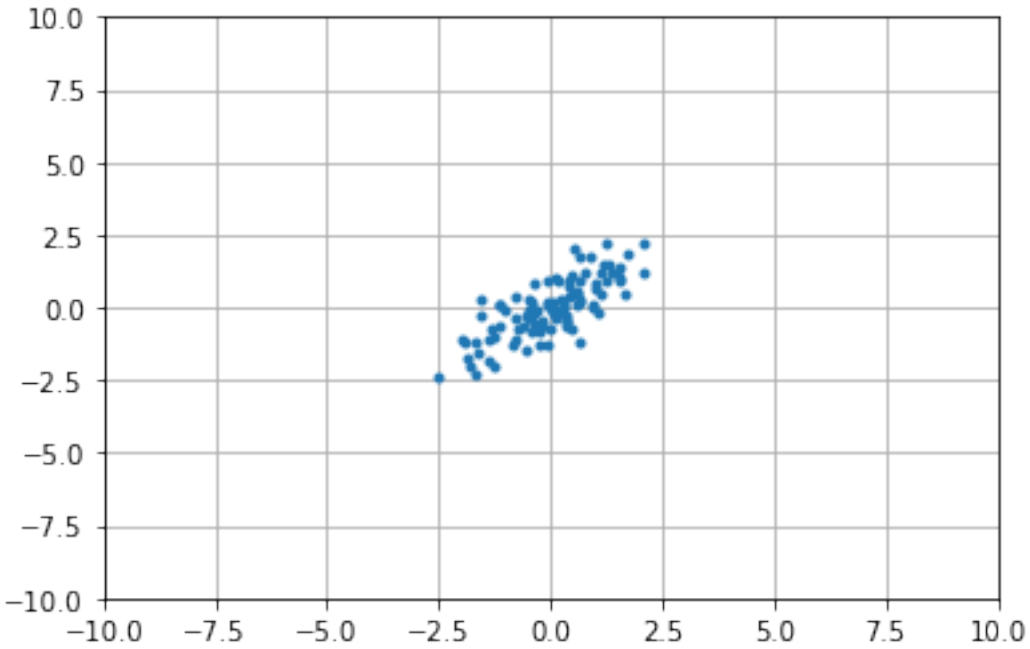
Consider data drawn from a 2 dimensional Normal distribution. Normalize the data by first subtracting the mean from each dimension and then divide the result by its respective standard deviation.

In [1]:
```
import matplotlib.pylab as plt
import numpy as np
from numpy.random import multivariate_normal as mvn
%matplotlib inline

# generates some toy data
mu = np.array([0,3])
C = np.array([[5.,4.],[4.,5.]])
X = mvn(mu,C,100)

# plot the data
plt.plot(X[:,0], X[:,1], '.')
plt.grid()
lim = [-10, 10]
plt.xlim(lim)
plt.ylim(lim)
```

Out[1]:
```
(-10, 10)
```




```
In [3]: mu = X.mean(axis=0)
        mu

Out[3]: array([-0.47603054,  2.71000698])

In [4]: stdev = X.std(axis=0)
        stdev

Out[4]: array([1.98633712, 2.3232049 ])

In [5]: # normalizing data to standard deviation with the z-scoring method
        Xnormalized = (X-mu)/np.std(X, axis=0)

In [6]: # plot the data
        plt.plot(Xnormalized[:,0], Xnormalized[:,1], '.')
        plt.grid()
        lim = [-10, 10]
        plt.xlim(lim)
        plt.ylim(lim)

Out[6]: (-10, 10)
```



2 Assignment 2 - One-Hot Encoding

Consider the data set [‘blue’, ‘yellow’, ‘blue’, ‘green’, ‘red’, ‘yellow’]

Write a function `one_hot_encoding` that takes a list of strings like the above and returns a samples-by-unique-items numpy array in which each row corresponds to the one-hot-encoded version of the respective data point in the original list.

```
In [7]: data = ['blue', 'yellow', 'blue', 'green', 'red', 'yellow']

In [8]: def one_hot_encoding_didactic(string_list):
            unique_list = np.unique(string_list)            # creates a unique list from the s
            onehot = []
            for string in string_list:
                onehot_element = 1*(unique_list == string)  # checks what unique element match
                onehot.append(onehot_element)               # appends each one hot coding to a
            onehot = np.array(onehot)
            return onehot

        def one_hot_encoding(string_list):
            return np.array([1*(np.unique(string_list)==string) for string in string_list])

In [9]: one_hot_encoded_data = one_hot_encoding(data)
        one_hot_encoded_data

Out[9]: array([[1, 0, 0, 0],
               [0, 0, 0, 1],
```

```
       [1, 0, 0, 0],
       [0, 1, 0, 0],
       [0, 0, 1, 0],
       [0, 0, 1, 0],
       [0, 0, 0, 1]])
```

In [10]:
```
# tests whether the first row encoding is the same as the third
assert (one_hot_encoded_data[0,:] - one_hot_encoded_data[2,:]).sum() == 0
# tests whether the second row encoding is the same as the last
assert (one_hot_encoded_data[1,:] - one_hot_encoded_data[-1,:]).sum() == 0
# tests whether each row has only one non-zero entry
assert (one_hot_encoded_data.sum(axis=1) - np.ones(one_hot_encoded_data.shape[0])).su
```