02_Exercise2_MaxL_

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0.1 Task1

Implement in Python (you can use SciPy library) the Maximum Likelihood Estimator to estimate the parameters for example mean and variance of some data. Your steps are: * Create a data set: - Set x-values for example: *x = np.linspace(0, 100, num=100)*, - Set observed y-values using a known slope (1.4), intercept (4), and sd (3), for example *y = 4 + 1.4x + np.random.normal(0, 3, 100)* * Create a likelihood function which arguments is a list of initial parameters * Test this function on various data sets (Hint: you can use minimize from scipy.optimize and scipy.stats to compute the negative log-likelihood)

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In [18]: from scipy import stats
         import numpy as np
         from scipy.optimize import minimize

In [20]: def loglikehoodfunction(params, args):
             m = params[1]
             c = params[0]

             y_predicted = m*args[0]+c
             LL = -np.sum( stats.norm.logpdf(args[1], loc=y_predicted) )
             return LL

         #check by setting slope to 1.4 and intercept to 4
         init_params = [1,1]
         xdata = np.linspace(0,100,100)
         ydata = xdata*1.4+4+np.random.normal(0,3,100)
         args = [xdata, ydata]
         results = minimize(loglikehoodfunction, init_params, args = args, method = 'nelder-mead
         print "slope is "+str(results.x[1])+" and y intercept is "+str(results.x[0])

         #Verfying for different datasets
         #check by setting slope to 5 and intercept to 10
         ydata = xdata*5+10+np.random.normal(0,3,100)
         args = [xdata, ydata]
         results = minimize(loglikehoodfunction, init_params, args = args, method = 'nelder-mead
         print "slope is "+str(results.x[1])+" and y intercept is "+str(results.x[0])

         #check by setting slope to 15 and intercept to 101
```

```
        ydata = xdata*15+101+np.random.normal(0,3,100)
        args = [xdata, ydata]
        results = minimize(loglikehoodfunction, init_params, args = args, method = 'nelder-mead
        print "slope is "+str(results.x[1])+" and y intercept is "+str(results.x[0])
```

```
slope is 1.3907866048754274 and y intercept is 4.441589889446215
slope is 5.030987101528639 and y intercept is 8.358925613165166
slope is 14.998814943691134 and y intercept is 101.05942980400953
```

0.1.1 Reference:

https://stackoverflow.com/questions/7718034/maximum-likelihood-estimate-pseudocode