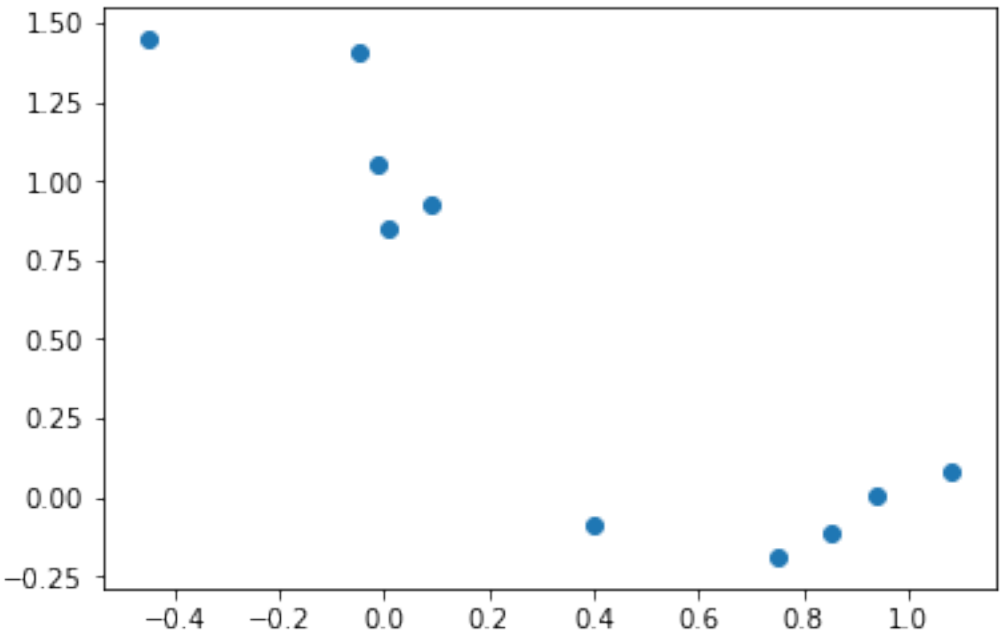
Index

March 24, 2019

```
In [175]: %matplotlib inline
          import numpy as np
          import matplotlib.pyplot as plt
          d1 = [[1.08,.08],[0.75,-0.19],[0.85,-0.11],[0.94,0.01],[0.4,-0.09],[1.25,-.21],[1.19,0
          d2 = [[0.01,0.85],[-0.01,1.05],[0.09,0.93],[-0.05,1.41],[-0.45,1.45],[0.07,1.20],[-0.3
          d1 = np.array(d1)
          d2 = np.array(d2)
          d1train = d1[0:5]
          d2train = d2[0:5]
          d1test = d1[5:10]
          d2test = d2[5:10]
          d = np.concatenate((d1,d2),0)
          dtest = np.concatenate((d1test,d2test),0)
          print(d)
          print(d[1,:])
          dtrain = np.concatenate((d1train,d2train),0)
          print('Training data is :\n', dtrain)
          dtrainx = dtrain[:,0]
          dtrainy = dtrain[:,1]
          w1 = [0,0]
          w2 = [0,0]
          w1 = np.array(w1)
          w2 = np.array(w2)
          T = [[1.0,0.0],[1.0,0.0],[1.0,0.0],[1.0,0.0],[1.0,0.0],[0.0,1.0],[0.0,1.0],[0.0,1.0],[
          T = np.array(T, dtype = float)
          plt.scatter(x = dtrainx, y = dtrainy)
          print('scatter plot is:')
          plt.show()
```

```
[[ 1.08  0.08]
 [ 0.75 -0.19]
 [ 0.85 -0.11]
 [ 0.94  0.01]
 [ 0.4  -0.09]
 [ 1.25 -0.21]
 [ 1.19  0.07]
 [ 0.99  0.04]
 [ 0.69 -0.02]
```

```
 [ 1.32  0.02]
 [ 0.01  0.85]
 [-0.01  1.05]
 [ 0.09  0.93]
 [-0.05  1.41]
 [-0.45  1.45]
 [ 0.07  1.2 ]
 [-0.33  0.88]
 [-0.06  1.08]
 [-0.33  1.1 ]
 [-0.24  1.01]]
[ 0.75 -0.19]
Training data is :
 [[ 1.08  0.08]
 [ 0.75 -0.19]
 [ 0.85 -0.11]
 [ 0.94  0.01]
 [ 0.4  -0.09]
 [ 0.01  0.85]
 [-0.01  1.05]
 [ 0.09  0.93]
 [-0.05  1.41]
 [-0.45  1.45]]
scatter plot is:
```



In [176]:
```
def compute_prob(xk,w1,w2):
    e1 = xk.dot(w1)
    e2 = xk.dot(w2)
    s = np.exp(e1) + np.exp(e2)
    p = [np.exp(e1)/s,np.exp(e2)/s]
    p = np.array(p)
    return p
```

In [177]:
```
def compute_y(d,w1,w2):
    y = np.zeros([int(d.size/2),2])
    for i in range(int(d.size/2)):
        x = d[i,:]
        y[i,:] = compute_prob(x,w1,w2)
    print(y)
    return y
```

In [178]:
```
def compute_cross_entropy(y,t):
    J = 0
    for i in range(2):
        for j in range(int(y.size/2)):
            J -= t[j][i]*np.log(y[j][i])
    return J
```

In [179]:
```
def g_descent(t,x,w1,w2,eta):
    w1n = w1
    w2n = w2

    for i in range(int(x.size/2)):
        y = compute_prob(x[i,:],w1n,w2n)
        w1n = w1n + eta*(float(t[i,0])-y[0])*x[i,:]
        w2n = w2n + eta*(float(t[i,1])-y[1])*x[i,:]
    return w1n,w2n
```

In [ ]:

In [180]:
```
w1x = w1
w2x = w2
J = np.zeros(20)
for i in range(20):
    w1x,w2x = g_descent(T,dtrain,w1x,w2x,0.1)
    y = compute_y(dtrain,w1x,w2x)
    J[i] = compute_cross_entropy(y,T)

print('Test data')
y1 = compute_y(dtest,w1x,w2x)

plt.plot(range(20),J)
plt.show
```

```
[[0.59747227 0.40252773]
 [0.59794312 0.40205688]
 [0.59801877 0.40198123]
 [0.59231113 0.40768887]
 [0.55132385 0.44867615]
 [0.39640174 0.60359826]
 [0.37088585 0.62911415]
 [0.39455154 0.60544846]
 [0.32644303 0.67355697]
 [0.28794881 0.71205119]]
[[0.67143026 0.32856974]
 [0.66965093 0.33034907]
 [0.67053475 0.32946525]
 [0.66219508 0.33780492]
 [0.59077016 0.40922984]
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 [0.22375784 0.77624216]
 [0.17246943 0.82753057]]
[[0.72705629 0.27294371]
 [0.72265064 0.27734936]
 [0.72440037 0.27559963]
 [0.71505581 0.28494419]
 [0.62197706 0.37802294]
 [0.27890755 0.72109245]
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 [0.27668682 0.72331318]
 [0.16223782 0.83776218]
 [0.11074431 0.88925569]]
[[0.76929926 0.23070074]
 [0.76268834 0.23731166]
 [0.76514619 0.23485381]
 [0.75558868 0.24441132]
 [0.6473409  0.3526591 ]
 [0.24342056 0.75657944]
 [0.19340989 0.80659011]
 [0.24146049 0.75853951]
 [0.12324637 0.87675363]
 [0.07571877 0.92428123]]
[[0.80191112 0.19808888]
 [0.79365125 0.20634875]
 [0.79663232 0.20336768]
 [0.78723539 0.21276461]
 [0.66842823 0.33157177]
 [0.21625579 0.78374421]
 [0.16492007 0.83507993]
 [0.21458902 0.78541098]
```

```
  [0.09711481 0.90288519]
  [0.05446382 0.94553618]]
 [[0.82754882 0.17245118]
  [0.81812751 0.18187249]
  [0.82147464 0.17852536]
  [0.81240643 0.18759357]
  [0.68629308 0.31370692]
  [0.19477066 0.80522934]
  [0.14325497 0.85674503]
  [0.19338068 0.80661932]
  [0.07875378 0.92124622]
  [0.04078384 0.95921616]]
 [[0.84806297 0.15193703]
  [0.8378598  0.1621402 ]
  [0.84145208 0.15854792]
  [0.83277945 0.16722055]
  [0.70166734 0.29833266]
  [0.17733127 0.82266873]
  [0.12628507 0.87371493]
  [0.1761869  0.8238131 ]
  [0.06534219 0.93465781]
  [0.03153818 0.96846182]]
 [[0.86474777 0.13525223]
  [0.85404484 0.14595516]
  [0.85779285 0.14220715]
  [0.84953254 0.15046746]
  [0.71507409 0.28492591]
  [0.16287684 0.83712316]
  [0.11266814 0.88733186]
  [0.16194509 0.83805491]
  [0.05522908 0.94477092]
  [0.02503268 0.97496732]]
 [[0.87851983 0.12148017]
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  [0.87136133 0.12863867]
  [0.86350561 0.13649439]
  [0.72689692 0.27310308]
  [0.15068943 0.84931057]
  [0.10152154 0.89847846]
  [0.14993999 0.85006001]
  [0.04739972 0.95260028]
  [0.02029993 0.97970007]]
 [[0.89003883 0.10996117]
  [0.87889572 0.12110428]
  [0.88277809 0.11722191]
  [0.87530779 0.12469221]
  [0.73742359 0.26257641]
  [0.14026575 0.85973425]
```

```
  [0.09224337 0.90775663]
  [0.13967222 0.86032778]
  [0.0412033  0.9587967 ]
  [0.01675938 0.98324062]]
 [[0.89978757 0.10021243]
  [0.88860502 0.11139498]
  [0.89249731 0.10750269]
  [0.88538855 0.11461145]
  [0.74687433 0.25312567]
  [0.13124236 0.86875764]
  [0.08441016 0.91558984]
  [0.1307823  0.8692177 ]
  [0.03620685 0.96379315]
  [0.01404744 0.98595256]]
 [[0.90812532 0.09187468]
  [0.89697945 0.10302055]
  [0.90085747 0.09914253]
  [0.89408512 0.10591488]
  [0.75542073 0.24457927]
  [0.12335009 0.87664991]
  [0.07771592 0.92228408]
  [0.12300458 0.87699542]
  [0.0321131  0.9678869 ]
  [0.01192785 0.98807215]]
 [[0.91532364 0.08467636]
  [0.90426852 0.09573148]
  [0.90811503 0.09188497]
  [0.90165449 0.09834551]
  [0.76319857 0.23680143]
  [0.11638521 0.88361479]
  [0.07193441 0.92806559]
  [0.11613836 0.88386164]
  [0.02871231 0.97128769]
  [0.01024215 0.98975785]]
 [[0.92159083 0.07840917]
  [0.91066453 0.08933547]
  [0.91446734 0.08553266]
  [0.90829534 0.09170466]
  [0.77031684 0.22968316]
  [0.11019058 0.88980942]
  [0.06689489 0.93310511]
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  [0.02585295 0.97414705]
  [0.00888102 0.99111898]]
 [[0.92708885 0.07291115]
  [0.91631772 0.08368228]
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```

```
 [0.7768641  0.2231359 ]
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 [0.06246625 0.93753375]
 [0.10455552 0.89544448]
 [0.0234232  0.9765768 ]
 [0.00776726 0.99223274]]
[[0.93194523 0.06805477]
 [0.92134706 0.07865294]
 [0.92503986 0.07496014]
 [0.91938201 0.08061799]
 [0.78291315 0.21708685]
 [0.09964447 0.90035553]
 [0.05854622 0.94145378]
 [0.09962151 0.90037849]
 [0.02133904 0.97866096]
 [0.00684512 0.99315488]]
[[0.93626153 0.06373847]
 [0.92584784 0.07415216]
 [0.92947902 0.07052098]
 [0.92405035 0.07594965]
 [0.78852444 0.21147556]
 [0.09511598 0.90488402]
 [0.0550539  0.9449461 ]
 [0.09514946 0.90485054]
 [0.01953629 0.98046371]
 [0.00607359 0.99392641]]
[[0.9401195  0.0598805 ]
 [0.92989717 0.07010283]
 [0.93346449 0.06653551]
 [0.92824862 0.07175138]
 [0.79374864 0.20625136]
 [0.09099315 0.90900685]
 [0.05192448 0.94807552]
 [0.09107617 0.90892383]
 [0.0179652  0.9820348 ]
 [0.00542199 0.99457801]]
[[0.94358562 0.05641438]
 [0.93355812 0.06644188]
 [0.93706043 0.06293957]
 [0.9320425  0.0679575 ]
 [0.79862853 0.20137147]
 [0.08722296 0.91277704]
 [0.0491055  0.9508945 ]
 [0.0873496  0.9126504 ]
 [0.0165867  0.9834133 ]
 [0.004867   0.995133  ]]
[[0.94671437 0.05328563]
 [0.93688269 0.06311731]
```
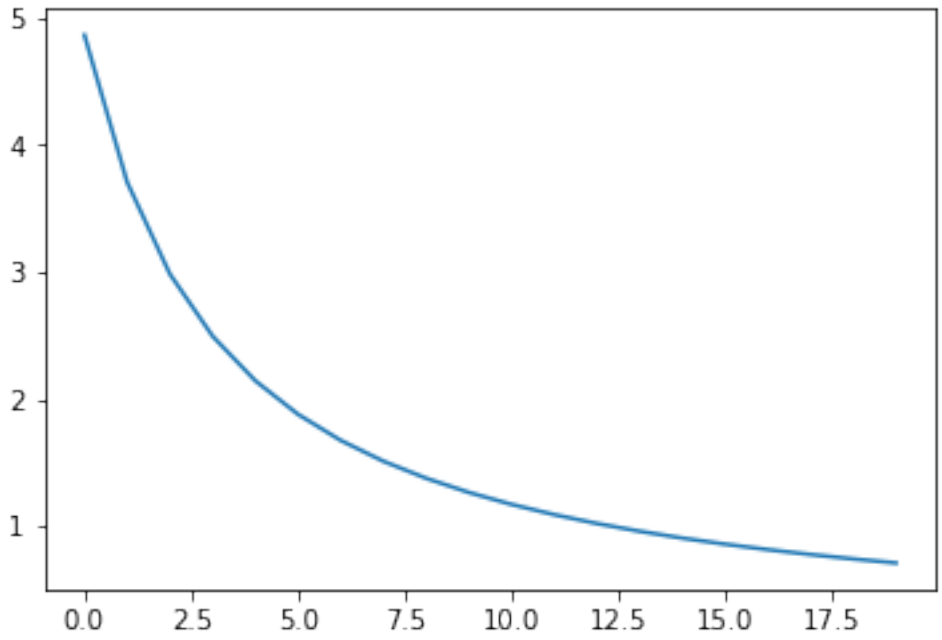

```
 [0.94031964 0.05968036]
 [0.93548617 0.06451383]
 [0.80320059 0.19679941]
 [0.08376132 0.91623868]
 [0.046554   0.953446  ]
 [0.08392649 0.91607351]
 [0.01536973 0.98463027]
 [0.00439068 0.99560932]]
Test data
[[0.98511082 0.01488918]
 [0.96165692 0.03834308]
 [0.93891718 0.06108282]
 [0.88501884 0.11498116]
 [0.97675787 0.02324213]
 [0.03854206 0.96145794]
 [0.03061072 0.96938928]
 [0.03737443 0.96262557]
 [0.01659462 0.98340538]
 [0.02746939 0.97253061]]
```

Out[180]: <function matplotlib.pyplot.show(*args, **kw)>



In [ ]:

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In [ ]: