Viterbi-Algorithms

November 21, 2017

```
In [73]: import numpy as np
         import math
```

```
In [74]: with open('initialStateDistribution.txt') as f:
             content = f.readlines()
         content = [line.strip() for line in content]
         pi = np.array(list(map(float,content)))
```

```
In [75]: with open('transitionMatrix.txt') as f:
             content = f.readlines()
         content = [line.strip() for line in content]
         A = np.array([list(map(float,d)) \
                       for d in [line.split(' ') for line in content]])
```

```
In [76]: with open('emissionMatrix.txt') as f:
             content = f.readlines()
         content = [line.strip() for line in content]
         B = np.array([list(map(float,d)) \
                       for d in [line.split(' ') for line in content]])
```

```
In [77]: with open('observations.txt') as f:
             content = f.readlines()
         content = [line.strip() for line in content]
         O = np.array(list(map(int,content[0].split(' '))))
```

```
In [78]: V = np.array([[0.0]*len(O)]*len(A))
         bp = np.array([[0]*len(O)]*len(A))
```

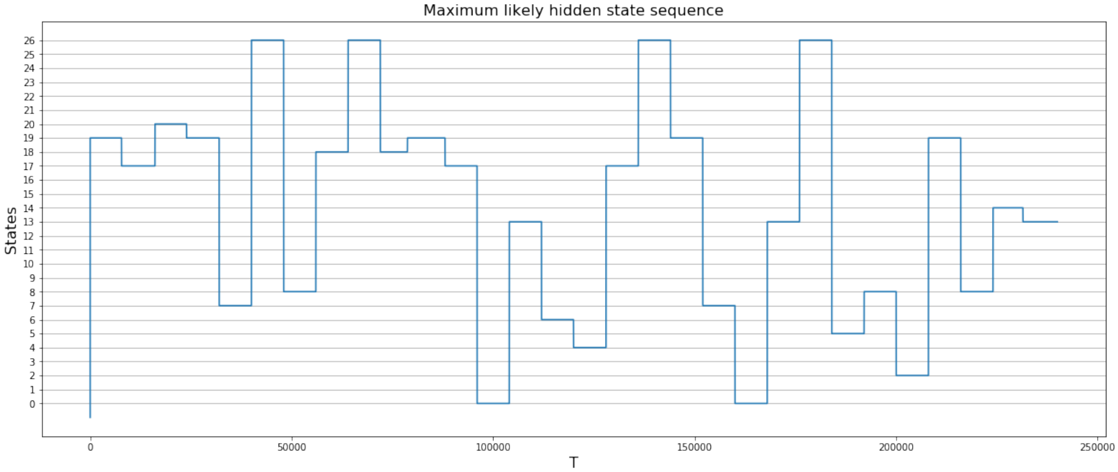
```
In [79]: import math
         for i in range(len(B)):
             V[i][0] = math.log(pi[i]*B[i][O[0]])
             bp[i][0] = -1
```

```
In [106]: for t in range(1,len(O)):
              for s in range(len(B)):
                  log_b = math.log(B[s][O[t]])
                  vec_comp = V[:,t-1] + np.log(A[:,s]) + log_b
                  V[s][t] = np.max(vec_comp)
                  bp[s][t] = np.argmax(vec_comp)
```

```
In [148]: S = []
          T = len(O)-1
          max_ll = np.sort(V[:,T])
          for ll in reversed(max_ll):
              s = [list(V[:,T]).index(ll)]
              backpointer = bp[s[0]][T]
              t = T-1
              while backpointer != -1:
                  s.append(bp[backpointer][t])
                  backpointer = s[len(s)-1]
                  t = t-1
              S.append(s)
```

```
In [149]: from matplotlib import pyplot as plt
          import string

          plt.figure(figsize=(20,8))
          plt.plot([s for s in reversed(S[0])])
          plt.title('Maximum likely hidden state sequence',fontsize=16)
          plt.yticks([i for i in range(len(B))])
          plt.xlabel('T', fontsize=16)
          plt.ylabel('States', fontsize=16)
          plt.grid(True,axis='y')
          plt.show()
```



```
In [150]: letters = [s for s in string.ascii_uppercase]
          letters.append(' ')

          for s in S:
              printstate = -1
              sentence = ''
```

```
            for state in reversed(s):
                if printstate != state:
                    sentence += letters[state]
                    printstate = state
            print "MOST LIKELY SENTENCE ",S.index(s)," = ",sentence
```

```
MOST LIKELY SENTENCE  0  =  TRUTH IS STRANGER THAN FICTION
MOST LIKELY SENTENCE  1  =  TRUTH IS STRANGER THAN FICTIONA
MOST LIKELY SENTENCE  2  =  TRUTH IS STRANGER THAN FICTIONB
MOST LIKELY SENTENCE  3  =  TRUTH IS STRANGER THAN FICTIONC
MOST LIKELY SENTENCE  4  =  TRUTH IS STRANGER THAN FICTIOND
MOST LIKELY SENTENCE  5  =  TRUTH IS STRANGER THAN FICTIONE
MOST LIKELY SENTENCE  6  =  TRUTH IS STRANGER THAN FICTIONF
MOST LIKELY SENTENCE  7  =  TRUTH IS STRANGER THAN FICTIONG
MOST LIKELY SENTENCE  8  =  TRUTH IS STRANGER THAN FICTIONH
MOST LIKELY SENTENCE  9  =  TRUTH IS STRANGER THAN FICTIONO
MOST LIKELY SENTENCE  10  =  TRUTH IS STRANGER THAN FICTIONI
MOST LIKELY SENTENCE  11  =  TRUTH IS STRANGER THAN FICTIONP
MOST LIKELY SENTENCE  12  =  TRUTH IS STRANGER THAN FICTIONJ
MOST LIKELY SENTENCE  13  =  TRUTH IS STRANGER THAN FICTIONR
MOST LIKELY SENTENCE  14  =  TRUTH IS STRANGER THAN FICTIONQ
MOST LIKELY SENTENCE  15  =  TRUTH IS STRANGER THAN FICTIONK
MOST LIKELY SENTENCE  16  =  TRUTH IS STRANGER THAN FICTIONS
MOST LIKELY SENTENCE  17  =  TRUTH IS STRANGER THAN FICTIONL
MOST LIKELY SENTENCE  18  =  TRUTH IS STRANGER THAN FICTIONT
MOST LIKELY SENTENCE  19  =  TRUTH IS STRANGER THAN FICTIONM
MOST LIKELY SENTENCE  20  =  TRUTH IS STRANGER THAN FICTIONU
MOST LIKELY SENTENCE  21  =  TRUTH IS STRANGER THAN FICTIONV
MOST LIKELY SENTENCE  22  =  TRUTH IS STRANGER THAN FICTIONW
MOST LIKELY SENTENCE  23  =  TRUTH IS STRANGER THAN FICTIONX
MOST LIKELY SENTENCE  24  =  TRUTH IS STRANGER THAN FICTIONY
MOST LIKELY SENTENCE  25  =  TRUTH IS STRANGER THAN FICTIONZ
MOST LIKELY SENTENCE  26  =  TRUTH IS STRANGER THAN FICTION
```