

IC 252:LAB1

Conditional probability and Bayes' rule

BY ADARSH SANTORIA(B21176)

1. When coded messages are sent, sometimes there are errors in transmission. In particular, Morse code uses “dots” and “dashes”, which are known to occur in the proportion of 3:4. i.e. $P(\text{dot sent}) = 3/7$ and $(P(\text{dash sent}) = 1 - P(\text{dot sent}))$. Suppose there is interference in transmission line, and with probability $1/8$ a dot is mistakenly received as dash, and vice versa. Write a program to find the probability of dot sent given that dot received. Take the probability of sending “dot” and probability of “dot” received as “dash” as user inputs.
2. A bin contains x defective (that immediately fail when put in use), y partially defective (that fail after a couple of hours of use), and z acceptable transistors. Write program to accept the values for x , y and z (user inputs). A transistor is chosen at random from the bin and put into use. If it does not immediately fail, write a program to find the probability it is acceptable i.e. $P(\text{accepted} \mid \text{not defective})$.
3. A publishing firm wants to develop special printing machines for English. For this, they need to determine the probability of occurrence of specific letters and words. You are given large text file (fileA-TimeMachine.txt). In this problem, uppercase and lowercase alphabets are considered the same and other characters like whitespace, punctuation and numerals are to be omitted. Write a program to accept the file name and two alphabets, say X

and Y from the user. The program should compute a) Prior probability of X i.e. $P(X)$. b) Prior probability of Y i.e. $P(Y)$. c) Conditional probabilities i.e., probability of occurrence of X given Y and probability of occurrence of Y given X. Example: We are looking for the bigrams. Let $X = 'a'$ and $Y = 'b'$. Prior probability of X means $P(X = 'a')$. Conditional probability $P(X = 'a' | Y = 'b')$ means probability of observing alphabet 'a' immediately after observing (given) alphabet 'b' (i.e. Y followed by X). d) Determine the posterior probabilities (probability of Y given X, $P(Y|X)$ and probability of X given Y, $P(X|Y)$) using Bayes rule.

1/ Gen soln

$$P(\text{dot sent}) = a$$

$$P(\text{mistakenly dot received as dash}) = b$$

$$P(\text{dot sent (dot received)}) = \frac{a(1-b)}{a(1-b) + (1-a)b}$$

Part. soln

$$a = 3/7, \quad b = 1/8$$

$$P_{\text{prob}} = \frac{3/7 \times 7/8}{3/7 \times 7/8 + 4/7 \times 1/8} = \frac{21}{25} = 0.84$$

$$2/ $P(\text{defective}) = x, \quad P(\text{partially defective}) = y$$$

$$P(\text{acceptable}) = z$$

$$P(\text{accepted / not defective}) = \frac{z}{y+z}$$

Code is displayed & in terminal, output is displayed with an examples as mentioned in question

Spyder

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C:\Users\HP\untitled0.py

temp.py X untitled0.py* X untitled1.py* X untitled2.py* X

```
1 #P(x) is probability of 'x'
2 '''Ques 1'''
3 a=float(input("P(dots sent):")) #eg:-P(a) is probability of dots sent
4 b=float(input("P(dot is mistakenly received as dash):"))
5 print("P(dot sent/ dot received)=(a*(1-b))/(a*(1-b)+(1-a)*b)")
6 #probability of dot sent given dot received is obtained by taking case when dot was sent
7 # & received out of dot was (sent & received) and (sent & but mistakenly received as dash)
8 '''Ques 2'''
9 x,y,z=int(input("defective :")),int(input("partially defective :")),int(input("acceptable :"))
10 #x,y,z are number of defective, partially defective & acceptable transistors respectively
11 #Taking x,y & z as 2,3,4 as an example
12 print("p(accepted/ non defective) :", z/(y+z))
13 #probability of accepted given non defective is obtained by taking acceptable transistors
14 #out of non defective (partially defective & acceptable)
15 '''Ques 3'''
16 file=open("fileA-TimeMachine.txt","r",encoding='Latin-1')
17 f=file.read().replace('\n','') #f is text data of the file
18 f.lower() #lower casing all text of f
19 data='' #assuming data a variable
20 for i in f:
21     if ord('a')<=ord(i)<=ord('z'):
22         data+=i
23 def P(X,data):
24     #making a function P(X,data) to calculate probability of X in data
25     count=data.count(X) #count is number of X in data
26     return count/len(data)
27 #probability is obtained as length of data is sample space
28 def P1(X,Y,data):
29     #making a function P(X,Y,data) to calculate probability of YX in data
30     count=data.count(Y+X) #count is number of YX in data
31     sample=data.count(Y) #sample is number of Y in data
32     return count/sample
33 #probability of X given Y before
34 X=input("X:") #X is the input of first variable
35 Y=input("Y:") #Y is the input of first variable
36 #Taking 1st & 2nd input as 'x' and 'y' respectively as an example
37 print("P(X) : ",P(X,data))
38 print("P(Y) : ",P(Y,data))
39 print("P(X/Y) : ",P1(X,Y,data))
40 print("P(Y/X) : ",P1(Y,X,data)) #probabilities are obtained
```

Name	Type	Size	
a	float	1	0.42857142857142855
b	float	1	0.125
data	str	151205	heimeachinenventionbyell...

Help Variable Editor

Console 6/A X

Python 3.7.9 (tags/v3.7.9:13c94747c7, Aug 17 2020, 18:58: Type "copyright", "credits" or "license" for more information)

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]: 3/7
Out[1]: 0.42857142857142855

In [2]: 1/8
Out[2]: 0.125

In [3]: runfile('C:/Users/HP/untitled0.py', wdir='C:/Users/HP/untitled0.py')

P(dots sent):0.42857142857142855

P(dot is mistakenly received as dash):0.125
P(dot sent/ dot received)= 0.8400000000000001

defective :2

partially defective :3

acceptable :4
p(accepted/ non defective) : 0.5714285714285714

X:x

Y:y
P(X) : 0.0017393604708838993
P(Y) : 0.019404120234119242
P(X/Y) : 0.00034083162917518747
P(Y/X) : 0.0

Python Console

LSP Python: ready