

### Practical-3

**Objective:** To implement Bayes classifier using multiple class and multiple features.

**Classes:** { yes, no }

**Features:** chills, runny nose, headache, fever.

**Training:**

Chills	Runny nose	Headache	Fever	Flu
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

**Testing:** Using *Bayes Theorem* to find the class belongingness of any object.

**A priori Probabilities :**  $P(W_i)$  where  $i = 1, 2, 3$  ( for all the 3 classes).

**Conditional Probabilities :**  $P(x_j/W_i)$  for feature  $x$  which can take values  $x_j$ .

**Posteriori Probabilities :** that an object has a feature  $x$  and also belongs to the class  $W_i$ .

$$P(W_i/x) = P(x/W_i) * P(W_i) / P(x)$$

**CODE :**

```
import pandas as pd
```

```
test = input().split()
```

```
df = pd.read_csv("data.csv")
```

```
g1 = df.groupby(['flu'])
```

```
g2 = df.groupby(['chills', 'flu'])
```

```
g3 = df.groupby(['runny nose', 'flu'])
```

```
g4 = df.groupby(['headache', 'flu'])
```

```
g5 = df.groupby(['fever', 'flu'])
```

```
apriori_prob = g1.size().div(len(df))
```

```
conditional_prob = [g2.size().div(len(df)).div(apriori_prob, axis=0, level='flu'),  
                    g3.size().div(len(df)).div(apriori_prob, axis=0, level='flu'),
```

```
g4.size()).div(len(df)).div(apriori_prob, axis=0, level='flu'),
g5.size()).div(len(df)).div(apriori_prob, axis=0, level='flu')]
```

```
class1, class2 = apriori_prob[1], apriori_prob[0]
```

```
for i, j in zip(test, conditional_prob):
```

```
    class1 *= j[i]["Y"]
```

```
    class2 *= j[i]["N"]
```

```
if class1 > class2:
```

```
    print("YES FLU")
```

```
else:
```

```
    print("NO FLU")
```

```
print()
```

```
print("A PRIORI PROBABILITIES")
```

```
print(apriori_prob)
```

```
print()
```

```
print("CONDITIONAL PROBABILITIES")
```

```
print(conditional_prob.first())
```

## OUTPUT :

```
if class1>class2:
    print("YES FLU")
else:
    print("NO FLU")
```

NO FLU

```
A PRIORI PROBABILITIES
flu
N    0.375
Y    0.625
dtype: float64

CONDITIONAL PROBABILITIES
[chills flu
N      N    0.666667
      Y    0.400000
Y      N    0.333333
      Y    0.600000
dtype: float64, runny nose flu
N      N    0.666667
      Y    0.200000
Y      N    0.333333
      Y    0.800000
dtype: float64, headache flu
mild   N    0.333333
      Y    0.400000
no     N    0.333333
      Y    0.200000
strong N    0.333333
      Y    0.400000
dtype: float64, fever flu
N      N    0.666667
      Y    0.200000
Y      N    0.333333
      Y    0.800000
```

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