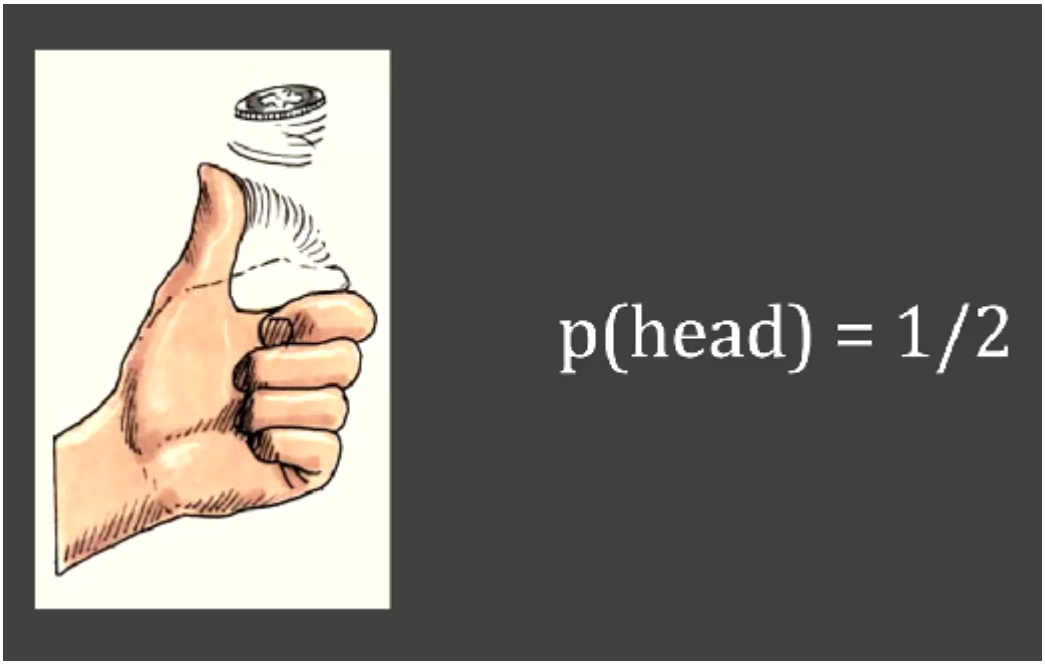
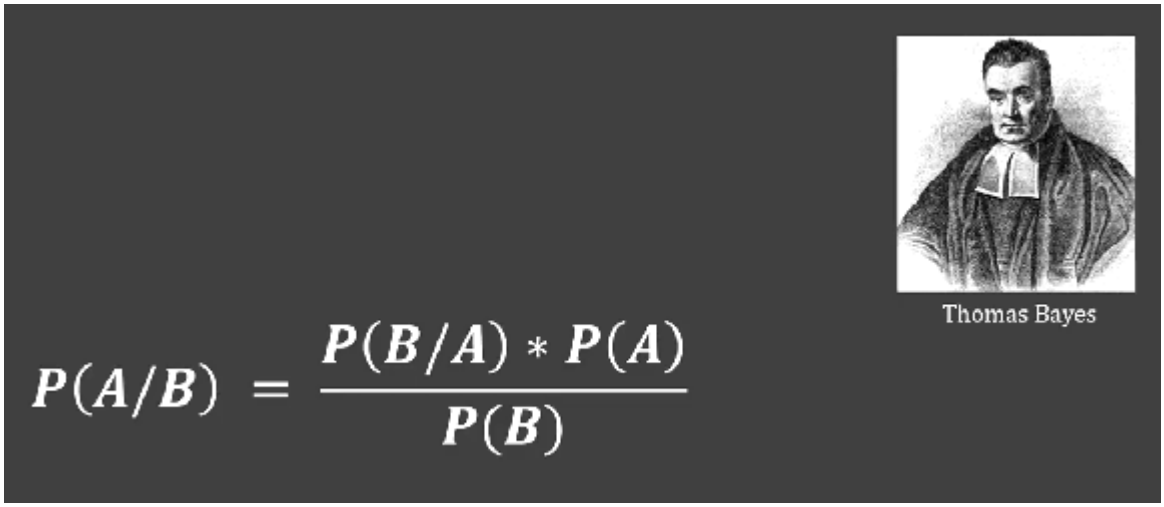
Naive Bayes Tutorial Part 1: Predicting survival from titanic crash



Conditional Probability



Consider the example to know the essence of conditional probability, a fair die is rolled, the probability that it shows “4” is 1/6, it is an unconditional probability, but the probability that it shows “4” with the condition that it comes with even number, is 1/3, this is a conditional probability.

Passenger Id	Name	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked	Survived
1	Braund, Mr. Owen Harris	3	male	22	1	0	21171	7.25		S	0
2	Cumings, Mrs. John Bradley	1	female	38	1	0	17599	71.2833	C85	C	1
3	Heikkinen, Miss. Laina	3	female	26	0	0	3101282	7.925		S	1
4	Futrelle, Mrs. Jacques Heath	1	female	35	1	0	113803	53.1	C123	S	1
5	Allen, Mr. William Henry	3	male	35	0	0	373450	8.05		S	0
6	Moran, Mr. James	3	male		0	0	330877	8.4583		Q	0
7	McCarthy, Mr. Timothy J	1	male	54	0	0	17463	51.8625	E46	S	0
8	Palsson, Master. Gosta Leonard	3	male	2	3	1	349909	21.075		S	0
9	Johnson, Mrs. Oscar	3	female	27	0	2	347742	11.1333		S	1
10	Nasser, Mrs. Nicholas	2	female	14	1	0	237736	30.0708		C	1

$$P\left(\frac{Survived}{Male \ \& \ Class \ \& \ Age \ \& \ Cabin \ \& \ Fare}\right)$$

Make a naïve assumption that features such as male, class, age , cabin, fare etc. are independent of each other

Some applications of Nayive Base:

1. Email Spam Detection
2. Hand Digit Recognition
3. Wheather Prediction
4. Face Detection
5. News Article Categorization

In [1]:
```
import pandas as pd
```

In [2]:
```
df = pd.read_csv("D:/Data_Science/My Github/Machine-Learning-with-Python/14. naiv
df.head()
```

Out[2]:

	PassengerId	Name	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embark
0	1	Braund, Mr. Owen Harris	3	male	22.0	1	0	A/5 21171	7.2500	NaN	
1	2	Cumings, Mrs. John Bradley (Florence Briggs Th...	1	female	38.0	1	0	PC 17599	71.2833	C85	
2	3	Heikkinen, Miss. Laina	3	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	
3	4	Futrelle, Mrs. Jacques Heath (Lily May Peel)	1	female	35.0	1	0	113803	53.1000	C123	
4	5	Allen, Mr. William Henry	3	male	35.0	0	0	373450	8.0500	NaN	

In [3]:
```
df.drop(['PassengerId','Name','SibSp','Parch','Ticket','Cabin','Embarked'],axis='
df.head()
```

Out[3]:

	Pclass	Sex	Age	Fare	Survived
0	3	male	22.0	7.2500	0
1	1	female	38.0	71.2833	1
2	3	female	26.0	7.9250	1
3	1	female	35.0	53.1000	1
4	3	male	35.0	8.0500	0

In [4]:
```
inputs = df.drop('Survived',axis='columns')
target = df.Survived
```

In [5]:
```
#inputs.Sex = inputs.Sex.map({'male': 1, 'female': 2})
dummies = pd.get_dummies(inputs.Sex)
dummies.head(3)
```

Out[5]:

	female	male
0	0	1
1	1	0
2	1	0

In [6]:
```
#append dummy variables into dataframes
inputs = pd.concat([inputs,dummies],axis='columns')
inputs.head(3)
```

Out[6]:

	Pclass	Sex	Age	Fare	female	male
0	3	male	22.0	7.2500	0	1
1	1	female	38.0	71.2833	1	0
2	3	female	26.0	7.9250	1	0

Drop Sex column

In [7]:
```
inputs.drop('Sex',axis='columns',inplace=True)
inputs.head(3)
```

Out[7]:

	Pclass	Age	Fare	female	male
0	3	22.0	7.2500	0	1
1	1	38.0	71.2833	1	0
2	3	26.0	7.9250	1	0

In [8]:
```
#Check if any nan value exist
inputs.columns[inputs.isna().any()]
```

Out[8]:
```
Index(['Age'], dtype='object')
```

In [9]:
```
inputs.Age[:10]
```

Out[9]:
```
0    22.0
1    38.0
2    26.0
3    35.0
4    35.0
5     NaN
6    54.0
7     2.0
8    27.0
9    14.0
Name: Age, dtype: float64
```

In [10]:
```
#Fill NAN value with mean value
inputs.Age = inputs.Age.fillna(inputs.Age.mean())
inputs.head()
```

Out[10]:

	Pclass	Age	Fare	female	male
0	3	22.0	7.2500	0	1
1	1	38.0	71.2833	1	0
2	3	26.0	7.9250	1	0
3	1	35.0	53.1000	1	0
4	3	35.0	8.0500	0	1

In [12]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(inputs,target,test_size=0.2)
```

In [13]:
```
len(X_train)
```

Out[13]:
```
712
```

In [14]:
```
len(X_test)
```

Out[14]:
```
179
```

In [15]:
```
from sklearn.naive_bayes import GaussianNB
model = GaussianNB()
```

In [16]:
```
model.fit(X_train,y_train)
```

Out[16]:
```
GaussianNB()
```

In [17]:
```
model.score(X_test,y_test)
```

Out[17]:
```
0.8324022346368715
```

In [18]:
```
X_test[0:10]
```

Out[18]:

	Pclass	Age	Fare	female	male
745	1	70.000000	71.0000	0	1
483	3	63.000000	9.5875	1	0
632	1	32.000000	30.5000	0	1
273	1	37.000000	29.7000	0	1
499	3	24.000000	7.7958	0	1
55	1	29.699118	35.5000	0	1
463	2	48.000000	13.0000	0	1
202	3	34.000000	6.4958	0	1
761	3	41.000000	7.1250	0	1
465	3	38.000000	7.0500	0	1

In [19]:
```
y_test[0:10]
```

Out[19]:
```
745    0
483    1
632    1
273    0
499    0
55     1
463    0
202    0
761    0
465    0
Name: Survived, dtype: int64
```

In [20]:
```
model.predict(X_test[0:10])
```

Out[20]:
```
array([0, 1, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

In [21]:
```
model.predict_proba(X_test[:10])
```

Out[21]:
```
array([[0.74309074, 0.25690926],
       [0.06610057, 0.93389943],
       [0.91881393, 0.08118607],
       [0.92167558, 0.07832442],
       [0.98684943, 0.01315057],
       [0.91244306, 0.08755694],
       [0.9759533 , 0.0240467 ],
       [0.98817594, 0.01182406],
       [0.98848654, 0.01151346],
       [0.9884357 , 0.0115643 ]])
```

0.74= not survived 0.25=survived

Calculate the score using cross validation

In [22]:
```
from sklearn.model_selection import cross_val_score
cross_val_score(GaussianNB(),X_train, y_train, cv=5)
```

Out[22]:
```
array([0.74825175, 0.72027972, 0.78873239, 0.82394366, 0.76056338])
```

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