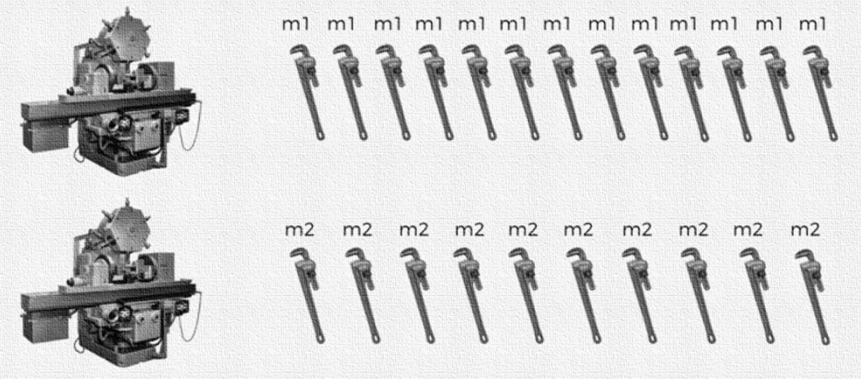
Naïve Bayes Classifier

Mohan M J

Bayes' Theorem



What is the probability that Machine 2 produces a defective item?

Bayes' Theorem

$$P(A|B) = \frac{P(B|A) * P(A)}{P(B)}$$

Bayes' Theorem

Mach1: 30 wrenches / hr	**-> P(Mach1) = 30/50 = 0.6**
Mach2: 20 wrenches / hr	**-> P(Mach2) = 20/50 = 0.4**
Out of all produced parts: **We can SEE that 1% are defective**	**-> P(Defect) = 1%**
Out of all defective parts: **We can SEE that 50% came from mach1** **And 50% came from mach2**	**-> P(Mach1 | Defect) = 50%** **-> P(Mach2 | Defect) = 50%**
Question: **What is the probability that a part produced by mach2 is defective = ?**	**-> P(Defect | Mach2) = ?**

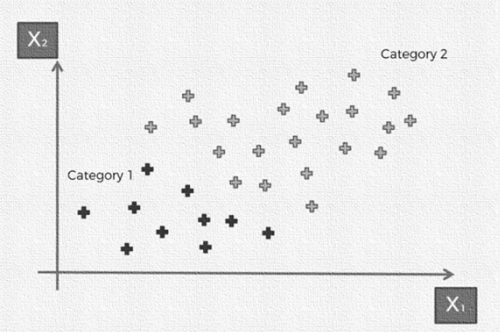
Bayes' Theorem

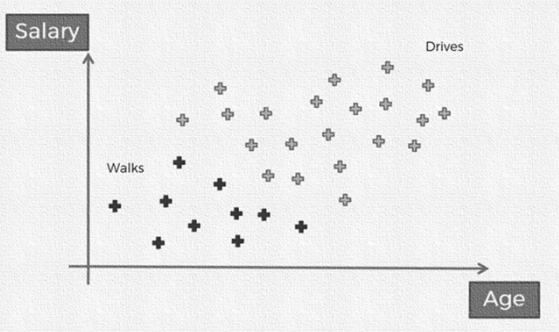
Mach1: 30 wrenches / hr
Mach2: 20 wrenches / hr
Out of all produced parts:
We can SEE that 1% are defective
Out of all defective parts:
We can SEE that 50% came from mach1
And 50% came from mach2
Question:
What is the probability that a part produced by mach2 is defective = ?

-> P(Mach2) = 20/50 = 0.4
-> P(Defect) = 1%
-> P(Mach2 | Defect) = 50%
-> P(Defect | Mach2) = ?

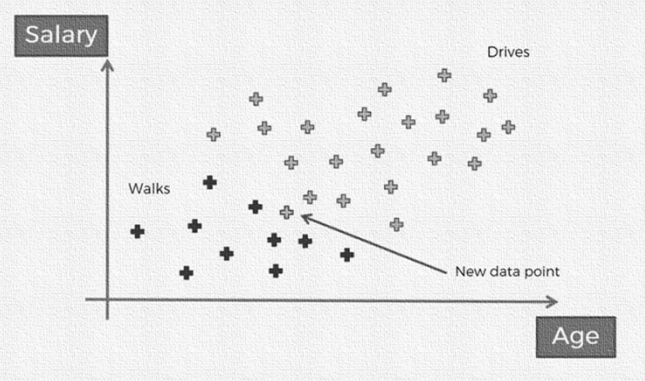
$$P(\text{Defect} \mid \text{Mach2}) = \frac{P(\text{Mach2} \mid \text{Defect}) * P(\text{Defect})}{P(\text{Mach2})} = 1.25\%$$

Naïve Bayes Classifier





Naïve Bayes Classifier

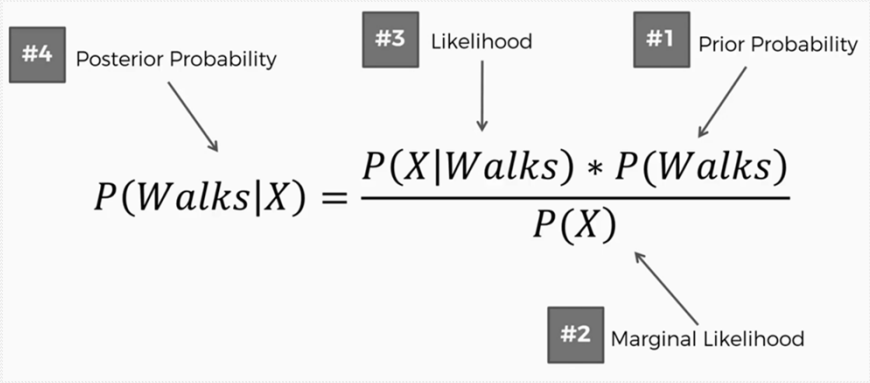


Naïve Bayes Classifier

$$P(A|B) = \frac{P(B|A) * P(A)}{P(B)}$$

$$P(Walks|X) = \frac{P(X|Walks) * P(Walks)}{P(X)}$$

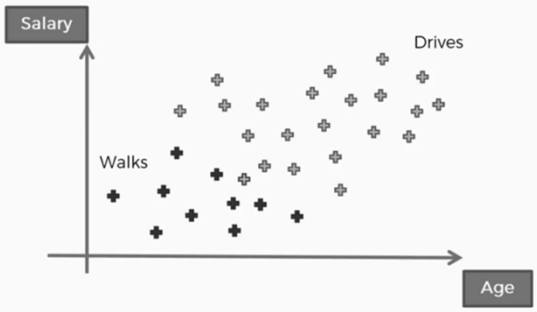
Naïve Bayes Classifier



$$P(Drives|X) = \frac{P(X|Drives) * P(Drives)}{P(X)}$$

$$P(Walks|X)\ v.s.\ P(Drives|X)$$

STEP 1:

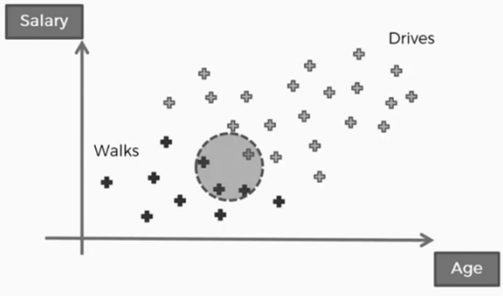


#1. P(Walks)

$$P(Walks) = \frac{Number\ of\ Walkers}{Total\ Observations}$$

$$P(Walks) = \frac{10}{30}$$

STEP 2:

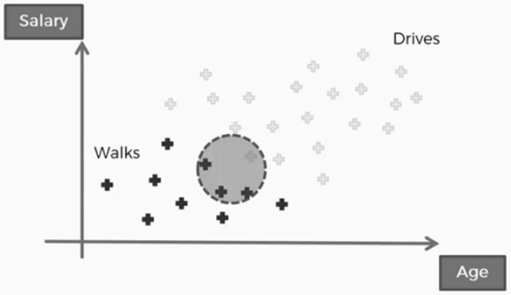


#2. P(X)

$$P(X) = \frac{Number\ of\ Similar\ Observations}{Total\ Observations}$$

$$P(X) = \frac{4}{30}$$

STEP 3:



#3. P(X|Walks)

$$P(X|Walks) = \frac{Number\ of\ Similar\ Observations\ Among\ those\ who\ Walk}{Total\ number\ of\ Walkers}$$

$$P(X|Walks) = \frac{3}{10}$$

Posterior Probability

#4 Posterior Probability

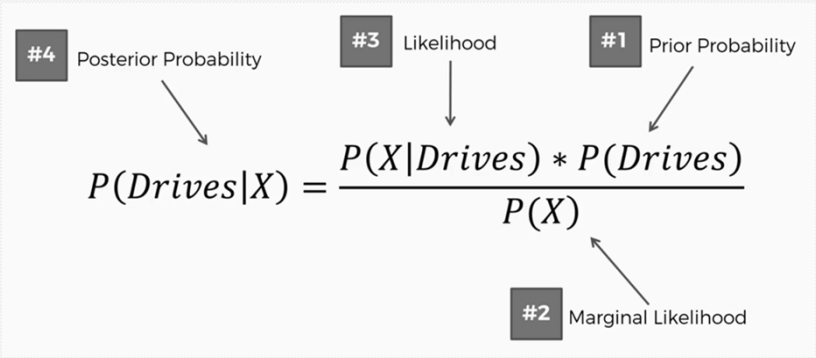
#3 Likelihood

#1 Prior Probability

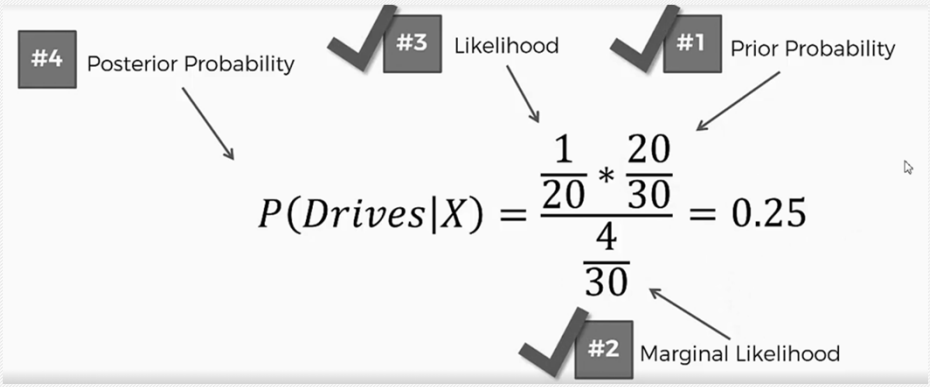
$$P(Walks|X) = \frac{\frac{3}{10} * \frac{10}{30}}{\frac{4}{30}} = 0.75$$

#2 Marginal Likelihood

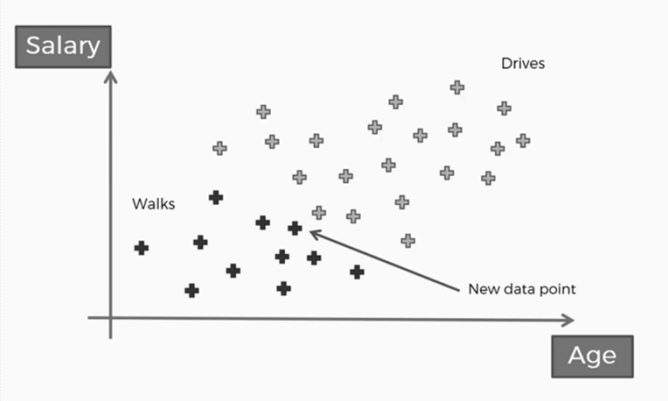
P(Drives|X)



P(Drives|X)



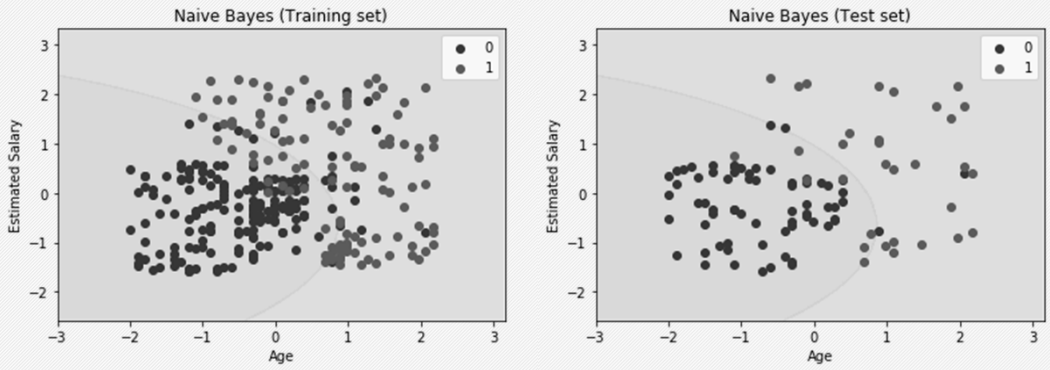
New Data Point – Walks to work!



PYTHON CODE

```
# Fitting Naive Bayes to the Training set
from sklearn.naive_bayes import GaussianNB
classifier = GaussianNB()
classifier.fit(X_train, y_train)
```

Visualization



THANK YOU