

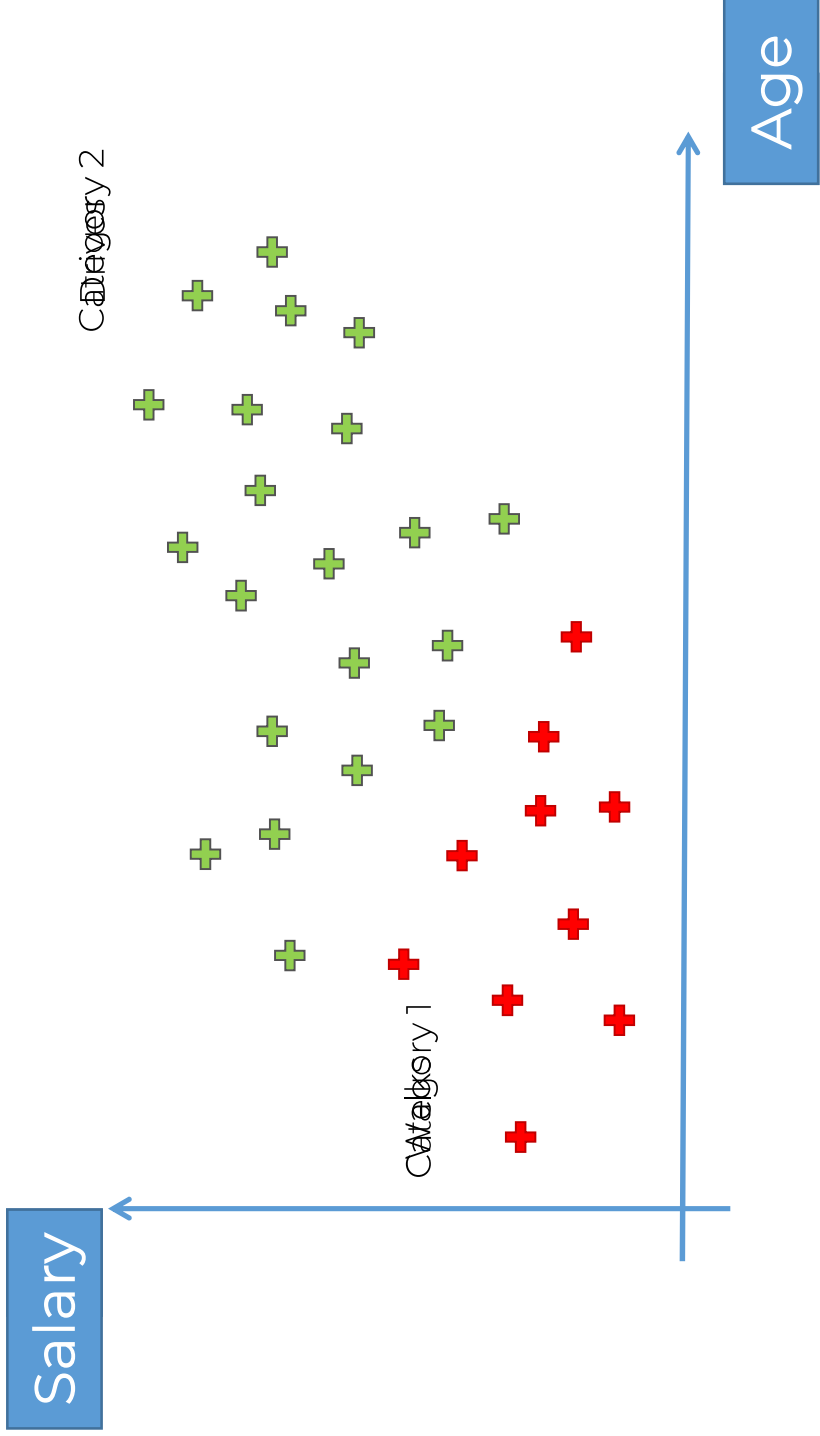
Naïve Bayes Classifier

Intuition

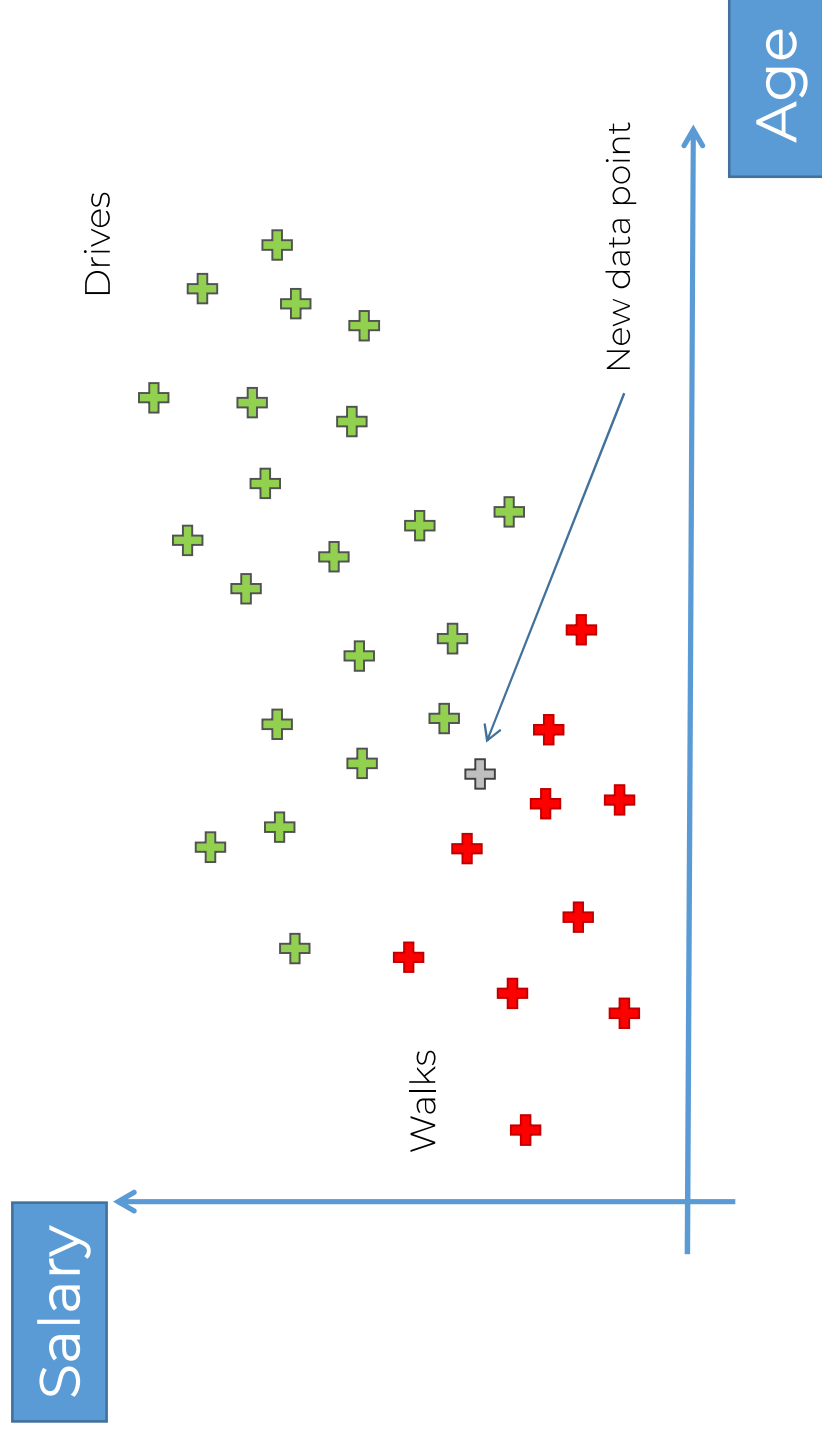
Naïve Bayes

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

Naïve Bayes



Naïve Bayes



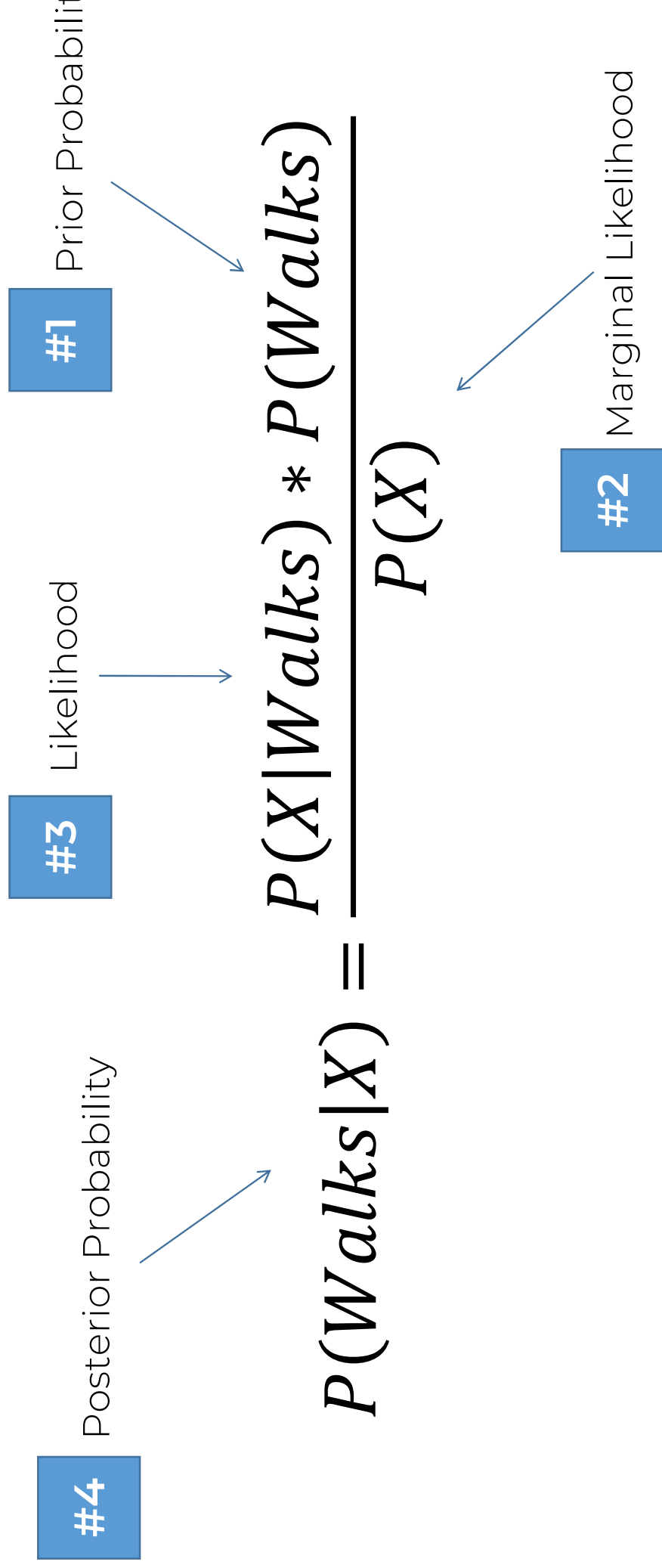
Naïve Bayes

Plan of Attack

Naïve Bayes

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

Step 1



#4 Posterior Probability

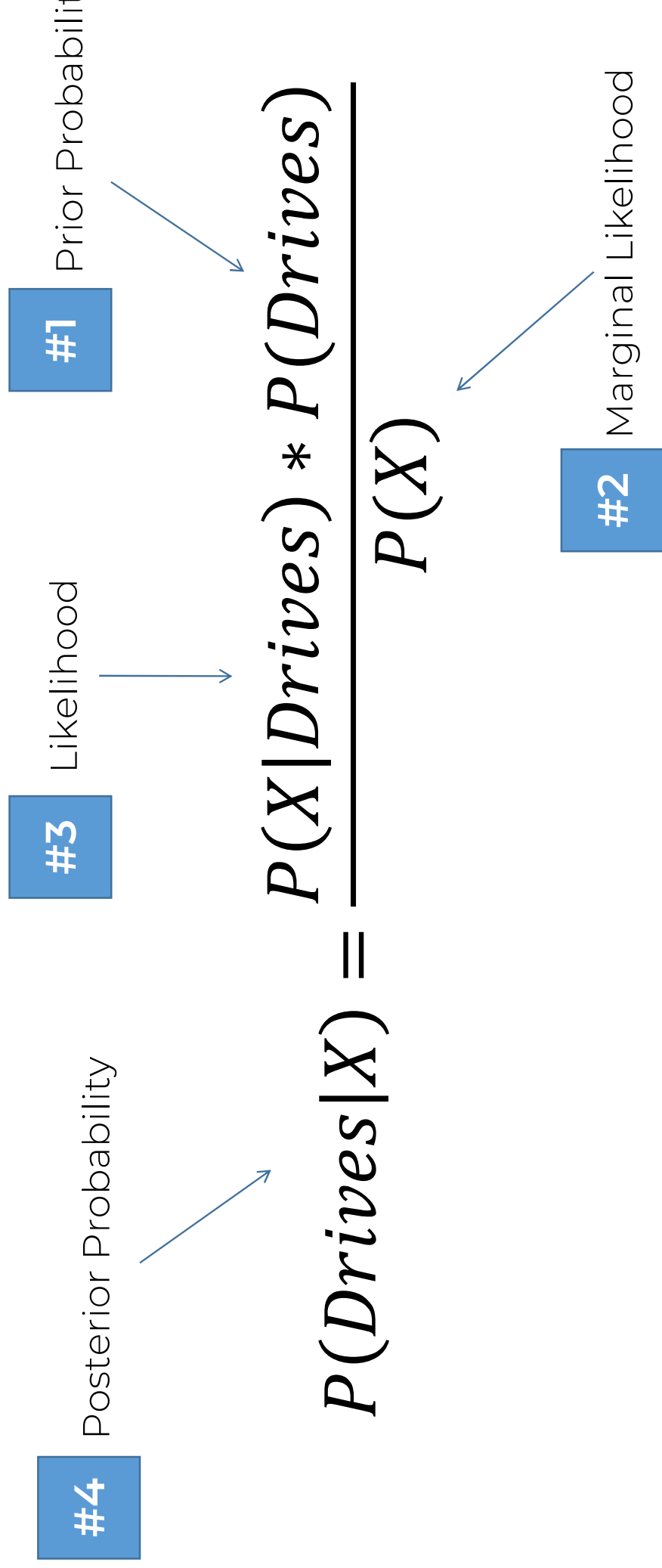
#3 Likelihood

#1 Prior Probability

#2 Marginal Likelihood

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

Step 2


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

#4 Posterior Probability

#1 Prior Probability

#3 Likelihood

#2 Marginal Likelihood

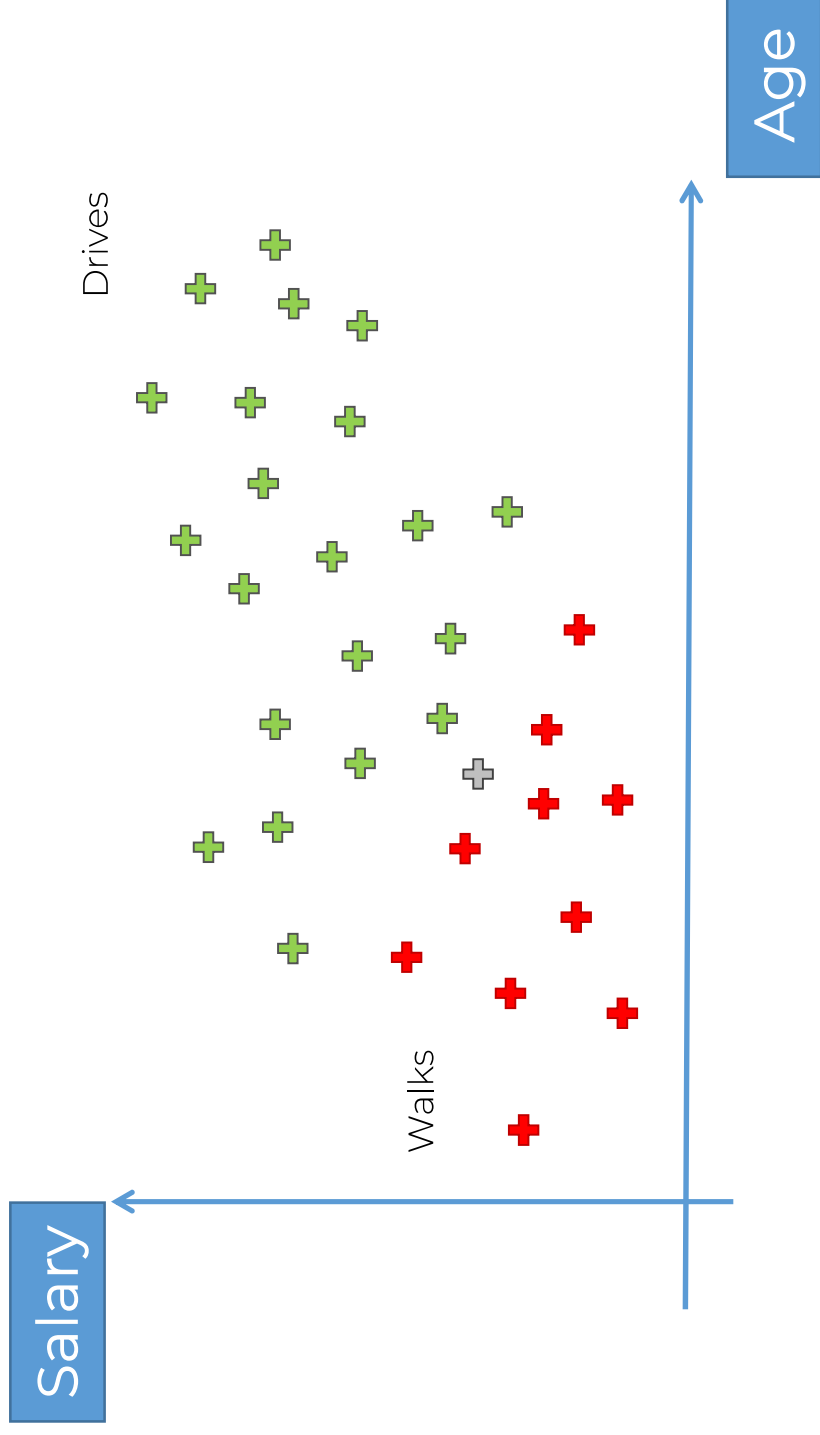
Step 3

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

Naïve Bayes

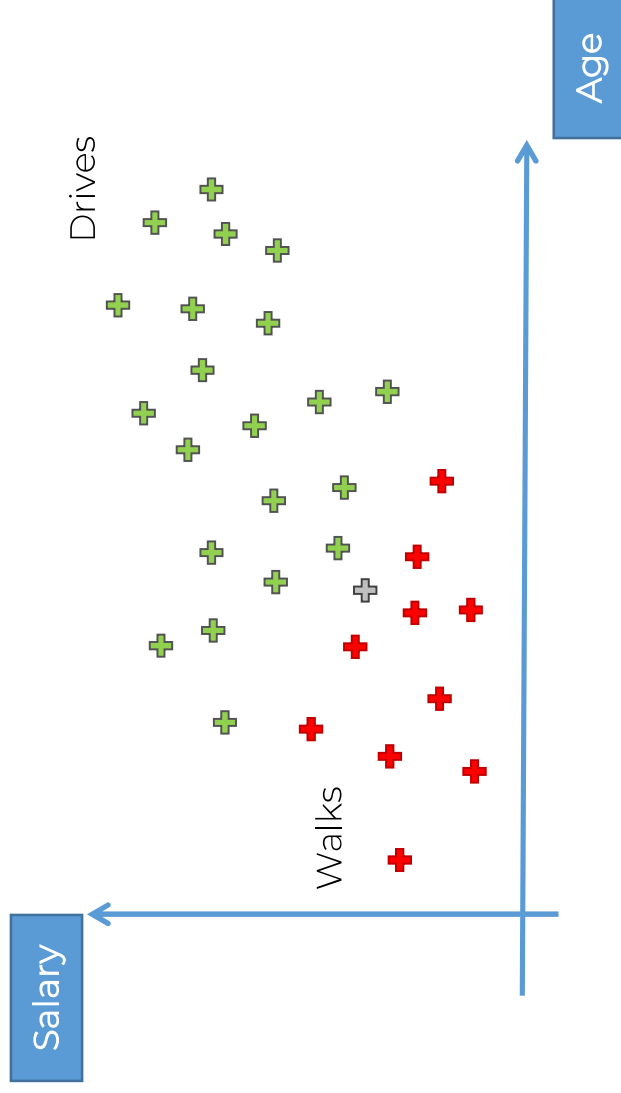
Ready?

Naïve Bayes: Step 1



Naïve Bayes: Step 1

#1. $P(\text{Walks})$



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

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

Naïve Bayes: Step 1

The diagram illustrates the first step of Naïve Bayes classification. It features the formula $P(Walks|X) = \frac{P(X|Walks) * P(Walks)}{P(X)}$. Annotations include: a green checkmark and a blue box labeled '#1' with the text 'Prior Probability' pointing to $P(Walks)$; a blue box labeled '#3' with the text 'Likelihood' pointing to $P(X|Walks)$; and a blue box labeled '#2' with the text 'Marginal Likelihood' pointing to $P(X)$. The box '#2' and its label are circled in red.

#4 Posterior Probability

#1 Prior Probability

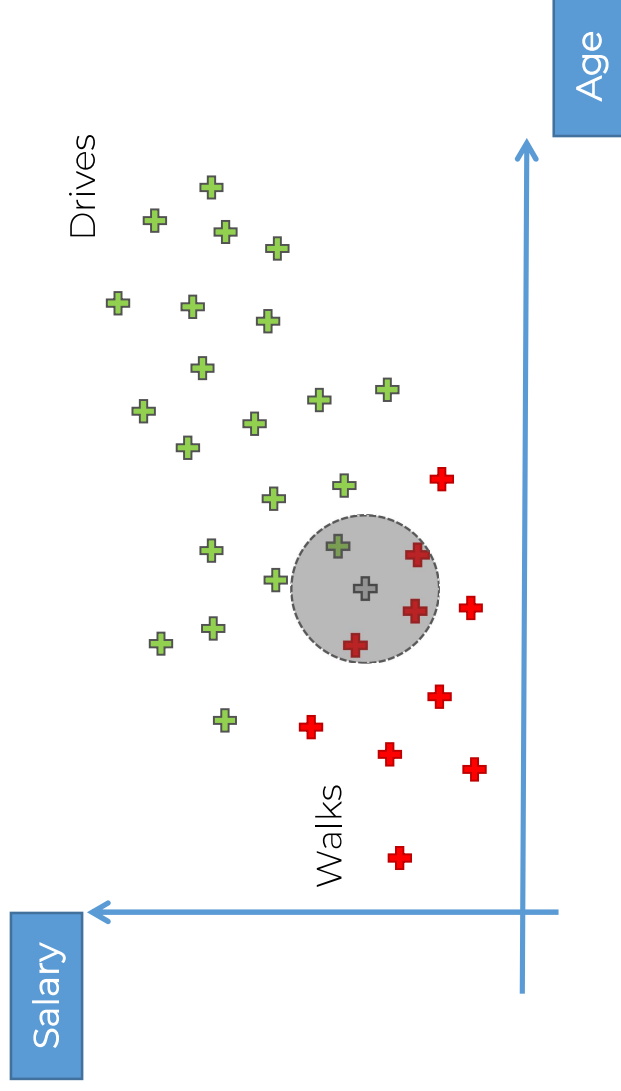
#3 Likelihood

#2 Marginal Likelihood

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

Naïve Bayes: Step 1

#2. $P(X)$



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

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

Naïve Bayes: Step 1

The diagram illustrates the first step of Naïve Bayes classification. It features the formula
$$P(Walks|X) = \frac{P(X|Walks) * P(Walks)}{P(X)}$$
 with four numbered annotations: #1 (Prior Probability) points to $P(Walks)$; #2 (Marginal Likelihood) points to $P(X)$; #3 (Likelihood) points to $P(X|Walks)$, which is circled in red; and #4 (Posterior Probability) points to the left side of the equation, $P(Walks|X)$. Green checkmarks are placed next to #1 and #2.

#4 Posterior Probability

#1 Prior Probability

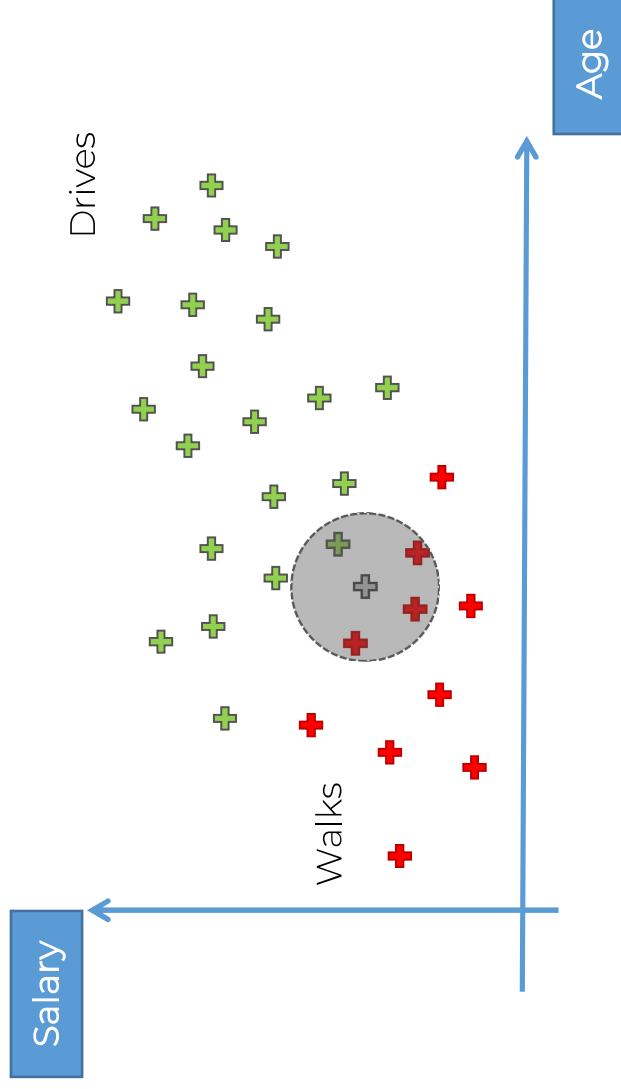
#3 Likelihood

#2 Marginal Likelihood

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

Naïve Bayes: Step 1

#3. $P(X|Walks)$



*Number of Similar
Observations*

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

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

Naïve Bayes: Step 1

The diagram illustrates the formula for the Naïve Bayes classifier in Step 1. The formula is:

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

The components are labeled as follows:

- #4** Posterior Probability: This label is circled in red and points to the left side of the equation, $P(Walks|X)$.
- #3** Likelihood: This label points to the numerator's first term, $P(X|Walks)$.
- #1** Prior Probability: This label points to the numerator's second term, $P(Walks)$.
- #2** Marginal Likelihood: This label points to the denominator, $P(X)$.

Each label is accompanied by a green checkmark icon, indicating that these components are correctly identified.

Naïve Bayes: Step 1

The diagram illustrates the Naïve Bayes formula for calculating the posterior probability of a class given a set of features. The formula is presented as:

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

Four components are identified and labeled with blue boxes and green checkmarks:

- #1** Prior Probability: Points to the term $\frac{10}{30}$ in the formula.
- #2** Marginal Likelihood: Points to the term $\frac{10}{30}$ in the formula.
- #3** Likelihood: Points to the term $\frac{3}{10}$ in the formula.
- #4** Posterior Probability: Points to the entire formula $P(Walks|X)$.

Naïve Bayes

Step 1 – Done.

Step 2

The diagram illustrates the components of Bayes' theorem for the probability of a drive given data X . The central equation is $P(Drives|X) = \frac{P(X|Drives) * P(Drives)}{P(X)}$. Four blue boxes with white text are connected to the equation by arrows:

- #4** Posterior Probability: An arrow points from this box to the left side of the equation, $P(Drives|X)$.
- #1** Prior Probability: An arrow points from this box to the numerator term $P(Drives)$.
- #3** Likelihood: An arrow points from this box to the numerator term $P(X|Drives)$.
- #2** Marginal Likelihood: An arrow points from this box to the denominator term $P(X)$.

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

Naïve Bayes: Step 2

#4 Posterior Probability **#3** Likelihood **#1** Prior Probability

$$P(\text{Drives}|X) = \frac{1}{20} * \frac{20}{4} * \frac{1}{30} = 0.25$$

#2 Marginal Likelihood

The diagram illustrates the Naïve Bayes formula for calculating the posterior probability. It features a central equation: $P(\text{Drives}|X) = \frac{1}{20} * \frac{20}{4} * \frac{1}{30} = 0.25$. Four blue boxes with white text and green checkmarks are positioned around the equation, each with an arrow pointing to a specific part of the formula. Box #4 (Posterior Probability) points to the left side of the equation, $P(\text{Drives}|X)$. Box #3 (Likelihood) points to the first fraction, $\frac{1}{20}$. Box #1 (Prior Probability) points to the second fraction, $\frac{20}{4}$. Box #2 (Marginal Likelihood) points to the third fraction, $\frac{1}{30}$.

Naïve Bayes

Step 2 – Done.

Step 3

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

Step 3

$0.75 \text{ } v.s. \text{ } 0.25$

Step 3

$$0.75 > 0.25$$

Step 3

$$P(Walks|X) > P(Drives|X)$$