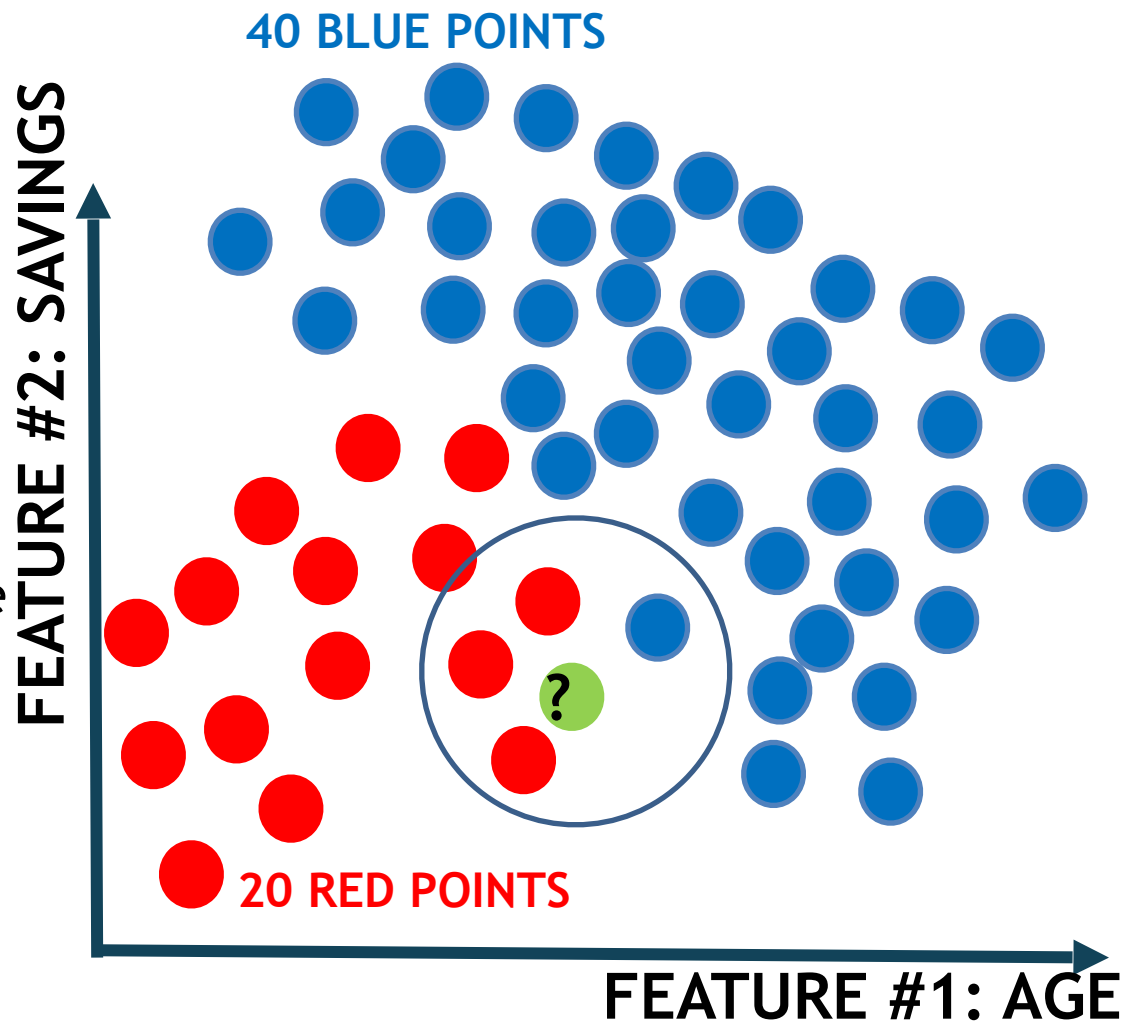
NAÏVE BAYES: REVIEW

- Let's combine prior probability and likelihood to create a posterior probability.
- **Prior probabilities:** suggests that X may be classified as BLUE Because there are twice as much blue points.
- **Likelihood:** suggests that X is RED because there are more RED points in the vicinity of X.
- Bayes' Rule combines both to form a posterior probability.



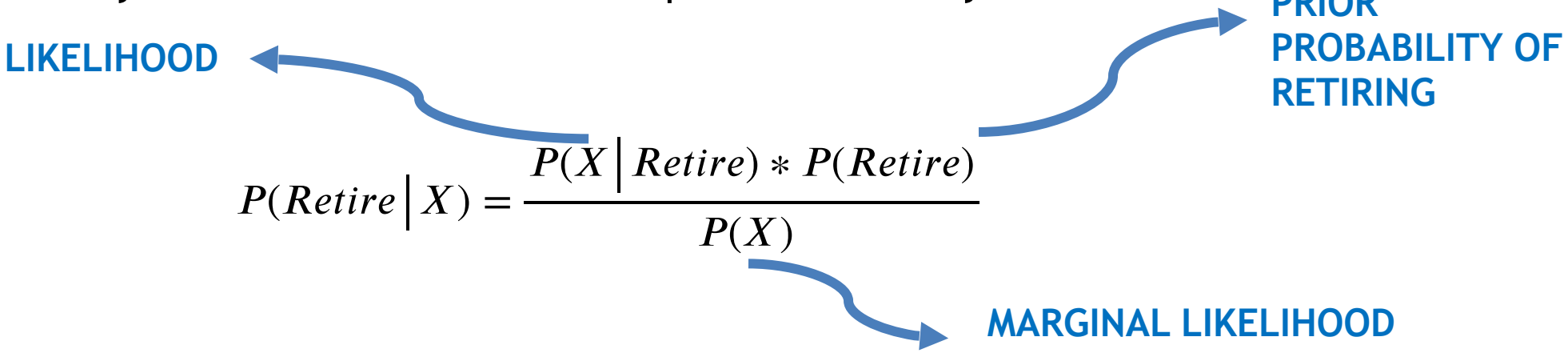
$$\text{eing } BLUE = \text{ Prior Probability of } BLUE * \text{Likelihood of } X \text{ being } BLUE = \frac{40}{60} * \frac{1}{40} = \frac{1}{60}$$

X CLASSIFIED AS RED (NON
SINCE IT HAS LARGER POST
PROBABILITY

$$\text{ility of } X \text{ being } RED = \text{ Prior Probability of } RED * \text{Likelihood of } X \text{ being } RED = \frac{20}{60} * \frac{3}{20} = \frac{1}{20}$$

NAÏVE BAYES: SOME MATH!

- Naïve Bayes is a classification technique based on Bayes' Theorem.



- : New Customer's features; age and savings
- : probability of customer retiring given his/her features, such as age and savings
- : Prior probability of retiring, without any prior knowledge
- : likelihood
- : Marginal likelihood, the probability of any point added lies into the circle

NAÏVE BAYES: SOME MATH!

LIKELIHOOD

PRIOR PROBABILITY OF RETIRING

$$P(Retire \mid X) = \frac{P(X \mid Retire) * P(Retire)}{P(X)}$$

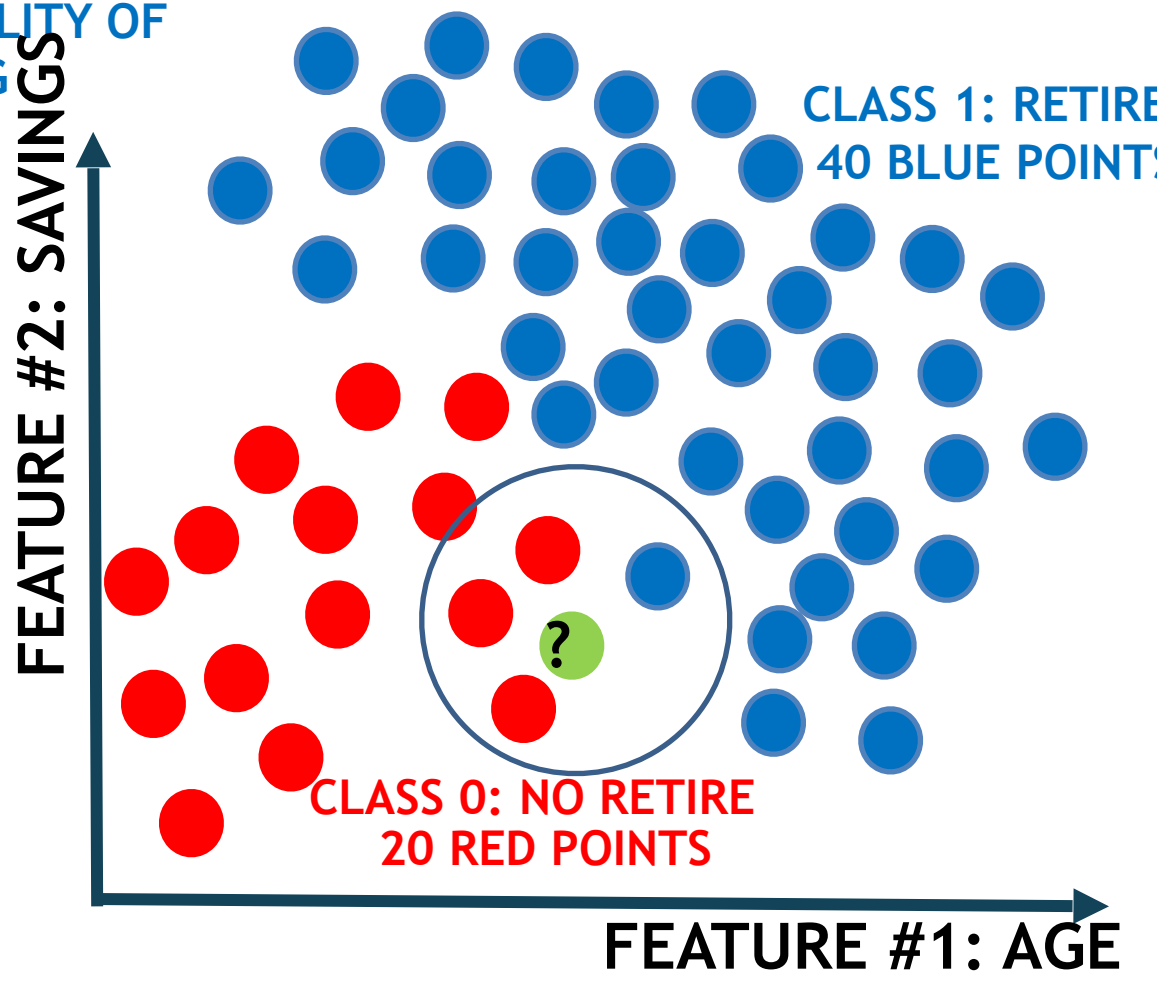
MARGINAL LIKELIHOOD

$$P(Retire) = \frac{\text{\# of Retiring}}{\text{Total points}} = 40/60$$

$$P(X \mid Retire) = \frac{\text{\# of smilar observations for retiring}}{Total\ \#\ retiring} = 1/40$$

$$P(X) = \frac{\text{\# of Similar observations}}{Total\ \#\ Points} = 4/60$$

$$P(Retire \mid X) = \frac{\frac{40}{60} * \frac{1}{40}}{\frac{4}{60}} = \frac{1/60}{4/60} = 0.25$$



NAÏVE BAYES: QUIZ/CALCULATE THE PROBABILTY OT NON-RETIRING (RED CLASS)

?

NAÏVE BAYES: QUIZ/CALCULATE THE PROBABILTY OT NON-RETIRING (RED CLASS)

LIKELIHOOD

PRIOR PROBABILITY OF NO RETIRING

$$P(No\ Retire \mid X) = \frac{P(X \mid No\ Retire) * P(No\ Retire)}{P(X)}$$

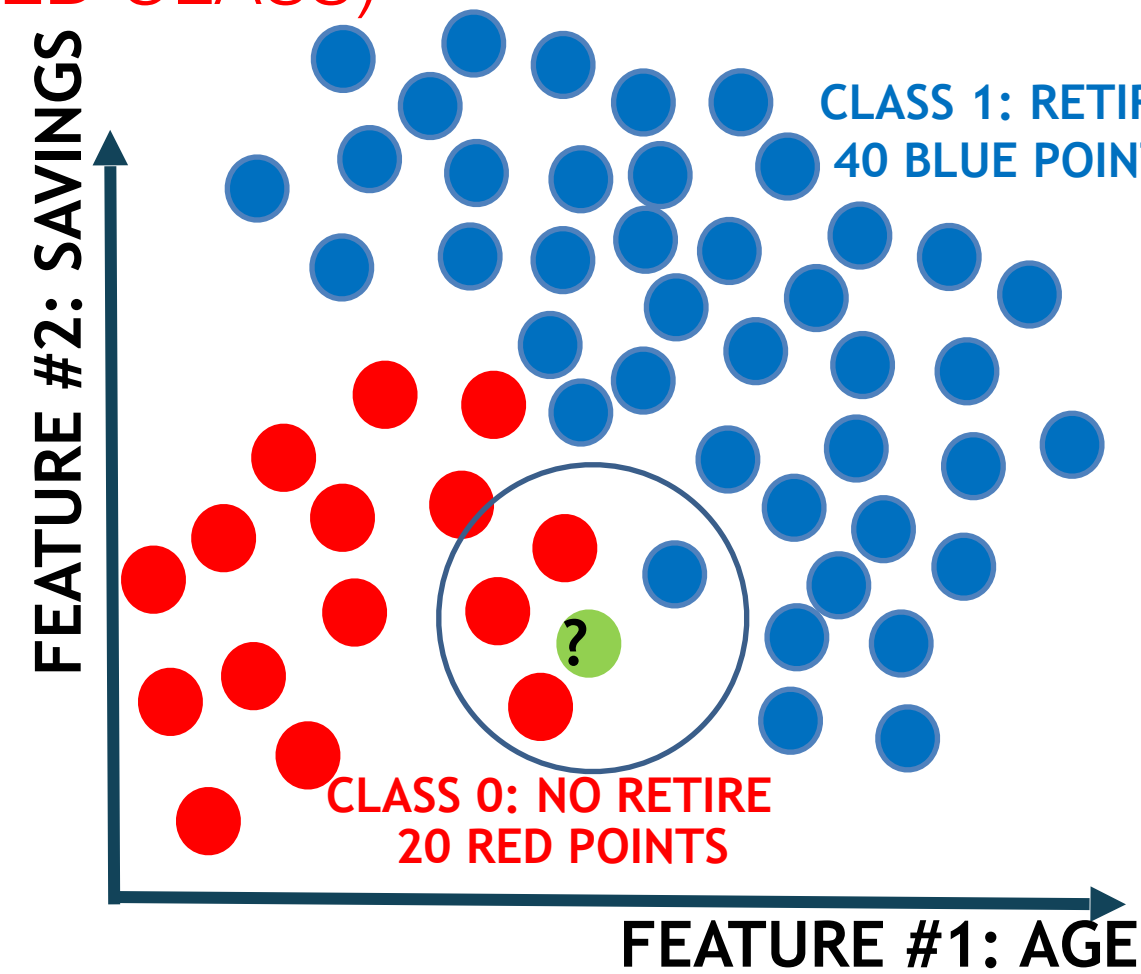
MARGINAL LIKELIHOOD

$$P(No\ Retire) = \frac{\#\ \text{of No Retiring}}{\text{Total points}} = 20/60$$

$$P(X \mid No\ Retire) = \frac{\#\ \text{of smilar observations for No retiring}}{Total\ \#\ no\ retiring} = 3/20$$

$$P(X) = \frac{\#\ \text{of Similar observations}}{Total\ \#\ Points} = 4/60$$

$$P(No\ Retire \mid X) = \frac{\frac{20}{60} * \frac{3}{20}}{\frac{4}{60}} = \frac{3/60}{4/60} = 0.75$$



$$NOTE:\ P(Non\ Retire \mid X) = 1 - 0.25 = 0.75$$

NAÏVE BAYES: WHY NAÏVE?

- It is called naive because it assumes that the presence of a certain feature in a class is independent of the presence of other features.
- EXAMPLE #1: Age/savings, the assumption is not necessarily true since age and savings might be dependant on each others
- EXAMPLE #2: fruit can be classified as watermelon if its color is green, tastes sweet, and round.
- These features might be dependant on each others, however, we assume they are all independent and that's why its 'Naive'!