

Introduction to AI - Bonus Question

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1 Question

In the National Football League (NFL), the likelihood that a team wins a game when losing 4+ turnovers (i.e., 4 turnovers or more) in that game is 13.3%. However, the percentage of games won by a team losing 4+ turnovers is 24% if their opponent is the Cleveland Browns.

There are 32 teams in the NFL. What is the likelihood of a team winning a game in which they lose 4+ turnovers, if their opponent is NOT the Cleveland Browns?

2 Answer

let,

W = Winning a game but losing 4 turnovers.

C = Playing against the Cleveland Browns.

Then $P(W) = 0.133$, since the % is 13.3%. Also, $P(W|C) = 0.24$, since the % is 24.0%.

Assuming that playing any team is equally likely, we know that $P(C) = \frac{1}{31}$, as there are 32 teams, and no team can play against themselves.

Hence, $P(\neg C) = \frac{30}{31}$, which is $1 - \frac{1}{31}$.

We want to find the probability of winning a game after losing 4+ turnovers, given that the opponent isn't the Cleveland Browns. That is, $P(W|\neg C)$.

By Bayes' Theorem,

$$P(W|\neg C) = \frac{P(\neg C|W)P(W)}{P(\neg C)}$$

Now we need to calculate $P(\neg C|W)$, and we know that $P(C|W) + P(\neg C|W) = 1$. Therefore, we also know that $P(\neg C|W) = 1 - P(C|W)$.

By Bayes' Theorem,

$$\begin{aligned} P(C|W) &= \frac{P(W|C)P(C)}{P(W)} \\ &= \frac{0.24 * \frac{1}{31}}{0.133} \\ &= \frac{240}{4123} \end{aligned}$$

Hence, $P(\neg C | W) = 1 - \frac{240}{4123} = \frac{3883}{4123}$

Hence,

$$\begin{aligned}P(W|\neg C) &= \\&= \frac{\frac{3883}{4123} * 0.133}{\frac{30}{31}} \\&= \frac{3883}{30000} \\&= 0.1294 \text{ (to 4 s.f.)}\end{aligned}$$

This is the likelihood of a team winning a game in which they lose 4+ turnovers, and their opponent is not the Cleveland Browns.