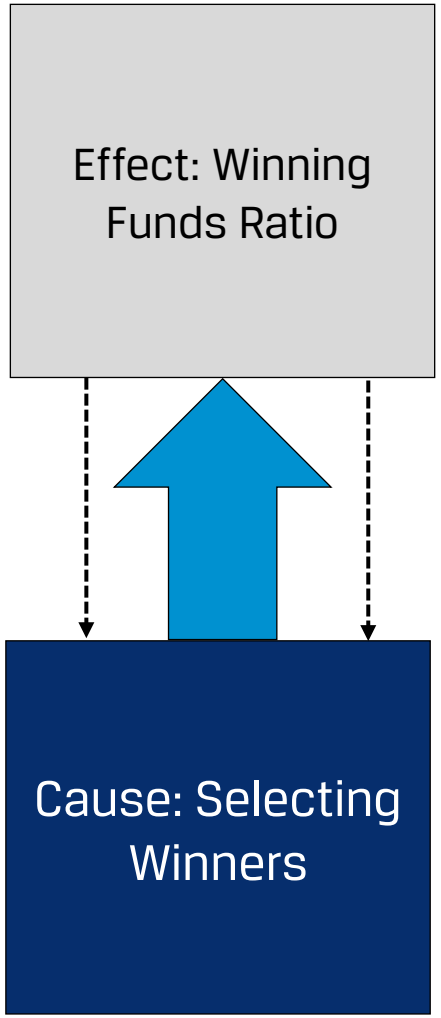
Bayes Theorem – Conceptual Example

An AI model you developed allows you to select potential winning funds based on certain properties. Published parameters for this model include:

- Sensitivity, which is nothing but the ability to flag winning funds from all funds that have beaten the benchmark. Sensitivity for the model is quite high: 85% $[P(W_{AI}|W_A)]$.
- False positives: The model detects about 15% of the losers as winners $[P(W_{AI}|\tilde{}W_A)]$.

You know one critical thing from published data: Over a one-year period, just 65% $[P(W_A)]$ of active funds beat their benchmark. Given these numbers, what is the probability that the next fund categorized by the AI software is a winner?



Using Bayes:

$$P(W_A|W_{AI}) = \frac{P(W_{AI}|W_A)}{P(W_{AI})} * P(W_A)$$

Where:

$$P(W_{AI}) = P(W_{AI}|W_A) * P(W_A) + P(W_{AI}|\tilde{}W_A) * P(\tilde{}W_A)$$

Is your updated probability answer 91%? If yes, you have made the correct substitutions.

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The substitutions are:

$P(W_A)$ = 65%

$P(W_{AI}|W_A)$ = Sensitivity of Test = 85%

$P(W_{AI}|{\sim}W_A)$ = False Positives = 15%

$$P(W_{AI}) = P(W_{AI}|W_A) * P(W_A) + P(W_{AI}|{\sim}W_A) * P({\sim}W_A)$$

That is, $P(W_{AI})$ = 0.85 * 0.65 + 0.15 * (1 - 0.65) = 0.605

Likelihood ratio = $\frac{P(W_{AI}|W_A)}{P(W_{AI})}$ = 0.85/0.605 = 1.40

Modified probability, $P(W_A|W_{AI})$ = Likelihood ratio $*$ $P(W_A)$ = 1.4 * 0.65 = 91%