Alternation 1: Conditional Probability

The probability of h given the evidence e

$$p(h|e) = \frac{N(h \wedge e)}{N(e)} (2)$$

where $N(e)$ denotes the number of observations.

Alternative 2: Formal definition of *Weight of Evidence (WOE)*

The *weight* in favour of a hypothesis h, provided by evidence e:

$$woe(h : e) = \log \frac{O(h|e)}{O(h)} (1)$$

where

$$O(h) = \frac{p(h)}{p(\bar{h})} = \frac{p(h)}{1 - p(h)} (1)$$

is the *prior* odds of the hypothesis, h being true, and

$$O(h|e) = \frac{p(h|e)}{p(\bar{h}|e)} = \frac{p(h|e)}{1 - p(h|e)} (2)$$

is the *posterior* odds of the hypothesis h being true condition on evidence e having been observed. WOE could be used to estimate the probability that hypothesis h is true, based on the the presence of evidence e.

WOE *measures likelihood of what has been observed:*

$$woe(h : e) = \log \frac{p(e|h)}{p(e|\bar{h})} (2)$$

From this expression, we see that the WOE can be viewed as how much more likely we would be to see the evidence given that the hypothesis were true, relative to the likelihood of observing the same evidence were it to be false.

WOE is additive

$$woe(h : e_1 \wedge e_2) = woe(h : e_1) + woe(h : e_2|e_1) (2)$$

This property states that the weight in favor of a hypothesis provided by two sources of evidence taken together is equal to the weight provided by the first piece of evidence, plus the weight provided by the second piece of evidence.