

KOGW-PM-KNP: The Psychometric Function in R

July 4, 2016

Complete the tasks using R. Your answers should include the code you wrote and relevant output images.

Task 0. R

Explore the help facilities of R. At the command line type `help(help)` and read over the documentation. Try the commands `help.start()`, `demo(graphics)`.

Task 1. Fitting a Psychometric Function to data

Task 2. Maximum Likelihood Criterion

To introduce the concept of 'likelihood' we start with a simple 1-Parameter example. Imagine we have a coin and wish to estimate the parameter corresponding to the probability that our coin lands 'heads' on any given flip of the coin. We designate the parameter *alpha*. We perform the experiment of flipping the coin 10 times. After each flip we denote whether it landed heads (H) or tails (T). The results are respectively:
HHTHTTTHHTH

The likelihood function associated with our parameter of interest is:

$$L(a|\mathbf{y}) = \prod_{k=1}^n p(y_k|a)$$

where a is a potential value for our parameter α , $p(y_k|a)$ is the probability of observing outcome y on trial k , given or assuming value a for α and n is the total number of trials. In our example it is obvious, that $p(y_k = H) = a$ and $p(y_k = T) = 1 - a$. The equation utilizes the multiplicative rule in probability theory for independent random events.

1. Calculate the likelihood for $a=0.4$.
2. Plot $L(a|\mathbf{y})$ as a function of a across the range $0 \leq a \leq 1$
3. As the term implies, the maximum likelihood estimate of parameter α is the value of a that maximizes the likelihood function $L(a|\mathbf{y})$. For which a is $L(a|\mathbf{y})$ maximal in the present example.
4. Please comment on the difference between a likelihood and a probability.