Slash distribution

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In probability theory, the **slash distribution** is the probability distribution of a standard normal variate divided by an independent standard uniform variate[1]. In other words, if the random variable *Z* has a normal distribution with zero mean and unit variance, the random variable *U* has a uniform distribution on [0,1] and *Z* and *U* are statistically independent, then the random variable *X* = *Z* / *U* has a slash distribution. The slash distribution is an example of a ratio distribution. The distribution was named by William H. Rogers and John Tukey in a paper published in 1972.[2]

The probability density function is

$$f(x) = \frac{\varphi(0) - \varphi(x)}{x^2}.$$

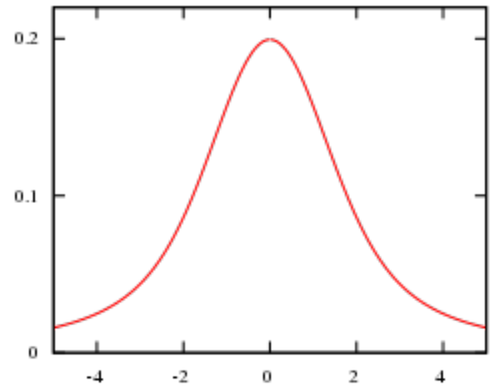
where φ(*x*) is the probability density function of the standard normal distribution.[3] This is undefined at *x* = 0, but the discontinuity is removable:

$$\lim_{x\to 0} f(x) = \frac{\varphi(0)}{2} = \frac{1}{2\sqrt{2\pi}}$$

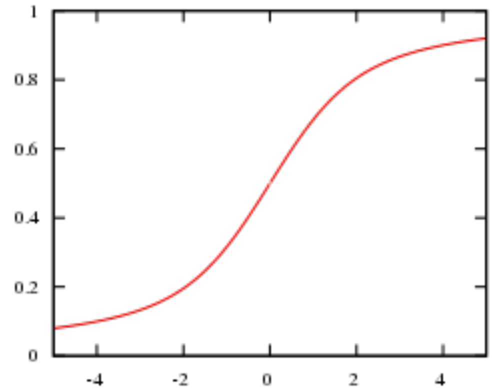
The most common use of the slash distribution is in simulation studies. It is a useful distribution in this context because it has heavier tails than a normal distribution, but it is not as pathological as the Cauchy distribution.[3]

Slash

Probability density function



Cumulative distribution function



parameters:	none
support:	$x \in (-\infty, \infty)$
pdf:	$\frac{\varphi(0) - \varphi(x)}{x^2}$
cdf:	$\begin{cases} \Phi(x) - [\varphi(0) - \varphi(x)]/x & x \neq 0 \\ 1/2 & x = 0 \end{cases}$
mean:	Does not exist
median:	0
mode:	0
variance:	Does not exist
skewness:	Does not exist
ex.kurtosis:	Does not exist
entropy:	
mgf:	Does not exist
cf:	$\sqrt{2\pi}\left(\varphi(t) + t\Phi(t) - \max\{t, 0\}\right)$

References

1. ^ Davison, Anthony Christopher; Hinkley, D. V. (1997). *Bootstrap methods and their application*. Cambridge University Press. p. 484. ISBN 9780521574716.
2. ^ Rogers, W. H.; Tukey, J. W. (1972). "Understanding some long-tailed symmetrical distributions". *Statistica Neerlandica* **26**: 211–226. doi:10.1111/j.1467-9574.1972.tb00191.x (http://dx.doi.org/10.1111%2Fj.1467-9574.1972.tb00191.x) .
3. ^ ***a*** ***b*** "SLAPDF" (http://www.itl.nist.gov/div898/software/dataplot/refman2/auxillar/slapdf.htm) . Statistical Engineering Division, National Institute of Science and Technology. http://www.itl.nist.gov/div898/software/dataplot/refman2/auxillar/slapdf.htm. Retrieved 2009-07-02.

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