Normal Distribution (probability) Statistics (collected data)

What are some real world examples of normally distributed quantities?

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10 Answers

Aaron Brown, MBA Finance & Statistics, The University of Chicago Booth School of Business (1982)

Answered January 12, 2017

I vote with Peter Flom and Terry Moore that nothing real follows a Normal distribution.

What is true is that many quantities are approximately bell-shaped in their centers. These are the examples other answers are citing. The reason for that is the Central Limit Theorem, which says (roughly) that if something results from a lot of small influences that are not too correlated with each other, you'll get a Normal distribution. Height, for example, is controlled by lots of genes, plus nutrition and other factors that work more or less independently.

However the Central Limit Theorem works from the center of the distribution out. Even if there aren't that many factors, and some are big, and some are correlated; you can still get a distribution that looks pretty Normal for 80% or 95% of the observations. If there are many factors, none big, and no major correlations; maybe the distribution looks Normal for 99% or 99.9% of the observations. But never for 100%. With height, for example, there are outliers due to genetic conditions or stunting. In other cases, the problem is not outliers, but maximum or minimum values.

The reason this is important, is you can look at a lot of data and see it follows something reasonably Normal, and therefore make confidence intervals based on Normal assumptions. But you know (or should know) that tails are never Normal. Depending on the application, a single outlier may be more important than all the rest of your data put together.

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Alfredo Sepúlveda-Jiménez, PhD Math Dec Sci, post-doc Comp Sci, Math Phys, FinMath

Answered Jan 10

Real phenomena only follow discrete empirical distributions and even they are vulnerable to perturbative noise (alas we are creators of finitist measurement). The CLT puts the Gaussian on a pedestal as an asymptotic distribution for weighted averages under certain circumstances, but there are also CLTs for other asymptotic distributions such as the Poison.

Asymptotic normality seems to adequately describe some phenomena such as long sequences of fair coin-flipping.

One can use a divergence measure such as the KL-divergence to measure a difference between an empirical distribution (from a certain population sample $\{X_i\}$ of size n) $e_n(\{X_i\})$, and a proposed model $\mathcal{N}(\mu, \sigma^2)$;

$$D_{KL}\left(e_n(\{X_i\}) \parallel \mathcal{N}(\mu, \sigma^2)\right) = \sum_{x \in \mathcal{X}} e_n(x) \log\left(\frac{e_n(x)}{f(x)}\right)$$

where $f(x)$ is the discretized normal density with parameters μ and σ.

There are other methods of measuring the approximate normality of a distribution based on using kernel density estimates.

2K views · Answer requested by Becca Veverka, Orville W. Feynman- Murdock and 1 more

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Sumedha Sengupta, Retired Ph.D. Statistician
Answered September 21, 2016

As continuous variables dimensional measurements such as , height, weight, etc. are most common Normally distributed variables. For Discrete cases, variables do not follow Normal distribution, but for very large samples, the sample statistics from these distributions tend to converge with that of Normal distributions and therefore the variables are considered following Normal Distributions. May be looking up the the Law of Large Numbers and the Central Limit Theorems will give further insight into this.

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Terry Moore, Interests in mathematics, statistics, science and computing.
Answered October 11, 2016 · Upvoted by Peter Flom, Independent statistical consultant for researchers in behavioral, social and medical sciences

There are no real world examples of normally distributed quantities.

Previous answers give some good examples of approximately normally distributed quantities. That's probably what you are really interested in. Approximate normality is very common in real world data, but not universal. Use with caution, but for inferences about the mean, when samples are large, or even moderately large, the sample mean will often

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But before trusting in the central limit theorem, do check for outliers or extreme tails.

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4 comments from Steven Sarasin and Amanda Osvaldo

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Answered Jan 12

Actually, there are no real normally distributed question u panties. The normal distribution is a conceptual math r magical idea.

Approximately normally distributed quantities are height and weight are approximately distributed. Variation in the rate of return in some financial instruments are normally distributed.

Finally, is the sample size is sufficiently large the sampling distributions of the sample mean, sample proportion are also approximately normally distribution. This follows from the central limit theorem.

641 views · Answer requested by Brandon C. Njichop, Becca Veverka and 1 more

Normal distributions have come under some theoretical attack with the advent of Chaos Theory in the 1970s.

For a real world example, take a bucket of sand and pour it onto a flat surface. From the side, it will look like a normal distribution.

Chaos Theory states you will get a slightly different distribution each time you pour no matter how hard you try to keep everything the same.

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Answered November 22, 2016

Although height and weight are often cited as examples, they are not exactly normally distributed. Weight, in particular, is somewhat right skewed. The average American man weighs about 190 pounds. There are some men who weigh well over 380 but none who weigh even close to 0.

IQ is sometimes cited as an example, but it has fatter tails than the normal.

No physical variable is exactly normally distributed.

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1 comment from Ed Caruthers

Tannaz,

Excellent question

The Natural Distribution Probability Bell Curve applies to any concept.

Wealth

Health

Size of trees

Housing

cost of clothing

Cars

Availability of water

Politics

intelligence

work ethic

Personal Appearance

ALL IS DISTRIBUTED. NO TWO PEOPLE HAVE “EACTLY” THE SAME OF ANYTHING.

Very few people understand this concept.

646 views · View Upvoters · Answer requested by Becca Veverka and Tannaz Adib

One example is the distribution of height, weight, and strength in the general population.

Another is the distribution of errors in measurements.

> One of the first applications of the normal distribution was to the analysis of errors of measurement made in astronomical observations, errors that occurred because of imperfect instruments and imperfect observers. Galileo in the 17th century noted that these errors were symmetric and that small errors occurred more frequently than large errors. This led to several hypothesized distributions of errors, but it was not until the early 19th century that it was discovered that these errors followed a normal distribution. Independently, the mathematicians Adrian in 1808 and Gauss in 1809 developed the formula for the normal distribution and showed that errors were fit well by this distribution.

[From History of Normal Distribution]

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A2A, thanks.

One that readily comes to mind is gaussian noise - Google Search.

308 views · Answer requested by Tannaz Adib

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