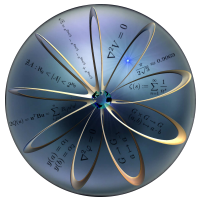

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Recursive Z-statistic

Canonical name	RecursiveZstatistic
Date of creation	2013-03-22 19:11:30
Last modified on	2013-03-22 19:11:30
Owner	statsCab (25915)
Last modified by	statsCab (25915)
Numerical id	4
Author	statsCab (25915)
Entry type	Definition
Classification	msc 62-00

In respones to: Consider a standard Z-statistic used in hypothesis testing. One of the variables needed to compute the Z-statistic is the number of observations. The problem is that with each additional observation one has to recompute the Z-statistic from scratch. It seems like there is no recursive formulation, e.g. a representation such as Z(n) = Z(n-1) + new piece of information. Is there perhaps an approximate recursive formulation? Any other thoughts? Thanks.

An example hypothesis test is:

$H_0 : \mu = \mu_0$

$H_1 : \mu \neq \mu_0$

We reject this hypothesis if $\overline{x}$ is either greater than or lower than a critical value. Assuming the critical values do not change all you have to update is Z_0.

The test statistic is:

$$Z_0 = \frac{\overline{X} - \mu}{\sigma/\sqrt{n}}$$

Assuming you know σ, when you get a new variable X_{n+1} you can update $\overline{x}$ using n, $\overline{X}$, and X_{n+1}, then recalculate Z_0.

Now if you do not know σ, and your sample size is large enough to use the Normal distribution, you have to update your sample variance, S^2. If your sample size is not large enough and you are using the t-distribution then your critical values will change when n changes.

To do update S without recalculating, you should keep running totals of $\sum_i X_i$ and $\sum_i X_i^2$, so you can update S using the computation formula for the sample variance.