AHELP for CIAO 3.4　　　　　　**mlr**　　　　　　Context: sherpa

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Synopsis

Computes significance using the Maximum Likelihood Ratio test.

Syntax

```
sherpa> MLR <delta_dof> <delta_stat>
```

Description

The command arguments are:

MLR Command Arguments

Argument	Description
<delta_dof>	The difference in the number of degrees of freedom (dofs) between the fits of the null and alternative (more complex) hypotheses.
<delta_stat>	The difference in the best–fit statistics between the two fits.

The Maximum Likelihood Ratio (MLR) test is a model comparison test. Model comparison tests are used to select from two competing models that which best describes a particular dataset. A model comparison test statistic T is created from the best–fit statistics of each fit; as with all statistics, it is sampled from a probability distribution p(T). The test significance is defined as the integral of p(T) from the observed value of T to infinity. The significance quantifies the probability that one would select the more complex model when in fact the null hypothesis is correct. A standard threshold for selecting the more complex model is significance < 0.05 (the "95% criterion" of statistics).

The MLR test may be used if:

- the simpler of the two models is nested within the other, i.e., one can obtain the simpler model by setting the extra parameters of the more complex model to default values, often zero;
- the extra parameters have values sampled from normal distributions under the null hypothesis (i.e., if one samples many datasets given the null hypothesis and fits these data with the more complex model, the distributions of values for the extra parameters must be Gaussian);
- those normal distributions are not truncated by parameter space boundaries; and

• the best−fit statistics for each fit individually are sampled from the chi−square distribution.

If these conditions are fulfilled, then the change in statistic from one fit to the other (<delta_stat>) is sampled from the chi−square distribution for <delta_dof> degrees of freedom. If these conditions are not fulfilled, then the MLR test significance may not be accurate.

The MLR test significance can also be retrieved using the Sherpa/S−Lang module function get_mlr.

Example

Perform the Maximum Likelihood Ratio test. Fit two models to the data, one with two more parameters than the other. The improvement in chi−square (or the Cash statistic) is 20.0. Determine the significance by computing the tail integral of the chi−square distribution for 2 degrees of freedom from 20.0 to infinity:

```
sherpa> MLR 2 20.00
significance = 4.53999e-05
```

If this significance is smaller than the predefined threshold for accepting the more complex model (e.g., 0.05), then the more complex model is selected. Otherwise, the null hypothesis is selected.

Bugs

See the Sherpa bug pages online for an up−to−date listing of known bugs.

See Also

sherpa

berrors, bsyserrors, compute_errors, compute_statistic, covariance, errors, ftest, get_paramest, get_paramestint, get_paramestlim, get_paramestreg, goodness, interval−projection, interval−uncertainty, list_paramest, projection, region−projection, region−uncertainty, restore_paramest, run_paramest, run_paramestint, run_paramestlim, run_paramestreg, set_errors, set_syserrors, staterrors, syserrors, uncertainty

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Example