Returns
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1.5.20 gauss1dfitter - Tool

Package utility
Module mathematics

Non-linear least-squares fit multiple 1-D Gaussians to vector
include "gfitgauss.g"

Constructors

gauss1dfit	Construct a gauss1dfit tool

Functions

eval	Evaluate a sum of Gaussians (usually the result of a fit)
fit	Fit Gaussian(s) to y vector given x vector
getstate	Get the state of the fitter
setcenter	Set the center state
setcriteria	Set the convergence criteria
setheight	Set the height state
setmaxiter	Set the maximum number of iterations
setstate	Set the state of the fitter
setwidth	Set the width state

Description

`gauss1dfitter` is a tool which allows the user to fit a Gaussian or multiple Gaussians to a vector given a vector of coordinate values (x). It remembers the state of the most recent fit. Repeated calls to the fit functions start from the current state. The tool also provides a function for evaluating the Gaussian parameters along a vector of x values.
At present, only fits to real data without constraints are supported.
The fits are carried out with double precision.
The form of a Gaussian is: $h \exp\left(-4\ln 2((x-x_0)/w)^2\right)$ where h is the `height`, x_0 is the `center` and w is the full `width` at half maximum. Multiple Gaussians are simply summed together to determine the best fit.

Example

```
- fitter := gauss1dfitter()
- x := [1:100]
- y := 5*exp(-4*ln(2)*(((x-40)/25)^2)) + 15*exp(-4*ln(2)*(((x-50)/8)^2))
- guess := [=]
- guess.height := [4.0,16.0]
- guess.center := [37.0, 55.0]
- guess.width := [28.0, 10.0]
- guess.maxiter := 15;
- fitter.setstate(guess)
- state := fitter.fit(x, y)
- print state.converged
T
```

This example begins by first constructing a gauss1dfitter tool. Then a vector is constructed which is the sum of 2 Gaussians extending over the given x range. The fitter needs an initial guess. This guess also sets the number of of components which will be fit. This is obviously contrived here since we know what the Gaussian parameters are. The maximum interations per invocation of fit is set to be 15. The setstate function is used to set the state as this initial guess and maxiter. We could have also used the setheight, setcenter, setwidth, and setmaxiter functions to change the state. The fit function is called with the given x and y values. This returns a state record. The state record indicates that this fit has converged.

gauss1dfit - Constructor

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Construct a gauss1dfit tool

Synopsis
gauss1dfit()

Returns
object

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gauss1dfitter.fit - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Fit Gaussian(s) to y vector given x vector

Synopsis
fit(x, y)

Arguments

x	X coordinate at y values Allowed:vector double
y	Y values to fit. Must be the same length as x. Allowed:vector double

Returns
record

Description
Fit a sinusoid to y values given the x coordinate values. The state of the fit is indicated in the returned record.

state - Record	The gauss1dfitter state record
state.converged	has the fit converged? Allowed: boolean Default: F
state.curriter	The number of iterations actually used in the most recent fit. Allowed: integer Default: 0
state.maxiter	The maximum number of iterations tried by fit. Allowed: integer Default: 30
state.criteria	The convergence criteria. Allowed: double Default: 0.001
state.chisq	The χ^2 for this fit. Allowed: double
state.height	The heights of the Gaussians Allowed: vector double
state.center	The centers of the Gaussians Allowed: vector double
state.width	The widths of the Gaussians Allowed: vector double
state.heighterror	The 1-sigma errors in the heights. Allowed: vector double
state.centererror	The 1-sigma errors in the centers.

	Allowed: vector double
state.widtherror	The 1-sigma errors in the widths. Allowed: vector double

The fit function first checks that `x` and `y` have the same length and that each of the parameter vectors have the same length. A fit is said to have converged when the fractional change in χ^2 in two succeessive interations is less than the convergence criteria value. This value can be set in the setcriteria or setstate functions. If the fit has not converged after maxiter iterations, the fit function will stop and return the current state of the fit and the current χ^2 value.

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gauss1dfitter.eval - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Evaluate a sum of Gaussians (usually the result of a fit)

Synopsis
eval(x)

Arguments

x	The coordinate values at which the function will be evaluated Allowed:vector double

Returns
vector double

Description
Evaluate the current Gaussian parameters indicated by the current state of the fitter at the x values supplied to this function. The result is the return value. Normally this is the most recent result of the use of `fit`, however you may use the setstate function to evaluate any sum of Guassians.

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gauss1dfitter.getstate - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Get the state of the fitter

Synopsis
getstate()

Returns
record

Description
The state record is returned. It is the same state record returned by the fit function with the exception that no `chisq` value is present.

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gauss1dfitter.setstate - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Set the state of the fitter

Synopsis
setstate(state)

Arguments

state	Part or all of a state record Allowed:record

Returns
boolean

Description
The following fields can be set by setting their values in the state record argument: `maxiter, criteria, height, width, center`. If any fields are not present in this record, their state will not be changed. These can all be set individually through use of the appropriate function.

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gauss1dfitter.setheight - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Set the height state

Synopsis
setheight(height)

Arguments

height	New vector of heights Allowed:vector double

Returns
boolean

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gauss1dfitter.setcenter - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Set the center state

Synopsis
setcenter(center)

Arguments

center	New vector of center Allowed:vector double

Returns
boolean

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gauss1dfitter.setwidth - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Set the width state

Synopsis
setwidth(width)

Arguments

width	New vector of widths Allowed:vector double

Returns
boolean

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gauss1dfitter.setmaxiter - Function

Package	**utility**
Module	**mathematics**
Tool	**gauss1dfitter**

Set the maximum number of iterations

Synopsis
setmaxiter(maxiter)

Arguments

maxiter	New maxiter Allowed:integer

Returns
boolean

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gauss1dfitter.setcriteria - Function