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Module: `membership`

skfuzzy.membership : fuzzy membership function generators

`skfuzzy.membership.dsigmf` (x, b1, c1, b2, c2)	Difference of two fuzzy sigmoid membership functions.
`skfuzzy.membership.gauss2mf` (x, mean1, ...)	Gaussian fuzzy membership function of two combined Gaussians.
`skfuzzy.membership.gaussmf` (x, mean, sigma)	Gaussian fuzzy membership function.
`skfuzzy.membership.gbellmf` (x, a, b, c)	Generalized Bell function fuzzy membership generator.
`skfuzzy.membership.piecemf` (x, abc)	Piecewise linear membership function (particularly used in FIRE filters).
`skfuzzy.membership.pimf` (x, a, b, c, d)	Pi-function fuzzy membership generator.
`skfuzzy.membership.psigmf` (x, b1, c1, b2, c2)	Product of two sigmoid membership functions.
`skfuzzy.membership.sigmf` (x, b, c)	The basic sigmoid membership function generator.
`skfuzzy.membership.smf` (x, a, b)	S-function fuzzy membership generator.
`skfuzzy.membership.trapmf` (x, abcd)	Trapezoidal membership function generator.
`skfuzzy.membership.trimf` (x, abc)	Triangular membership function generator.
`skfuzzy.membership.zmf` (x, a, b)	Z-function fuzzy membership generator.

dsigmf

`skfuzzy.membership.` `dsigmf` *(x, b1, c1, b2, c2)* **[source]**

Difference of two fuzzy sigmoid membership functions.

Parameters: **x** : 1d array

  Independent variable.

  b1 : float

  Midpoint of first sigmoid; $f1(b1) = 0.5$

  c1 : float

  Width and sign of first sigmoid.

  b2 : float

  Midpoint of second sigmoid; $f2(b2) = 0.5$

  c2 : float

  Width and sign of second sigmoid.

Returns: **y** : 1d array

  Generated sigmoid values, defined as

  $y = f1 - f2 \; f1(x) = 1 / (1. + \exp[- c1 * (x - b1)]) \; f2(x) = 1 / (1. + \exp[- c2 * (x - b2)])$

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gauss2mf

`skfuzzy.membership.` `gauss2mf` *(x, mean1, sigma1, mean2, sigma2)*[source]

Gaussian fuzzy membership function of two combined Gaussians.

Parameters:	**x** : 1d array or iterable

                Independent variable.

        mean1 : float

                Gaussian parameter for center (mean) value of left-side Gaussian. Note mean1 <= mean2 required.

        sigma1 : float

                Standard deviation of left Gaussian.

        mean2 : float

                Gaussian parameter for center (mean) value of right-side Gaussian. Note mean2 >= mean1 required.

        sigma2 : float

                Standard deviation of right Gaussian.

Returns:	**y** : 1d array

                Membership function with left side up to mean1 defined by the first Gaussian, and the right side above mean2 defined by the second. In the range mean1 <= x <= mean2 the function has value = 1.

gaussmf

`skfuzzy.membership.` `gaussmf` *(x, mean, sigma)*[source]

Gaussian fuzzy membership function.

Parameters:	**x** : 1d array or iterable

                Independent variable.

        mean : float

                Gaussian parameter for center (mean) value.

        sigma : float

                Gaussian parameter for standard deviation.

Returns:	**y** : 1d array

                Gaussian membership function for x.

gbellmf

`skfuzzy.membership.` `gbellmf` (*x*, *a*, *b*, *c*)[source]

Generalized Bell function fuzzy membership generator.

Parameters: **x** : 1d array

> Independent variable.

a : float

> Bell function parameter controlling width. See Note for definition.

b : float

> Bell function parameter controlling slope. See Note for definition.

c : float

> Bell function parameter defining the center. See Note for definition.

Returns: **y** : 1d array

> Generalized Bell fuzzy membership function.

Notes

Definition of Generalized Bell function is:

> y(x) = 1 / (1 + abs([x - c] / a) ** [2 * b])

piecemf

`skfuzzy.membership.` `piecemf` (*x*, *abc*)[source]

Piecewise linear membership function (particularly used in FIRE filters).

Parameters: **x** : 1d array

> Independent variable vector.

abc : 1d array, length 3

> Defines the piecewise function. Important: if abc = [a, b, c] then a <= b <= c is REQUIRED!

Returns: **y** : 1d array

> Piecewise fuzzy membership function for x.

Notes

Piecewise definition:

> y = 0, min(x) <= x <= a y = b(x - a)/c(b - a), a <= x <= b y = x/c, b <= x <= c

pimf

`skfuzzy.membership.` `pimf` (*x, a, b, c, d*)[source]

Pi-function fuzzy membership generator.

Parameters:	**x** : 1d array
	Independent variable.
	a : float
	Left 'foot', where the function begins to climb from zero.
	b : float
	Left 'ceiling', where the function levels off at 1.
	c : float
	Right 'ceiling', where the function begins falling from 1.
	d : float
	Right 'foot', where the function reattains zero.
Returns:	**y** : 1d array
	Pi-function.

Notes

This is equivalently a product of smf and zmf.

psigmf

`skfuzzy.membership.` `psigmf` (*x, b1, c1, b2, c2*)[source]

Product of two sigmoid membership functions.

Parameters:	**x** : 1d array
	Data vector for independent variable.
	b1 : float
	Offset or bias for the first sigmoid. This is the center value of the sigmoid, where it equals 1/2.
	c1 : float
	Controls 'width' of the first sigmoidal region about b1 (magnitude), and also which side of the function is open (sign). A positive value of c1 means the left side approaches zero while the right side approaches one; a negative value of c1 means the opposite.
	b2 : float
	Offset or bias for the second sigmoid. This is the center value of the sigmoid, where it equals 1/2.
	c2 : float
	Controls 'width' of the second sigmoidal region about b2 (magnitude), and also which side of the function is open (sign). A positive value of c2 means the left side approaches zero while the right side approaches one; a negative value of c2 means the opposite.
Returns:	**y** : 1d array

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Generated sigmoid values, defined as
y = f1(x) * f2(x)

$$f1(x) = 1 / (1. + \exp[- c1 * (x - b1)]) \quad f2(x) = 1 / (1. + \exp[- c2 * (x - b2)])$$

Notes

For a smoothed rect-like function, c2 < 0 < c1. For its inverse (zero in middle, one at edges) c1 < 0 < c2.

sigmf

`skfuzzy.membership.` `sigmf` (*x*, *b*, *c*)[source]

The basic sigmoid membership function generator.

Parameters:
 x : 1d array

> Data vector for independent variable.

 b : float

> Offset or bias. This is the center value of the sigmoid, where it equals 1/2.

 c : float

> Controls 'width' of the sigmoidal region about b (magnitude); also which side of the function is open (sign). A positive value of a means the left side approaches 0.0 while the right side approaches 1.; a negative value of c means the opposite.

Returns:
 y : 1d array

> Generated sigmoid values, defined as y = 1 / (1. + exp[- c * (x - b)])

Notes

These are the same values, provided separately and in the opposite order compared to the publicly available MathWorks' Fuzzy Logic Toolbox documentation. Pay close attention to above docstring!

smf

`skfuzzy.membership.` `smf` (*x*, *a*, *b*)[source]

S-function fuzzy membership generator.

Parameters:
 x : 1d array

> Independent variable.

 a : float

> 'foot', where the function begins to climb from zero.

 b : float

> 'ceiling', where the function levels off at 1.

Returns:
 y : 1d array

> S-function.

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Notes

Named such because of its S-like shape.

trapmf

`skfuzzy.membership.` `trapmf` (*x*, *abcd*)[source]

Trapezoidal membership function generator.

Parameters:	**x** : 1d array
	Independent variable.
	abcd : 1d array, length 4
	Four-element vector. Ensure a <= b <= c <= d.
Returns:	**y** : 1d array
	Trapezoidal membership function.

trimf

`skfuzzy.membership.` `trimf` (*x*, *abc*)[source]

Triangular membership function generator.

Parameters:	**x** : 1d array
	Independent variable.
	abc : 1d array, length 3
	Three-element vector controlling shape of triangular function. Requires a <= b <= c.
Returns:	**y** : 1d array
	Triangular membership function.

zmf

`skfuzzy.membership.` `zmf` (*x*, *a*, *b*)[source]

Z-function fuzzy membership generator.

Parameters:	**x** : 1d array
	Independent variable.
	a : float
	'ceiling', where the function begins falling from 1.
	b : float
	'foot', where the function reattains zero.

Returns: **y** : 1d array

> Z-function.

Notes

Named such because of its Z-like shape.

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