Supported Distributions

Statistics and Machine Learning Toolbox™ supports more than 30 probability distributions, including parametric, nonparametric, continuous, and discrete distributions.

The toolbox provides several ways to work with probability distributions.

- Use *probability distribution objects* to fit a probability distribution object to sample data, or to create a probability distribution object with specified parameter values. Once you create a probability distribution object, you can use object functions to:
  - Compute confidence intervals for the distribution parameters (`paramci`).
  - Compute summary statistics, including mean (`mean`), median (`median`), interquartile range (`iqr`), variance (`var`), and standard deviation (`std`).
  - Evaluate the probability density function (`pdf`).
  - Evaluate the cumulative distribution function (`cdf`) or the inverse cumulative distribution function (`icdf`).
  - Compute the negative loglikelihood (`negloglik`) and profile likelihood function (`proflik`) for the distribution.
  - Generate random numbers from the distribution (`random`).
  - Truncate the distribution to specified lower and upper limits (`truncate`).

  Each distribution object page provides information about the object's properties and the functions you can use to work with the object.
- Use *probability distribution functions* to work with data input from matrices. Some of the supported distributions have distribution-specific functions. These functions use the following abbreviations, as in `normpdf`, `normcdf`, `norminv`, `normstat`, `normfit`, `normlike`, and `normrnd`:
  - pdf — Probability density functions
  - cdf — Cumulative distribution functions
  - inv — Inverse cumulative distribution functions
  - stat — Distribution statistics functions
  - fit — Distribution Fitter functions
  - like — Negative loglikelihood functions
  - rnd — Random number generators

  You can also use the following generic functions to work with most of the distributions:
  - `pdf` — Probability density function
  - `cdf` — Cumulative distribution function
  - `icdf` — Inverse cumulative distribution function
  - `random` — Random number generating function
  - `mle` — Distribution fitting function
- Use *probability distribution apps and user interfaces* to interactively fit, explore, and generate random numbers from probability distributions. Available apps and user interfaces include:
  - The **Distribution Fitter** app, to interactively fit a distribution to sample data, and export a probability distribution object to the workspace.
  - The **Probability Distribution Function** user interface, to visually explore the effect on the pdf and cdf of changing the distribution parameter values.
  - The Random Number Generation user interface (`randtool`), to interactively generate random numbers from a probability distribution with specified parameter values and export them to the workspace.

For more information on the different ways to work with probability distributions, see Working with Probability Distributions.

Continuous Distributions (Data)

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps and UIs

Beta	`BetaDistribution`	`betapdf`
		`betacdf`
		`betainv`
		`betastat`
		`betafit`
		`betalike`
		`betarnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Birnbaum-Saunders	`BirnbaumSaundersDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Burr Type XII	`BurrDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Exponential	`ExponentialDistribution`	`exppdf`
		`expcdf`
		`expinv`
		`expstat`
		`expfit`
		`explike`
		`exprnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Extreme value	`ExtremeValueDistribution`	`evpdf`
		`evcdf`
		`evinv`
		`evstat`
		`evfit`
		`evlike`
		`evrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Gamma	`GammaDistribution`	`gampdf`
		`gamcdf`
		`gaminv`
		`gamstat`
		`gamfit`
		`gamlike`
		`gamrnd`
		`randg`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps and UIs

Generalized extreme value	`GeneralizedExtremeValueDistribution`	`gevpdf`
		`gevcdf`
		`gevinv`
		`gevstat`
		`gevfit`
		`gevlike`
		`gevrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Generalized Pareto	`GeneralizedParetoDistribution`	`gppdf`
		`gpcdf`
		`gpinv`
		`gpstat`
		`gpfit`
		`gplike`
		`gprnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Half-Normal	`HalfNormalDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Inverse Gaussian	`InverseGaussianDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Logistic	`LogisticDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Loglogistic	`LoglogisticDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Lognormal	`LognormalDistribution`	`lognpdf`
		`logncdf`
		`logninv`
		`lognstat`
		`lognfit`
		`lognlike`
		`lognrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Nakagami	`NakagamiDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps and UIs

Normal (Gaussian)	`NormalDistribution`	`normpdf`
		`normcdf`
		`norminv`
		`normstat`
		`normfit`
		`normlike`
		`normrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Piecewise linear	`PiecewiseLinearDistribution`			

Rayleigh	`RayleighDistribution`	`raylpdf`
		`raylcdf`
		`raylinv`
		`raylstat`
		`raylfit`
		`raylrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Rician	`RicianDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Stable	`StableDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Triangular	`TriangularDistribution`			

Uniform (continuous)	`UniformDistribution`	`unifpdf`
		`unifcdf`
		`unifinv`
		`unifstat`
		`unifit`
		`unifrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Probability Distribution Function
				`randtool`

Weibull	`WeibullDistribution`	`wblpdf`
		`wblcdf`
		`wblinv`
		`wblstat`
		`wblfit`
		`wbllike`
		`wblrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Continuous Distributions (Statistics)

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps and UIs

Chi-square		`chi2pdf`
		`chi2cdf`
		`chi2inv`
		`chi2stat`
		`chi2rnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps and UIs

F		`fpdf`
		`fcdf`
		`finv`
		`fstat`
		`frnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

Noncentral chi-square		`ncx2pdf`
		`ncx2cdf`
		`ncx2inv`
		`ncx2stat`
		`ncx2rnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

Noncentral *F*		`ncfpdf`
		`ncfcdf`
		`ncfinv`
		`ncfstat`
		`ncfrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

Noncentral *t*		`nctpdf`
		`nctcdf`
		`nctinv`
		`nctstat`
		`nctrnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

Student's *t*		`tpdf`
		`tcdf`
		`tinv`
		`tstat`
		`trnd`
			`pdf`
			`cdf`
			`icdf`
			`random`
				Probability Distribution Function
				`randtool`

t location-scale	`tLocationScaleDistribution`		`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter

Discrete Distributions

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps/UIs

Binomial	`BinomialDistribution`	`binopdf`
		`binocdf`
		`binoinv`
		`binostat`
		`binofit`
		`binornd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Distribution Fitter
				Probability Distribution Function
				`randtool`

Bernoulli			`mle`	

Geometric		`geopdf`
		`geocdf`
		`geoinv`
		`geostat`
		`mle`
		`geornd`
			`pdf`
			`cdf`
			`icdf`
			`random`
			`mle`
				Probability Distribution Function
				`randtool`

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps/UIs
Hypergeometric		hygepdf hygecdf hygeinv hygestat hygernd	pdf cdf icdf random mle	**Probability Distribution Function** randtool
Multinomial	MultinomialDistribution	mnpdf mnrnd		
Negative binomial	NegativeBinomialDistribution	nbinpdf nbincdf nbininv nbinstat nbinfit nbinrnd	pdf cdf icdf random mle	**Distribution Fitter** **Probability Distribution Function** randtool
Poisson	PoissonDistribution	poisspdf poisscdf poissinv poisstat poissfit poissrnd	pdf cdf icdf random mle	**Distribution Fitter** **Probability Distribution Function** randtool
Uniform (discrete)		unidpdf unidcdf unidinv unidstat unidrnd	pdf cdf icdf random mle	**Probability Distribution Function** randtool

Multivariate Distributions

Distribution	Object	Distribution-Specific Functions	Generic Functions	Apps/UI
Copula (Gaussian copula, *t* copula, Clayton copula, Frank copula, Gumbel copula)		copulapdf copulacdf copulaparam copulastat copulafit copularnd		
Gaussian Mixture	gmdistribution	fitgmdist pdf cdf random		
Inverse Wishart		iwishrnd		
Multivariate normal		mvnpdf mvncdf mvnrnd		
Multivariate *t*		mvtpdf mvtcdf mvtrnd		
Wishart		wishrnd		

Nonparametric Distributions

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps/UIs
Kernel	`KernelDistribution`	`ksdensity`		**Distribution Fitter**
Pareto tails	`paretotails`			

Flexible Distribution Families

Distribution	Distribution Objects	Distribution-Specific Functions	Generic Functions	Apps/UIs
Pearson system		`pearsrnd`		
Johnson system		`johnsrnd`		

Related Topics

- Working with Probability Distributions
- Nonparametric and Empirical Probability Distributions

How useful was this information?