distrACTION

Version 1.0.0

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distrACTION is a jamovi (<u>www.jamovi.org</u>) module for calculating and plotting the cumulative distribution function and the quantile function (inverse cumulative distribution function) for a number of discrete and continuous distributions.

distrACTION can be installed from within the jamovi program using the '+' sign in the right upper corner of the jamovi window.

Content

Statistical Distributions

So far, the module contains the following continuous and discrete distributions:

- Continuous distributions:
 - o Normal distribution
 - o T-Distribution
 - \circ χ^2 -Distribution
 - o F-Distribution
- Discrete distributions:
 - o Binomial Distributions

Parameters

Every distribution contains a number of parameters to set for its calculation. Non-centrality parameters (λ) are also included.

Normal-Distribution	Mean	SD		
T-Distribution	df	λ		
χ^2 -Distribution	df	λ		
F-Distribution	df_1	df ₂	λ	
Discrete Distributions				
Binomial	Size	Probability		

Modes

There are three modes available in distrACTION:

- Plot: Creates a plot of the distribution with the chosen parameters.
 ⇒ This runs automatically and cannot be turned off.
- **Compute probability**: Calculates the lower-tail or upper-tail probability for a given x value or the probability for an [x₁, x₂] interval.
- **Compute quantile(s)**: Calculates the quantile(s) (x-value(s)) for a given cumulative or central interval probability.

		Compute probability				Compute quantile(s)		
Distribution	$P(X \le x1)$	P (X ≥ x1)	$P(x1 \le X \le x2)$	P (X = x1)	Cumulative	Central interval		
Normal	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark		
Т	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark		
χ^2	\checkmark	\checkmark	\checkmark		\checkmark			
F	\checkmark	\checkmark	\checkmark		\checkmark			
Binomial	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		

Some sub-functions are not included in every distribution type:

Example

Phil's IQ – An illustrative example with the Normal Distribution

Phil claims to have an IQ of 130. Because he is so smart, he claims to know that only 1% of the population has a higher IQ than himself. Thanks to the distrACTION module, Phil's argument can now be checked without much effort.

A normal distribution with a mean value of 100 and a standard deviation of 15 is used to check Phil's statement. The cumulative 99% quantile is then calculated.

Normal Distribution		\ominus	Normal Distribution
Normal Distribution Parameters Mean = 100 SD = 15 Function Compute probability x1 = 0 $P(X \le x1)$ $P(X \le x1)$ $P(X \le x]$ $P(X \le x2)$ x2 = 1	 Compute quantile(s) 0.99 cumulative quantile central interval quantiles 		Normal Distribution Input values Parameters "Compute quantile(s)" Mean = 100 p = 0.99 SD = 15 cumulative mode Results
			0.00 40 50 70 60 100 115 130 140 160

As can now be seen, the IQ of the smartest 1% is \geq 134,895. This is higher than Phil's IQ.

The probability function even shows that 2.3% of a population do have an IQ of at least 130:

Normal Distribution	(-	Normal	Distribution		
Parameters		Input values			
Mean = 100		Parameter			
SD = 15		Mean = 100 SD = 15	0 x1 = 130 Mode: P(X ≥ x1)		
Function					
Compute probability	Compute quantile(s)	Results Probability	_		
x1 = 130	p = 0.5	P = 0.023	-		
○ P(X ≤ x1)	 cumulative quantile 	P = 0.023	-		
O P(X ≥ x1)	 central interval quantiles 				
P(x1 ≤ X ≤ x2) x2 = 1		0.02-		2 12 130 143 180	P (Area)

It is also possible to compare Phil's IQ of 130 with the 99% quantile within the same plot. This plot can then be exported and sent to Phil to show him his error:

Normal Distribution		\ominus	Normal D	istribution		
Parameters Mean = 100 SD = 15 Function Compute probability x1 = 130 PI(X = x1)	Compute quantile(s) p = 0.99		Input values Parameters Mean = 100 SD = 15 Results Probability P = 0.023	'Compute probability' x1 = 130 Mode: P(X $\ge x1$) Quantile(s) x1 = 134.895	'Compute quantile(s)' p = 0.99 cumulative mode	
 P(X ≥ x1) P(x1 ≤ X ≤ x2) x2 = 1 	central interval quantiles		0.02-	50 70 eb 10		 Copy Save Quantile P (Area)