

SERA Magnitude Complexity Toolbox:
Application: App_2A_v1 – ‘ADTestMag_V1_8’

[pval,mmin,NN,P,S,bval]=ADTestMag_V1_8(vector,EPS,MTdistribution,Mmin,Mmax,trials)
COMPATIBLE with Matlab version 2017b or later

APPLICATION DESCRIPTION

This Application performs the Anderson-Darling test for testing whether a given random variable (e.g. a set of magnitudes), follows the exponential or Weibull distribution. The analysis is performed for a variety of minimum parameter thresholds defined by the User. The input data can be any vector corresponding to a random variable, which can be uploaded e.g. from an ASCII file. This is a Hybrid Version, where the Application can be performed in two different modes, allowing or not allowing interactivity with the User:

Mode 1 [Interactive Mode]: If only the Input Data vector is defined as input argument, then the Application allows interactivity in a series of pop-up windows and graphs (*GUI enabled*):

[pval mmin NN P S bval]=ADTestMag_V1_8(x); %for Interactivity ON

Mode 2 [Function Mode]: If all parameters are set as input arguments then the Application behaves as a matlab function, returning the outputs (*GUI disabled*):

[pval mmin NN P S bval]=ADTestMag_V1_8(x,0.1,'exp',0.5,2.0,200) %for Interactivity OFF

A directory ‘Outputs_ADTestMag’ is automatically generated by running the function. The description of input-output parameters can also be found within the source code as well:

Inputs:

Parameter	Variable	Type	Format	Possible Values	Default
Parameter Vector (e.g. Magnitude)	Vector	Vector	Double	-	-
Minimum Vector Value	Mmin	Scalar	Double	$\min(M) \leq Mmin \leq \max(M)$	Min(M)
Maximum Vector Value	Mmax	Scalar	Double	$mMin \leq Mmax \leq \max(M)$	Max(M)
Input Vector Round-off interval	EPS	Scalar	Double	\leq input data values range, Recommended: 0.1	0.1
Input Vector distribution to be tested	MTdistribution	String	String	‘exp’, ‘weibul’	‘exp’
Number of trials	trials	Scalar	Integer	Recommended: $10 < m < 10000$	100

Outputs:

Output Parameters	Type	Format	Comments
pval	Structure		Structure with the vectors of p-values obtained by the defined number of trials for each minimum input parameter

			value (field 'pval.p'). It also contains parameters 'P' and 'mmin' [see below].
mmin	Vector	Double	Vector of selected parameter cutoff values
NN	Vector	Double	Number of events with M greater or equal to each 'mmin'
P	Vector	Double	The average of the p-values obtained by the defined number of trials performed (also exists within the output structure 'pval')
S	Vector	Double	The corresponding standard deviation of the p-values obtained by the defined number of trials
bval	Vector	Double	b-value corresponding to each set defined by the aforementioned mmin values

Report: “REPORT_ADTestMag.txt” is generated and stored, including a summary of the input parameters and data considered, as well as the results obtained from the analysis for different M_{\min} (number of events, b-value, p-value and test decision).

FIGURE: An output figure “ADTestMag_Output.jpg” is generated and stored showing the p-value (significance) of the null hypothesis (Exponential or Weibull distributed input parameter values) as a function of M_{\min} . The histogram of number of events within specified data bins is demonstrated as well. (see figure below).

