How do normality tests behave for rounded data?

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Who are we?

M. Iturrate-Bobes

I. Montes

R. Pérez-Fernández

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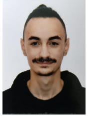
D. Nieto-Barba


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Objective

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To study and compare the behaviour of three normality tests in the presence of imprecision caused by rounding:

1. Anderson-Darling normality test.
2. Lilliefors normality test.
3. Shapiro-Wilk normality test.

$$\begin{cases} H_0 : X \equiv N(\mu, \sigma) \\ H_1 : X \not\equiv N(\mu, \sigma) \end{cases}$$

Method

A random set-based approach

- A continuous random variable X is rounded to the d-th decimal number ($d \in \mathbb{Z}$).
- Set of possible values: $\mathbb{Z}_d = \{x \mid 10^d \cdot x \in \mathbb{Z}\}$.
- We construct the random (interval) set:

$$\Gamma = [\tilde{X} - 5 \cdot 10^{-(d+1)}, \tilde{X} + 5 \cdot 10^{-(d+1)}[\,,$$

where $\tilde{X}$ is the observed rounded variable.

The p-value associated with an interval-valued sample $I_1, \ldots, I_n$ is a set

$$\text{p-value}(I_1, \ldots, I_n) = \{\text{p-value}(x_1, \ldots, x_n) \mid x_i \in I_i\,, \forall i \in \{1, \ldots, n\}\}\,,$$

based on which three regions arise:

(1) rejection region, **(2)** acceptance region and **(3)** **indecision region**.

Experimental setup

Experimental setup

We use Monte Carlo simulation with the aim of:

1. Exploring the influence of $\sigma = \sqrt{Var(X)}$ on the power of the normality tests.
2. Determining the probability of the rejection region, the acceptance region and the indecision region for each normality test.

Results can be found in POSTER 6.

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