

Use of the *p-value* as a size-dependent function: model and applications

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<https://github.com/BIIG-UC3M/pMoSS>

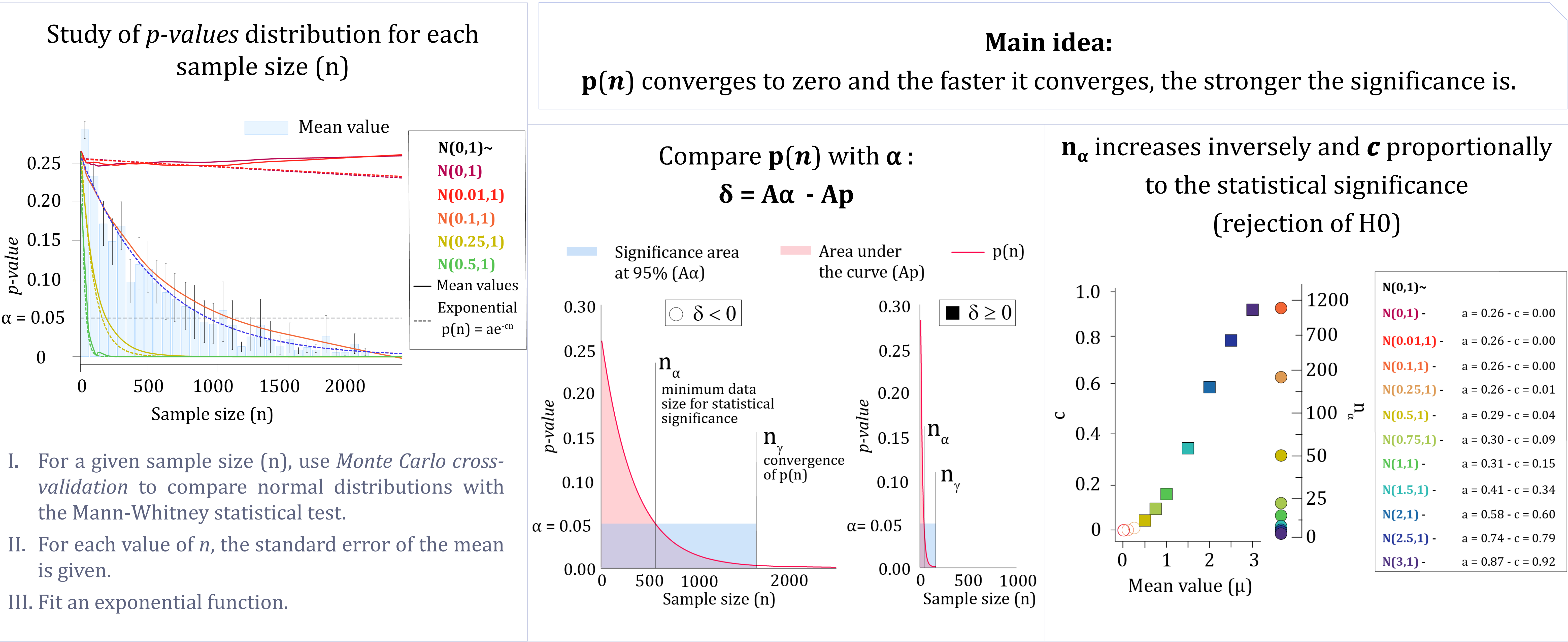
ABSTRACT

The use of the statistical *p-value* as a deterministic index is largely extended in scientific research. However, this measure saturates with the size of the data: the common threshold 0.05 is easily reachable whenever the available dataset is large enough or when the right combination of data is subject to the null hypothesis (H0) testing. This fact, known as *p-hacking*, breaks completely with the assumption of statistical *p-value* being an objective and robust measure. Moreover, it can lead to misleading conclusions being extracted from scientific experiments.

CONTRIBUTIONS

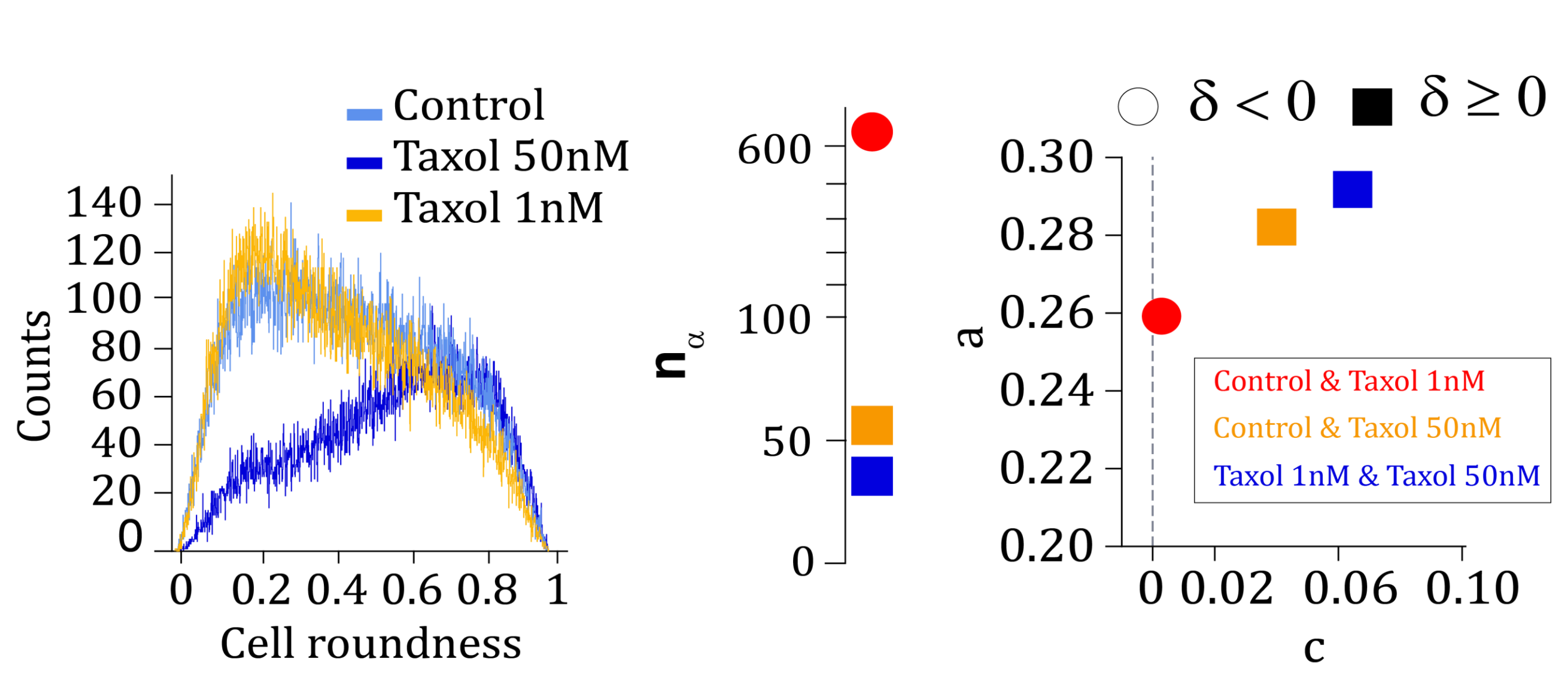
- In our recent work [1] we
- Proved that the *p-value* can be modeled as a continuous exponential function, $\mathbf{p(n)} \cong \mathbf{a \cdot e^{(-cn)}}$, $\mathbf{a, c} \in \mathbb{R}^+$.
 - Introduced an innovative methodology for the decision-making process based on a new distance measure: δ , mathematically constrained and stable.

METHOD



EXPERIMENT I: ASSESS H0 ROBUSTLY

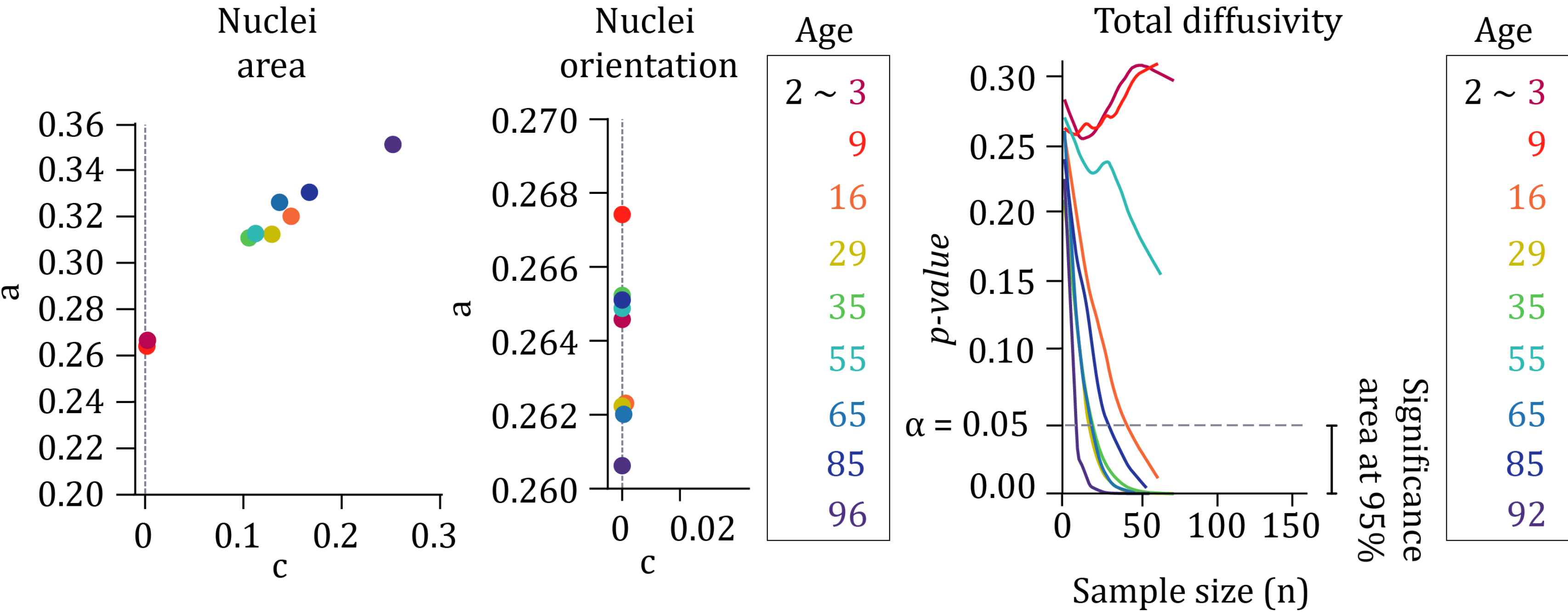
- Data: Microscopy images of cancer cells (MDA-MB-231) embedded in a 3D collagen type I matrix.
- Task: Does Taxol have any effect in the cellular morphology?



While Taxol at 1 nM does not affect cell shape, Taxol at 50 nM inhibits cell elongation.

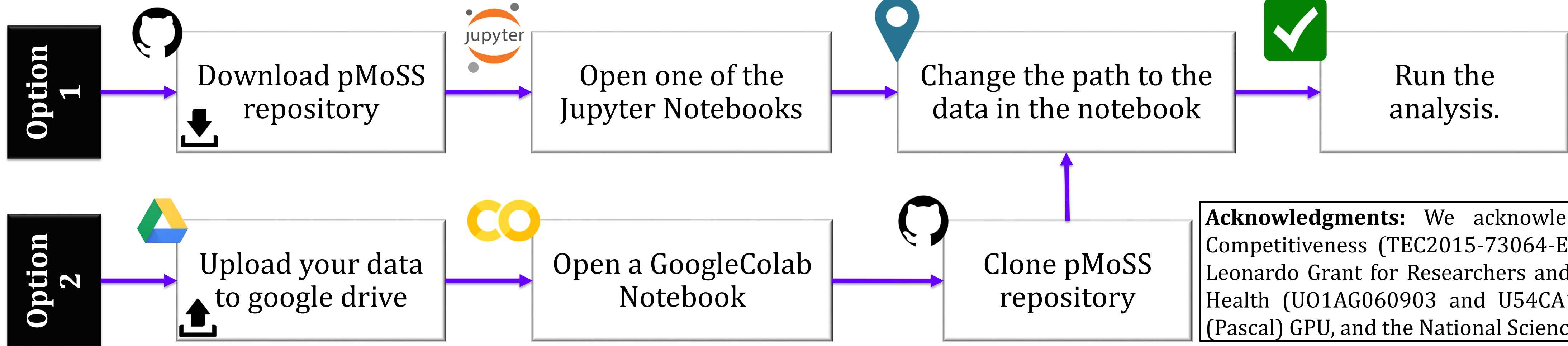
EXPERIMENT II: EARLY DETECTION OF INFORMATIVE FEATURES

- Data: Human primary dermal fibroblasts extracted from individuals between 2 and 96 years old [2].
- Task: Determine which features characterize the age of healthy human cells.



Nuclei area is a valid feature and nuclei orientation is a non-informative measure. Even if just 50 measures of diffusivity were available, the data is enough to determine that the total diffusivity can characterize cellular aging in humans as the decay is proportional to the age.

TRY IT YOURSELF



1. Gómez-de-Mariscal *et al.*, *bioRxiv*, 2019
2. Phillip *et al.*, *Nature Biomed Eng*, 2017



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