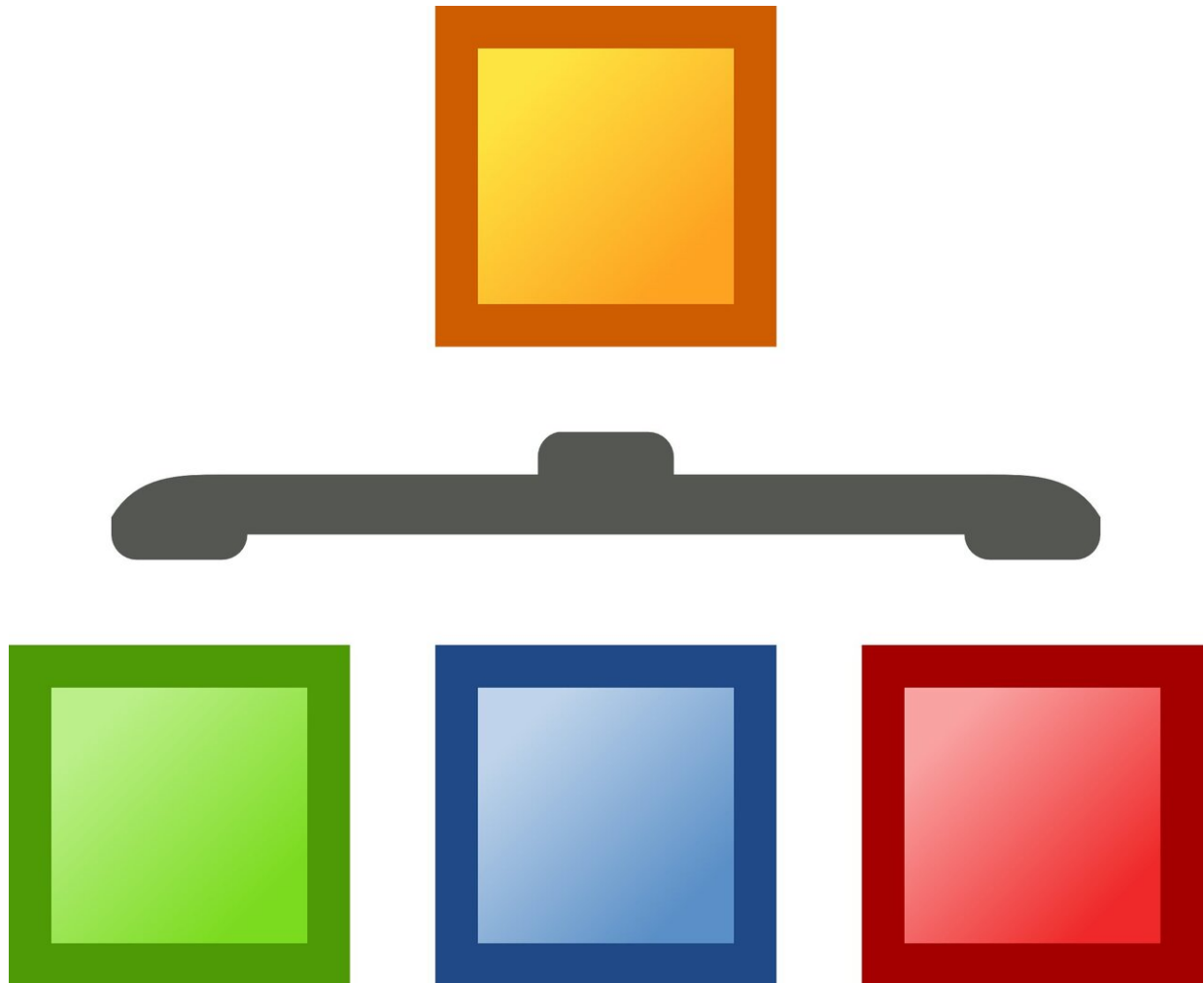


# Examining the cracks in Gaussian Processes

November 15 2021

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The technique of Gaussian Processes (GP) is widely used to reconstruct

cosmological parameters, most notably the expansion rate of the universe, using observational data. For many cosmologists, the crowning achievement of this approach is its 'model independence' – meaning it can be applied universally across all models. Through new analysis published in *EPJ C*, Eoin Ó Colgáin at Sogang University, Seoul, and Mohammad Mehdi Sheikh-Jabbari at IPM, Tehran, use the Hubble constant ( $H_0$ ) to show that this may not be the case—and that it may be time to question the validity of model independence itself.

The duo's results could have [profound implications](#) for the methods cosmologists use to study the universe. As they construct their models, these researchers must make assumptions about certain parameters which they can't possibly know everything about. Inevitably, their differing assumptions lead to contradictions between models—which in turn, can seed new progress towards better cosmological descriptions. Around 20 years ago, this led to the ' $\Lambda$ CDM' [model](#): which in its current form, can account for the universe's accelerating expansion. Inevitably, however, the  $\Lambda$ CDM model soon created new tensions in other areas. The GP data reconstruction approach has recently emerged in the face of these conflicts; and thanks to the widespread assumption of its model-independence, it has now become a centrally important tool in cosmology.

In their study, Ó Colgáin and Sheikh-Jabbari evaluated GP using  $H_0$ : a value defining the relationship between galaxies' distances from us, and speeds at which they move away from us. Within extensive data gathered so far, a mismatch has emerged between smaller-scale measurements of  $H_0$ , and its overall value, measured across the entire sky. Through their analysis, the duo concluded that the model-independent statement of this 'Hubble tension,' which is partly based on GP analysis methods, is a misnomer. Going further, they suggest that 'model independence' itself is an outdated concept in the era of 'precision cosmology', as it typically underestimate the errors on parameters.

The research was published in *The European Physical Journal C*.

**More information:** Eoin Ó Colgáin et al, Elucidating cosmological model dependence with  $H_0$ , *The European Physical Journal C* (2021). [DOI: 10.1140/epjc/s10052-021-09708-2](https://doi.org/10.1140/epjc/s10052-021-09708-2)

Provided by Springer

Citation: Examining the cracks in Gaussian Processes (2021, November 15) retrieved 11 May 2024 from <https://phys.org/news/2021-11-gaussian.html>

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