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Classification of sloppy models based on curvature BENJAMIN FRANCIS, MARK TRANSTRUM, Brigham Young Univ - Provo — Often in physics, complex processes can be explained by relatively simple models. A explanation for the existence of these effective theories, known as sloppiness, has recently been proposed using Information Geometry. In this approach, models are mappings between parameters and predictions that are naturally interpreted as manifolds. Sloppy models are characterized by a low effective dimensionality, that is, the manifold is bounded with many very narrow widths. Narrow widths correspond to irrelevant directions while long directions correspond to the relevant directions of the effective theory. We consider the curvature of several model manifolds. In many cases, the curvatures are small compared to the manifold widths. In other cases, such as oscillatory systems, the curvatures are much larger. Large curvatures pose technical challenges for model analysis, e.g., leading to local minima in the objective function when fitting to data. However, they can also be the signature of high dimensionality in the effective theory, for example, as in chaotic systems. We propose a subclassification of sloppy models based on their curvatures and discuss its broader implications for modeling complex systems.

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