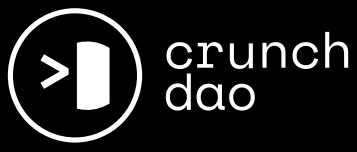

Data Science Problems and Hidden Dynamical Systems

DESCI LONDON HACKATHON

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Data Science Problems and Hidden Dynamical Systems

abstract

DeSci London Hackathon is a hackathon event taking place on the 12th and 13th of January 2023. This hack is aimed at anyone interested in DeSci.

1. Machine Learning and Dynamical Systems: Supervised Learning

We have noisy observations associated with a deterministic dynamical system and we are interested in best fitting, in some sense, these high-dimensional observations with a target scalar observation, related to the same system.

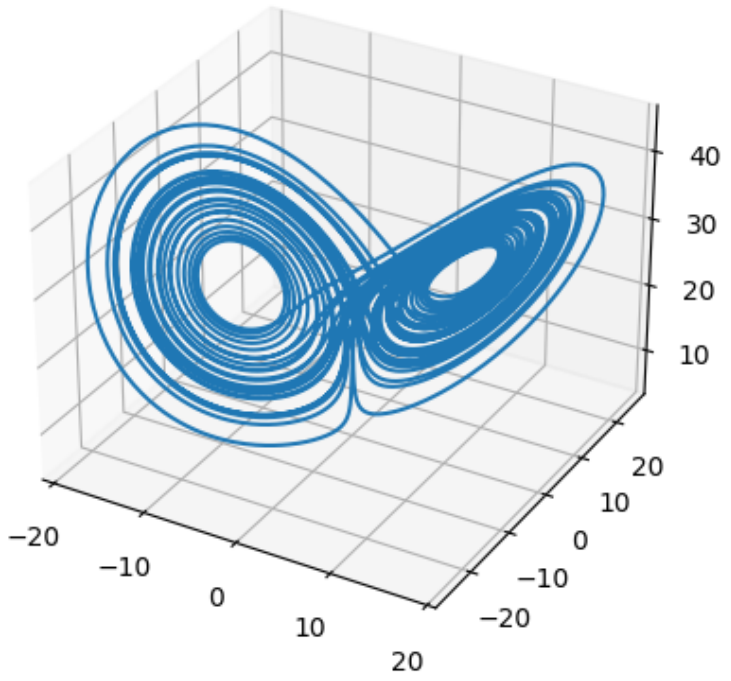


Figure 1: Hello Lorenz!

See (Vahid Nateghi 2022) and (Champion et al. 2019) for additional context.

2. Convex Optimization

The estimated targets are part of a pipeline sending them to a convex optimizer which returns a fitness different from your fitness. You cannot modify the convex optimizer.

See (Diamond and Boyd 2016) for additional context.

3. Chaos

Following the methodology discussed in https://desci.crunchdao.com/projects/unipi/stochastic-chaos BIBITEM missing, it is possible to use the tools of chaos theory in order to investigate the existance of coherent structures in the underlying dynamical system FROYLAND BIBITEM MISSING HERE.

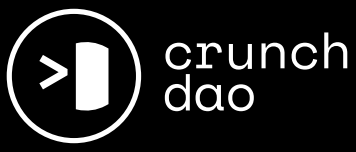
In particular, the use of IPFS enables the integration of multimedia contents in this work, accessible both from the paper and from the source code.

References

Champion, Kathleen, Bethany Lusch, J. Nathan Kutz, and Steven L. Brunton. 2019. “Data-Driven Discovery of Coordinates and Governing Equations.” *Proceedings of the National Academy of Sciences* 116 (45): 22445–51. https://doi.org/10.1073/pnas.1906995116.

Diamond, Steven, and Stephen Boyd. 2016. “CVXPY: A Python-Embedded Modeling Language for Convex Optimization.” arXiv. https://doi.org/10.48550/ARXIV.1603.00943.

Vahid Nateghi, Matteo Manzi. 2022. “Machine Learning Methods for Nonlinear Reduced-Order Modeling of the Thermospheric Density Field.” *Preprint*. https://doi.org/10.13140/RG.2.2.12431.05280.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