Data Science Problems and Hidden Discrete Dynamical Systems

DESCI LONDON HACKATHON

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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. The event will have two tracks – code and no-code. All submissions will be open source.

Step 1: Machine Learning: 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.
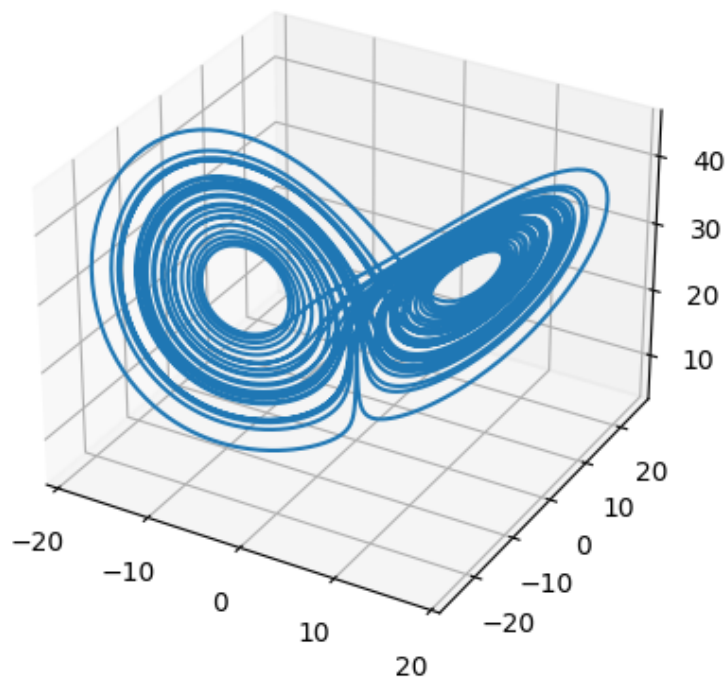

Figure 1: Hello Lorenz!

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

Step 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.

Step 3 Convex Optimizer-in-the-loop backpropagation

You can use backpropagation to train your model against the post-optimizer fitness.

See (Agrawal et al. 2019) for additional context.

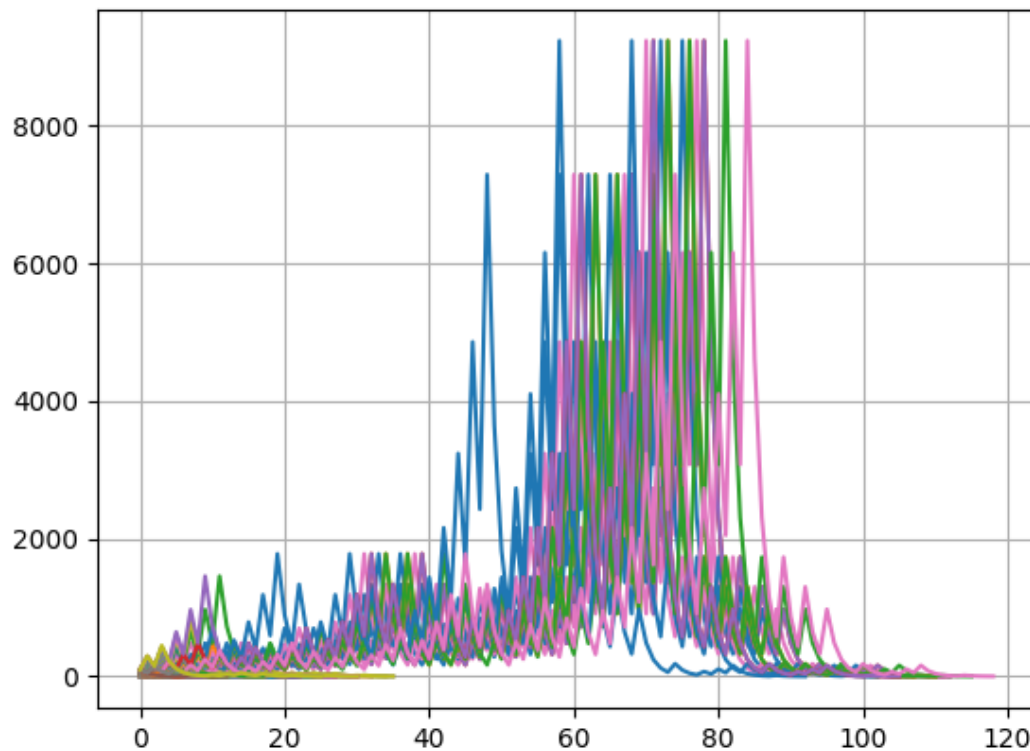## Bonus Problem

Award for this problem: 1M dollars. Good luck.

Figure 2: Prove the Collatz conjecture.

See (Tao 2019) for additional context.

References

Agrawal, Akshay, Brandon Amos, Shane Barratt, Stephen Boyd, Steven Diamond, and Zico Kolter. 2019. "Differentiable Convex Optimization Layers." arXiv. https://doi.org/10.48550/ARXIV.1910.12430.

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