Propositions

accompanying the thesis

Solving the Gravitational N-body Problem with Machine Learning

1. The implementation of physical knowledge into machine learning methods leads to more accurate results and better extrapolation capabilities *(Chapter 2 & 3)*.
2. The chaotic nature of the gravitational N-body problem leads to rapid accumulation of the statistical errors in machine learning predictions, often leading to unphysical solutions over short time scales *(Chapter 2)*.
3. The use of default values and absence of in-depth studies on decision parameters in astrophysics simulations often leads to sub-optimal results and invalid scientific conclusions *(Chapter 3)*.
4. The chaotic nature of the gravitational N-body problem implies that a small change in the simulation parameters or initial conditions can lead to radically different outcomes, making systematic studies highly challenging *(Chapter 4)*.
5. Machine learning is still in early stages of development for many scientific applications, but it will be present in the future of astrophysics simulations.
6. Scientific research should balance exploitation of established methods and exploration of new ones.
7. The scientific community is missing substantial progress because of the gap between scientific and technical fields.
8. Scientists should be able to communicate their research at different levels and to members of multiple disciplines.
9. A great challenge in making academia a healthy work environment is shifting the focus from researcher's reputations to a genuine wish for scientific progress.
10. The importance of socializing is only equal to that of granting yourself enough time alone.
11. The best method to deal with failure is to allow yourself a self-pity day before trying again.
12. Life is like a puzzle, some parts are easier, some parts are hard, but in the end what really matters is the people that help you put the pieces together.

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