The Physics of Data. Part XV

The Physics of Data. Part XV | Alfonso R. Reyes

The following is a list of top twenty recommended papers on Physics-Informed Neural Networks, PINNs, by Chat GPT and Deepseek.

Before releasing this PDF, I have curated both lists. Both, ChatGPT and Deepseek made several mistakes. In few cases, they made up the name and authors of the papers, by mixing and matching. Those papers have been removed from the lists.

In addition to that, I have an extensive library of papers on Physics Learning Machines, which include papers on PINNs, and many other methods that use scientific machine learning.

The list recommended by the generative chatbots would be matching my list by a margin of 40 percent.

For my list - not included in the PDF - I have used several metric indicators to qualify the papers such as the number of:

- keyword matches in the title and abstract;
- keyword matches in the body of the PDF;
- critique and highlight statements;
- callouts extracted;
- new terms learned;
- related terms mentioned;
- schematics;
- equations: latex and screenshots;
- tables;
- algorithms;
- PDF embeds;
- crucibles + questions + ideas
- Citation inlinks;
- Citation outlinks;
- References, bibliography
- if the paper has a code+data repository
- applications covered by the papers;

None of these indicators are covered by any of the chatbots. Most likely the selection by the chatbots has been done based on the number of citations of the papers.

In my papers database, every paper is covered exhaustively in each note. I don't use the number of citations. I used a flexible annotator and a sort of database of markdown text notes using Obsidian. The language of choice is JavaScript, and some Python for the PDF scan of the body of the papers searching for selected keywords.

This is a long term work. It will continue with the release of code, data, working examples, instructions, etc. Most likely the code will be written in Python (Py Torch + TensorFlow), and Julia. For the heavy stuff, I will use Java given its speed and scientific computational physics toolkit available in the form of OpenSourcePhysics.

Ideally, this should serve to any engineer with some semesters of math and Physics background to explore and open new frontiers beyond Data Science and classic Machine Learning, and help establish sound models based on laws of physics and Differential Equations instead of a purely data-driven approach that requires lots of data and yields low quality predictions. Physics-informed models is the basis of a scientific Artificial Intelligence not yet fully exploited because of its complexity and requirements of a new skill set.

Alfonso R. Reyes • You
VP Artificial Intelligence Engineering - Energy Division
4mo • Edited •

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#PhysicsOfData #SciML #petroleumEngineering #spe #seg #aapg #pl

Deepseek

1. Physics-Informed Neural Networks (PINNs): A Deep Learning Framework for Solving Forward and Inverse Problems Involving Nonlinear Partial Differential Equations

Authors: Raissi, M., Perdikaris, P., Karniadakis, G.E.