Physics-informed Neural Networks (PINNs) with non-differentiable loss function

Project No. B1099-211

Physics-informed Neural Networks (PINN) are neural networks that are trained to solve supervised learning tasks while respecting any given law of physics described by general nonlinear partial differential equations. It forms a new class of data-efficient universal function approximators that naturally encode any underlying physical laws as prior information. Yet in solving the real-world problem, loss function that are non-differentiable is involved, which can not be optimized by typical method like gradient descent. Therefore, in the project we intend to compare the current non-differentiable optimization method and make certain improvements for better adjustment for PINN.

Timeline:

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| Conducting Survey on PINN and Non-differentiable Optimization | Aug 2021 -Sep 2021 |
| Identify and Formulate the Problem | Oct 2021 |
| Implementation | Oct 2021 – Jan 2022 |
| Improvement of current implementation | Jan 2022 – Mar 2022 |
| Draft Report | 25th Mar 2022 |
| Final Report | 8th Apr 2022 |
| Project Demonstration | 11th – 14th Apr 2022 |
| Oral Presentation | 9th May 2022 |

The project started by conducting literature survey on both PINN and Non-differentiable optimization methods to find appropriate approaches for this project. Corresponding experiments will be reproduced. Certain defects of current approaches will be found along the way. Improvements will be made to better the algorithm.

The project will target on developing a feasible approach to solve non-differentiable loss in PINN.