Departamento de Matemática Disciplina de Programação Avançada Ano lectivo de 2024/2025

Proposta de tema

Título: Neural Network for ODE

Sumário: We aim at developing several techniques for solving EDO system when the dynamic function is not given but only the dataset (measurement) are available. Basically, seja (t^n, x^n) , $n = 1, \dots, N$ a time series. We assume that the underlying physical problem is the differential equation $\dot{x} = f(x)$ where f is not known. The point is to approach f(x) with a neural network $f(x, \Theta)$ we train with the data set.

- First method using an interpolation (no NN).
- Second method using a simple feed-forward NN we train to provide the derivative approximation (lost function based o the derivative \dot{x}).
- Third method, solving time-step after time-step a guess of the NN we train based on the loss function of the solution.
- All the technique will be implemented in C++.
- Comparison of the accuracy using synthetic dataset and the exact solution.

Condições de Preferência: Programação C ou C++

Condições Especiais:

Orientador(es): Professor Stephane Clain

Data: $2^{\underline{0}}$ Semestre de 2024/2025