Data Driven Models for Solving Partial Differential Equations

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INTRODUCTION

- Traditional approaches include finite difference, finite element etc. They can't effectively handle high dimensional equations.
- Data-driven models can be used to learn/approximate the governing equations of a dynamical system using deep neural network(DNN).
- Residual Network (ResNet) is effectively used in this work as an Euler method.

METHOD

- **Data is obtained from a numerical solver then passed into the ResNet model as a one-time-stepping Euler method.**
- **Both linear and nonlinear system of ODE were used as test examples.**
- **Keras and Tensorflow on Python were used to build and generate the results.**

REFERENCE

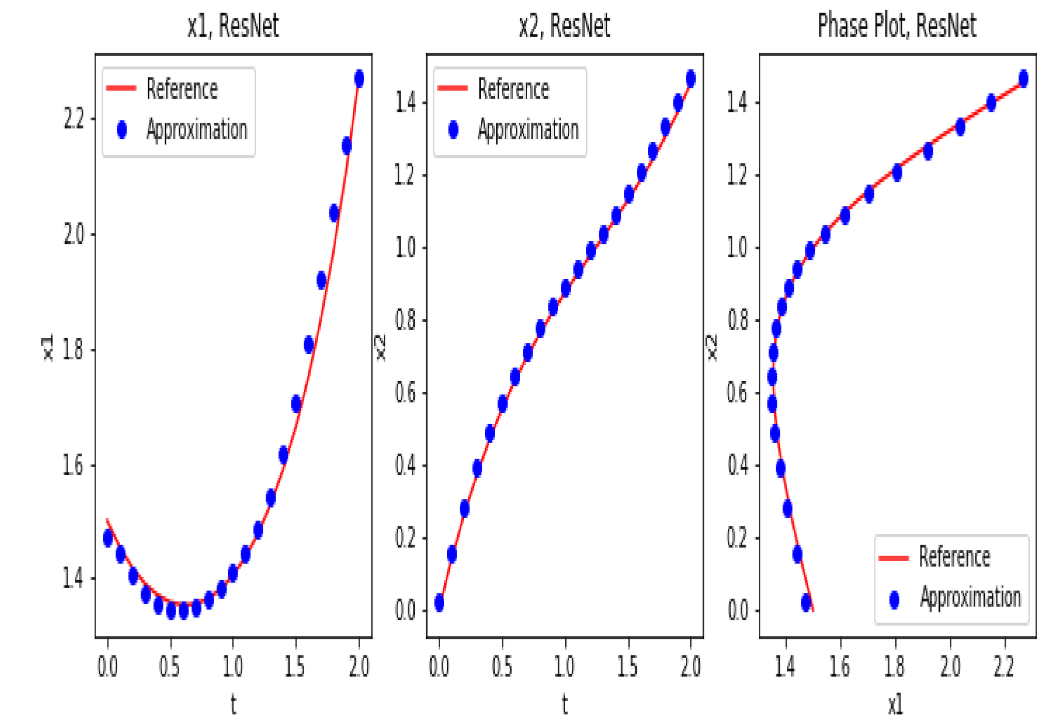
Qin Tong, Wu Kailiang, Xiu Dongbin "Data diven governing equations approximation using deep neural networks" Journal of Computaional Physics 395(2019):620-635

**We present a data-driven model as a numerical method to learn the unknown function of a dynamical system.
In particular, residual network (ResNet) as a one-time-stepping Euler method is used to solve partial differential equations.**

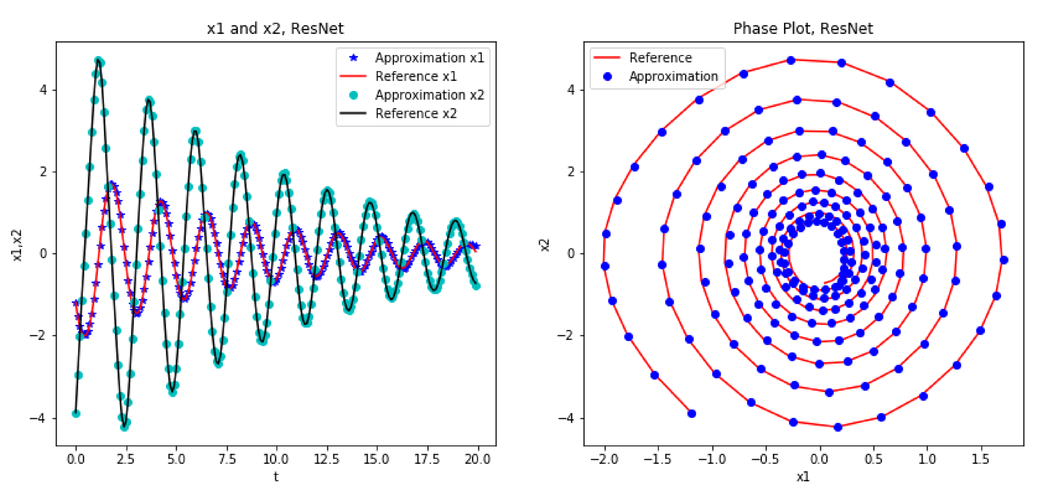
Computational Science

RESULTS

Prediction accuracy was 100%. Relative error in prediction was 0.19e-01 and 0.23e-01 for x1 and x2 respectively.



Prediction accuracy was about 99.5%. Relative error in prediction was 0.30e-01 and 0.16e-01 for x1 and x2 respectively.



DISCUSSION

- **No benchmark error comparison.**
- **We will build neural network models to learn the dynamics of SIR models for COVID-19 both as forward and inverse problems.**