DL Neural ODE

May 15, 2025

1 Team

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2 Introduction

Time-series forecasting is the main problem in areas such as finance and weather prediction. Basic DL models use fixed time intervals; here we consider the continuous-time approach, which allows us to work with irregular intervals. Our main goal is to implement and evaluate NeuralODE [1] for irregular time series, where discrete models as RNN cannot be used. We would like to compare NeuralODE's with RNN's and see its performance.

Table 1: Comparison of RNN and Continuous-time RNN (Latent ODE)

Regular RNN	**Neural ODE + RNN (Latent ODE)**
Discrete steps: $\mathbf{h}_{t+1} = RNN(\mathbf{h}_t, \mathbf{x}_t)$	Continuous dynamics: $\frac{d\mathbf{h}(t)}{dt} = f_{RNN}(\mathbf{h}(t), t)$
Requires **fixed intervals** between $\mathbf{x}_t$	Works with **arbitrary** $t_0, t_1, \ldots$
Backprop through all steps ($O(L)$ memory)	Backprop via adjoint method ($O(1)$ memory)

3 Scope of work

- Download Dataset
- Implement NeuralODE from the article [1], using PyTorch and TensorFlow
- Compare performance with RNN.

References

[1] Ricky T. Q. Chen et al. "Neural Ordinary Differential Equations". In: *Advances in Neural Information Processing Systems* 31 (2018). URL: https://arxiv.org/abs/1806.07366.