MASTER'S DEGREE THESIS

Dipartimento di Informatica
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RON something..

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Abstract

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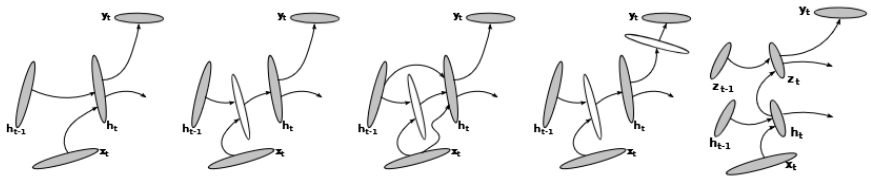
Chapter 1

Introduction

1.1 Stack RNN



(a) RNN (b) DT-RNN (b*) DT(S)-RNN (c) DOT-RNN (d) Stacked RNN

Figure 2: Illustrations of four different recurrent neural networks (RNN). (a) A conventional RNN. (b) Deep Transition (DT) RNN. (b*) DT-RNN with shortcut connections (c) Deep Transition, Deep Output (DOT) RNN. (d) Stacked RNN

FIGURE 1.1: Various ways to go deep in RNNs

We can refer to this type of deep architecture as *sRNN* or in case of Reservoir, as *DeepESN*. Particularly the stacked version encourage the model to look at the data at different timescales, they can be used to learn complex patterns in sequential data, the depth allows the network to learn hierarchical representations of the data. We want to analize the behaviour of Recurrent Oscillator Newtwork (RON) presented in[1] with other well known Reservoir architectures like Echo State Networks and their deep counterparts. Another option that could be explored is what happens if we train such architectures when they are constructed in a "Deep" fashion, firstly we will develope the depth and structure by stacking our reservoir layers.

One fundamental property of stacking RNN in layers is that we can consider a sRNN as a dense RNN where some units are not connected.

Stack Recurrent Neural Networks (Stack RNNs) are a type of neural network architecture that incorporates a stack data structure into the recurrent neural network framework. This allows the network to maintain a form of memory that can be pushed to and popped from, enabling it to handle more complex sequences and hierarchical structures. Stack RNNs are particularly useful in tasks that require the processing of nested or recursive data, such as natural language parsing and certain types of algorithmic learning.

1.2 Recurrent Online Neural Networks (RON)

Recurrent Online Neural Networks (RONs) are a variant of recurrent neural networks designed for online learning scenarios. In online learning, the model is updated continuously as new data arrives, rather than being trained on a fixed dataset. RONs are designed to efficiently handle this continuous stream of data, making them suitable for real-time applications where the model needs to adapt quickly to new information. This makes RONs particularly useful in dynamic environments such as financial markets, real-time recommendation systems, and adaptive control systems.

Chapter 2

Background

Chapter 3

Problem Statement and Related works

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Conclusion and Future Works

Bibliography

[1] Andrea Ceni, Andrea Cossu, Maximilian W Stölzle, Jingyue Liu, Cosimo Della Santina, Davide Bacciu, and Claudio Gallicchio. "Random Oscillators Network for Time Series Processing". In: *Proceedings of The 27th International Conference on Artificial Intelligence and Statistics*. Ed. by Sanjoy Dasgupta, Stephan Mandt, and Yingzhen Li. Vol. 238. Proceedings of Machine Learning Research. PMLR, Feb. 2024, pp. 4807–4815. URL: https://proceedings.mlr.press/v238/ceni24a.html.