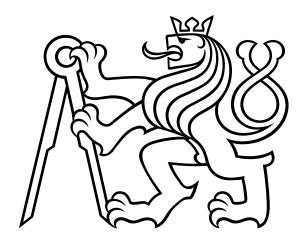
Czech Technical University in Prag Faculty of Mechanical engineering

Department of instrumentation and control enfineering
Automation and industry informatics



Master Thesis

Title

Subtitle

January 29, 2021

Roman Dušek

Contents

ackground 1 Supervised learning
Neural networks 2.2.1 Perceptron 2.2.2 Learning and optimalization 3 Recurrent neural networks 2.3.1 Vanilla version 2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.2.1 Perceptron 2.2.2 Learning and optimalization Recurrent neural networks 2.3.1 Vanilla version 2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.2.2 Learning and optimalization Recurrent neural networks 2.3.1 Vanilla version 2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
Recurrent neural networks 2.3.1 Vanilla version 2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.3.1 Vanilla version 2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.3.2 Long-short-term-memories 2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.3.3 Gated recurrent units 2.3.4 Other types of RNN 2.3.5 Problems using RNN 4 High order neural networks
2.3.4 Other types of RNN
2.3.5 Problems using RNN
2.4.1 High order naural unit
2.4.1 High order neural unit
2.4.2 Recurrent HONN
2.4.3 Problems using HONN
xperimental Setup
iscussion
onclusion
j

Nomenclature

GRU Gated Recurrent Unit

HONN High Order Neural Network

HONU High Order Neural Unit

LSTM Long-Short-Term Memory

NN Neural network

RHONN Recurrent High Order Neural Network

RNN Recurrent Neural network

1 Introduction

- 2 Background
- 2.1 Supervised learning
- 2.2 Neural networks
- 2.2.1 Perceptron
- 2.2.2 Learning and optimalization
- 2.3 Recurrent neural networks
- 2.3.1 Vanilla version
- ${\bf 2.3.2}\quad {\bf Long\text{-}short\text{-}term\text{-}memories}$
- 2.3.3 Gated recurrent units
- 2.3.4 Other types of RNN
- 2.3.5 Problems using RNN
- 2.4 High order neural networks
- 2.4.1 High order neural unit
- 2.4.2 Recurrent HONN
- 2.4.3 Problems using HONN
- 3 Experimental Setup
- 4 Discussion
- 5 Conclusion

References

- [1] Filippo Maria Bianchi et al. Recurrent Neural Networks for Short-Term Load Forecasting: An Overview and Comparative Analysis. en. 1st ed. 2017. SpringerBriefs in Computer Science. Cham: Springer International Publishing: Imprint: Springer, 2017. ISBN: 978-3-319-70338-1. DOI: 10.1007/978-3-319-70338-1.
- [2] Ivo Bukovský. "Nonconventional Neural Architectures and Their Advantages for Technical Applications". In: ().
- [3] L.R. Desker and L.C. Jain. Recurrent Neural Netowrks Design and Applications.
- [4] Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning.
- [5] M. Madan Gupta and Ivo Bukovsky. "Fundamentals of Higher Order Neural Networks for Modeling and Simulation". In: ().
- [6] LazyProgrammer. Recurrent Neural Networks in Python.
- [7] Danilo Mandic and Jonathon A. Chambers. "Recurrent Neural Networks for Prediction Learning Algorithms, Architectures, and Stability by Danilo Mandic, Jonathon Chambers". In: ().
- [8] Danilo P. Mandic and Jonathon A. Chambers. Recurrent Neural Networks for Prediction. en. Ed. by Simon Haykin. Wiley Series in Adaptive and Learning Systems for Signal Processing, Communications, and Control. Chichester, UK: John Wiley & Sons, Ltd, Aug. 2001. ISBN: 978-0-471-49517-8 978-0-470-84535-6. DOI: 10.1002/047084535X.
- [9] Christopher Olah. Understanding LSTM Networks. en. Aug. 2015.
- [10] Jorge D. Rios et al. Neural Networks Modeling and Control: Applications for Unknown Nonlinear Delayed Systems in Discrete Time. en. First. Waltham: Elsevier, 2019. ISBN: 978-0-12-817078-6.
- [11] Ming Zhang. Artificial Higher Order Neural Networks for Economics and Business. en.

Appendix