Neural Networks Paper Title

Thesis Subtitle

Sneha Lodha
Marco Gallo
Max Falziri
Yasmin de Groot

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University of Groningen
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Abstract

abstract text (10 lines)

Contents

1 Introduction

2 Data

	Hi-hat-closed	Hi-hat-open	Bass drum	Crash	Snare	High-tom	Mid-tom	Floor-tom	Ride
Quarter 1	0	0	1	0	0	0	0	0	0
Quarter 2	0	0	0	0	0	0	0	0	0
Quarter 3	0	0	1	0	0	0	0	0	0
Quarter 4	0	0	0	0	0	0	0	0	0

- pseudocode of the generator - what happens with 8th and 16th - this is 1 bar, this matrix repeats for multiple bars - how much we generated

3 Methods

In this experiment, one pipeline is used. This consists of the learning algorithm, the post processing and the performance metrics. All of these steps will be explained in detail in this section. The reason there is no pre-process present is because the data is generated in such a way that it does not need to be pre-processed for the network. The way this data is generated was explained in the previous section. The code of this project is mainly written in Python, while the statistical analysis is done in R.

3.1 Echo State Network

In this music generating task an ESN is used. The input signal of the ESN is created as described in the pre-prosessing. The set up of this ESN is based on "GUIDE REFERECE". This guide contained the base code of this project. It also provided the needed knowledge about the network and its parameters as descibed below. The given code has been rewritten to fit this project. The transformers, sparce matrix and noice vector were added as an addition. The documentation of the code can be found *here*. Regarding the ESN, the following parameters have been set:

The resevoir size

Within ESNs, it is serverly important that the resevoir is big enough, such that is it possible to obtain the target output $y^{target}(n)$ from a linear combination of this signal space. The resevoir in this project has been set to ...

The resevoir density

The density of a resevoir is mainly dependent on the distribution of the nonzero elements in the resevoir. In this project a basic uniform distribution is used. Besides the distribution, the density of the resevoir is set to ....

Spectral radius

Another main parameter for fitting the ESN is the spectral radius ϱ. This spectral radius is a parameter that will scale the resevoir matrix $\mathbf{W}$. The effect this parameter has is mainly seen on the learning accuracy of the the network. The new scaled matrix $\mathbf{W}$ is calculated using

$$\boldsymbol{W_{new}} = \mathbf{W} * (\frac{\varrho}{\max(|\lambda|)})$$

where λ represents the eigenvalues of the resevoir matrix $\mathbf{W}$, and $\mathbf{W_{new}}$ represents the updated resevoir matrix. After experimenting, the ϱ has been set to ...

Leaking rate

The leaking rate α for an ESN determines how well a resevoir unit maintains its value and how much it gets updated. Therefore α is one of the main parameters regarding the training process of this project. In this project α is set to ...

Regularization

The regularization of this project is implemented using a ridge regression in the learning step of the network. This is used to stabilize the output in the long run. The parameter that scales the identity matrix in the ridge regression is the actual set parameter in this situation. In this code this parameter is set to e^{-8}.

Besides the ridge regression, a noise vector is also present in the code. This is not used during this project.

Transformers

@Max :) Transformer (the 3 mentioned is the intro paper: treshold, sigmoid, sigmoid probability) (?) each transformer has a parameter and a squeezing function (for now).

3.2 Post-processing

Output

not sure what to write here yet

3.3 Fitting

evaluation function (MLP/Jaeger idea). expanding parameters: bfs with gradient decent.

4 Results

5 Discussion