# DST - Final Project

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February 24, 2022

# 1 Summary LSTM [2]

The invention of LSTM was motivated by the regularization of recurrent neural networks (RNNs). In addition to inputs $\boldsymbol{i}_t$, RNNs use also loops in order to include informations from previous hidden states $\boldsymbol{h}_{t'}$(where $t' < t$) in the calculation of the current state $\boldsymbol{h}_t$ at time $t$. The Elman network [1] is for example defined by [1]:

$$\boldsymbol{h}_t = \sigma_h(\boldsymbol{W}_{hi} \cdot \boldsymbol{i}_t + \boldsymbol{W}_{hh} \cdot \boldsymbol{h_{t-1}} + b_h) \tag{1}$$

$$\boldsymbol{o}_t = \sigma_o(\boldsymbol{W}_{oh} \cdot \boldsymbol{h}_t + b_o) \tag{2}$$

# 2 Results

What do you think about the idea to shortly present the results of task 3 here, i.e. saying the sigma and the cutoff frequency and maybe some training graphics ...

## 2.1 Lorenz63

## 2.2 Lorenz96

# References


[1] Jeffrey L. Elman. "Finding Structure in Time". In: *Cognitive Science* 14.2 (1990), pp. 179–211. DOI: https://doi.org/10.1207/s15516709cog1402_1. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1207/s15516709cog1402_1. URL: https://onlinelibrary.wiley.com/doi/abs/10.1207/s15516709cog1402_1.

[2] Pantelis R. Vlachas et al. "Data-driven forecasting of high-dimensional chaotic systems with long short-term memory networks". In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 474.2213 (2018), p. 20170844. DOI: 10.1098/rspa.2017.0844. eprint: https://royalsocietypublishing.org/doi/pdf/10.1098/rspa.2017.0844. URL: https://royalsocietypublishing.org/doi/abs/10.1098/rspa.2017.0844.


[1] see also https://en.wikipedia.org/wiki/Recurrent_neural_network#Elman_networks_and_Jordan_networks