Analysis of Neural Networks Methods for Realistic Handwriting Synthesis

Project Proposal

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Abstract

Recurrent neural networks and Long Short-Term Memory architecture are commonly used for generation of sequential data. For this project, we will be building, analysing and testing these these networks for generating realistic-seeming handwriting

1 Introduction

Recurrent neural networks (RNNs) are often used for generation various forms of sequential data, such as music and text. They are trained on real data sequences, where they attempt to predict the next element in the sequence. Subsequently, sequence generation can be performed by feeding previous networks outputs as inputs into the network, and sampling from them to generate the next element.

RNNs unfortunately do not have good memory, and therefore their predictions are based on only the last few inputs. To mitigate this, the RNN architecture Long Short-Term Memory (LTSM) is used.

2 Related Works

The paper *Generating Sequences with Recurrent Neural Networks* by Alex Graves goes into detail on how LSTM RNNs are used for sequence generation, with details on architecture and behavior. Furthermore, the paper explains how these neural networks can be used for handwriting synthesis. [1]

Another relevant paper is *Realistic Handwriting Generation using Recurrent Neural Networks and Long Short-Term Networks* by Bodapati et al. This paper uses a similar style of RNNs, in addition to using Mixed Density Networks (MDNs) in order to better capture randomness. [2]

3 Method / Algorithm

Both papers use deep recurrent neural networks for predicting and generating handwriting. The network has a many sequences and a large number of "skip connections".

Preprint. Under review.

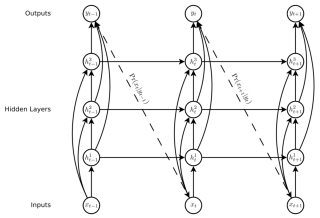

Figure 1: Deep RNN architecture.

In order to increase the memory capacity of the RNN, Long Short-Term Memory (LSTM) cells are used.

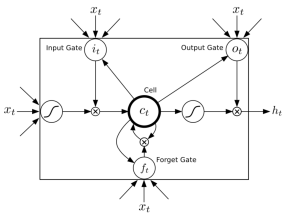

Figure 2: LSTM cell.

For the purpose of this analysis, we plan to perform sensitivity analysis on the hyperparameters, including layer count, number of mixture components and number of hidden layers. While doing this, we will be analyzing the handwriting output and how realistic it looks.

4 Summary

In summary, for this project we plan to build, analyze and test a recurrent neural network using a Long Short-Term Memory architecture for the purpose of generating realistic handwriting. During analysis and testing we will be focusing on tuning hyperparameters and architectures in order to improve the realism of the generated handwriting.

5 References

[1] Alex Graves. Generating sequences with recurrent neural networks, 2014.

[2] Suraj Bodapati, Sneha Reddy, and Sugamya Katta. Realistic handwriting generation using recurrent neural networks and long short-term networks. In K. Srujan Raju, A. Govardhan, B. Padmaja Rani, R. Sridevi, and M. Ramakrishna Murty, editors, *Proceedings of the Third International Conference on Computational Intelligence and Informatics*, pages 651–661, Singapore, 2020. Springer Singapore. ISBN 978-981-15-1480-7.