



**FACULTY  
OF MATHEMATICS  
AND PHYSICS**  
Charles University

## **BACHELOR THESIS**

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# **Generating text from structured data**

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Dedication.

Title: Generating text from structured data

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# Introduction

# 1. Problem statement

Recent years have seen a big surge of utilisation of deep neural networks in the field of Natural Language Processing. While most work focuses on neural machine translation, the aim of this thesis is to explore the task of natural language generation conditioned on the input database.

## 1.1 Data to text generation

Known datasets (WIKIBIO, WeatherGov, RoboCup) -> short description, the generated summaries are one-two sentences long. Rotowire -> really long summaries although only a fraction of the number of unique tokens from the WIKIBIO dataset. Only short description of the dataset, the statistics and observations are in the second chapter.

## 1.2 Fantasy sports

What it is, where it originates, the relation to basic optimisation problems, why NLGenerated summaries could be added value.

## 1.3 My goal

Fluent text which captures the important statistics from the table

## 2. The Rotowire dataset

Introduced in paper by Wiseman et al... Collected from rotowire.com.

### 2.1 The statistics of the dataset

General statistics of the dataset before preprocessing - number of tokens, unique tokens, player names, city names. Why we want to make the number of tokens lower while keeping the ability to have rich vocabulary.

### 2.2 Cleaning

Lorem Ipsum as one of the summaries, the paper doesn't mention if it's used as augmentation of the dataset or if it's a bug - removed. Player initials "C.J. McCollum" in table "CJ McCollum" in text.

### 2.3 Transformations of player names, city and team names

The motivation - making data denser. In a lot of summaries the player is firstly introduced "It was up to LeBron James to take over for Cleveland" and then referenced only by his surname "James finished with 27 points, 14 assists and 8 rebounds..." Many transformations were omitted although possible. The text looks more natural if the network learns that Philadelphia is sometimes mentioned as Philly. Those nuances are left in the text.

### 2.4 Byte pair encoding

What it is, who introduced it. How it decreases the number of tokens.

### 2.5 Other transformations made to the dataset

Here I'll mention lowercasing, number transformations.

### 2.6 The statistics of the transformed dataset

What is achieved with the use of all the mentioned transformations. The number of unique tokens decreased almost 4 times (11 300 to 2 900). The fraction of tokens mentioned more than 5 times increased from 47% to 89,5%. Highlight the differences to processing of



## 3. Neural Network Architectures

Why only neural network approach is used - mention many authors and papers which approach the problem of NLG by making use of deep neural networks.

### 3.1 RNN

What it is, creating the representation of sequence, etc. etc. Gradient vanishing and gradient explosion problems.

### 3.2 LSTM

What it is, how it solves the mentioned problems, cite the paper Massive Exploration of Neural Machine Translation Architectures which experiments with LSTMs, GRUs and vanilla RNNs and shows that LSTMs are the most promising option for the sequence to sequence tasks.

### 3.3 Attention

What it is, cite Bahdanau, Luong, possible subsection about the input feeding approach. It should select the most relevant entry from the database of match statistics.

### 3.4 Copy mechanism

What it is, right now I've implemented only Joint Copy mechanism, possibly add Conditional Copy

### 3.5 Truncated Backpropagation Through Time

Why it is infeasible to generate sequences of average 350 tokens with full back-propagation. Which types of truncated BPTT exist and which I've chosen.

### 3.6 Beam search

Why greedy search isn't enough, what is beam search, when is it used.

### 3.7 Transformers

Right now I don't think I'll get this far in my exploration and implementation of DNN architectures.

## 4. Models

The main goal is to explore the architectures. Therefore each model is manually implemented making use of the tensorflow library

### 4.1 Tensorflow

What is it, mention the paper introducing it, mention other frameworks and motivation why this is the one which is used.

### 4.2 Sequence to Sequence architecture

Encoder, decoder. Encoder creates the representation of the input in some meta language, decoder creates the output from the representation.

### 4.3 Encoder

Mention the embedding and MLP encoding (the main approach used in the ro-towire paper) - MLP is used instead of LSTM in the encoding process, then the 2 initial decoder states are obtained by mean pooling over the MLP encodings of the embedded source records.

### 4.4 Decoder

2 layer LSTM, embeddings, dimensionality.

### 4.5 Base Model

Seq2Seq architecture with attention, both Luong style Dot Attention and Bah-danau style Concat Attention are used, input feeding approach. Maybe some pictures.

### 4.6 Joint Copy model

Uses 2 attention mechanisms. Definitely some pictures.

# 5. Experiments

This chapter should present the observations about the generated data and the steps taken to improve the generations.

## 5.1 BLEU

What it is, why do I use such a metric for evaluating the data.

## 5.2 Manual evaluation

How the summaries for manual evaluation are chosen, how many people do evaluate the predicted summaries.

## 5.3 Other evaluation approaches

Which approaches are presented in the read papers, which improvements should be made.

## 5.4 Results of the baseline model

Learned which teams play, what are the greatest stars of each team, although the summaries diverge, only first few sentences from the generated summaries are relevant.

## 5.5 Dropout

What it is, where I apply the dropout - on the decoder LSTM cells.

## 5.6 Scheduled Sampling

What it is, how it solves the divergence of the summaries.

## 5.7 Copy methods

How do they help the model to choose more relevant data from the table, how do they fare in the concurrence of the baseline model.

# Conclusion

# Bibliography

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