

Learning to be Poetic: Automatic Generation of Chinese Song Ci Using RNN

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ABSTRACT

Judy: To be re-written In this project, we are going to develop a poem generator for Ci poetry. A system based on recurrent neural network (RNN) will be implemented to solve the sequence-to-sequence learning problem. We will also compare the performance of this model with the traditional automatic method that used to generate poem. We hope that our system can learn the complete rule from training dataset without any given constraints and generate poems with meaningful syntax that following the special rules for rhyme and tone in the Ci.

Keywords

Song Ci (poetry); Recurrent Neural Network; sequence-to-sequence learning problem

1. PROBLEM DESCRIPTION

1.1 Motivation

Judy: To be extended In this project, we propose and evaluate different approaches to automatically generate Chinese poems. Especially, we study how to automatically generate Chinese Ci using machine learning skills. Ci are one of the most important genres of Chinese classical poetry. As a precious cultural heritage, not many of them have been passed down onto the current generation. Therefore, the study of automatic generation of Ci is meaningful, not only because it supplements entertainment and education resources to modern society, but also because it demonstrates the feasibility of applying artificial intelligence in Art generation.

1.2 Background

Judy: To be extended Ci is a form of Chinese classical poetry. It arose with the so-called banquet music in Tang dynasty and reached its peak one hundred years later, as a major alternative to Shi poetry [2].

Derived from the structure used in Tang poetry, Ci follows strict rule determining the number of characters for different lines, the arrangement of rhyme, and the location of tones. There are more than 800 rule sets for

Ci, which is called Cipai [8]. The author of Ci needs to fill in the words according to the matrix associated to the Cipai. The uneven lines in Ci follow more continuous syntax than traditional Chinese Tang poetry [2].

1.3 Proposed Approach

Judy: To be extended We propose an AI system which generate Ci in an interactive approach. First, our system will prompt the user to provide a Cipai name. Because Ci belonging to different Cipai may contain different emotions or grammatical rules. Next, the system will receive few of keyword inputs that convey the detailed sentiments of the Song Ci. the first sentence of the iambic will be generated based on the keyword inputs. Further, the system generate following sentences based on previously-generated contexts using both RNN and SMT technique. Finally, we evaluate the quality of the generated Ci using an evaluation tool named BLEU.

1.4 Technical Challenges and Proposed Solutions

Judy: To be extended The first challenge to build a general model for all types of Song Ci. Different from Shi poetry whose structure is strict, Song Ci has more than 800 set of Cipai, and different Cipai follows different structural or rhythmic patterns. Therefore, it is difficult to generalize a model for all the Song Ci from limited training dataset. Our solution is to create a model based on Recurrent Neural Network. For every line generated in the SongCi, its probability is based on the probability of all previously lines.

Another challenge is to maintain consistent and poetic meanings throughout the generated SongCi. Compared with Shi poetry, Song Ci are much longer in length and therefore more complicated in context. It is difficult to keep long-distance memory using conventional RNN. Our solution is to use a Long Short Term Memory (LSTM) model that can track the long-distance information.

2. RELATED WORK

Judy: To be extended Approaches to poetry automatic generation can be divided into the following categories. **Using rules and templates.** This approach adopts templates to generate poems that comply with grammatical rules, such as the rhythms, lines, and word frequencies [6, 9].

Using evolutionary algorithms. This approach is mainly based on natural selection. It generates all possible candidates, and use search and evaluation algorithms to select the optimal one [4, 5].

Using Statistical Machine Translation (SMT) methods. [3]. This approach first receives keywords and extract most relevant constituents to these keywords. Next, it generates poems by iteratively selecting among these constituents based on phonological, structural, and poetic requirements.

Using neural network. This approach adopts an RNN Encoder-Decoder structure [1, 7]. It generates new iambics context using previously-generated contexts. based on the rationale that, in Chinese poems, two consecutive lines have high semantical relevance.

3. DATA DESCRIPTION

Judy: To be filled ...

3.0.1 Tang Poetry Corpus

3.0.2 Song Ci Corpus

4. PROJECT MILESTONES

4.1 Completed Milestones

4.1.1 Background Survey

For this initial step, we plan to search for related works to computational literary creation to gain the basic knowledge of Song Ci. We are interested in the following questions: what is the criterion of a good Song Ci? How to evaluate the correctness, fluency and style of poems generated? Better understanding of related work and Song Ci composition rules will provide us with great help for the following work, especially algorithm testing and comparison.

4.1.2 Corpus Search and Analysis

Nan: describe corpus: size, content, etc. We collected corpus that are comprehensive on poem styles, and are precisely analyzed for content.

Wei: insert a picture of word-frequency analysis.

4.1.3 Implementation of a Vector Space Model

Vector space models (VSMs) represent words in a continuous vector space where semantically similar words are mapped to nearby points. We implemented this model to find the semantic relations between each

Chinese character, so that given a few of keyword characters, such as 'spring' and 'beauty', we can generate poetries with coherent meanings using characters which are close to these keywords in the vector space. We give a visualized result in Figure 1. The figure is embedded with 100 Chinese characters in a 2-D space, which are randomly chosen from the most frequent 500 Chinese characters in the Song Ci corpus. The 2-D space corresponds to the first two dimensions in the vector space.

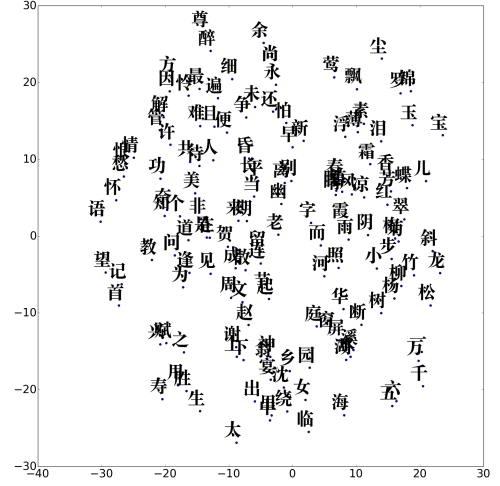


Figure 1: Vector Space Model

4.1.4 Implementation of a RNN + LSTM Model

We implement a preliminary version of our model. It is a special kind of RNN with Long Short Term Memory units (LSTM), which can capture long-term dependencies. The reason of adding LSTM to our model is that, different from Tang poetry, Song Ci has more content and is variant in styles. We may lose the coherent meaning of generated Song Ci without backtracking previous context.

We present a preliminary result in Figure 2.

4.2 Remaining Milestones

4.2.1 Implementation of Song Ci Generating Model

4.2.2 Model Testing and Comparison

4.2.3 Project Writing

5. REFERENCES

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Figure 2: A poetry generated using RNN+LSTM model

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