Text Generation with LSTM and Transformer based on Jin Yong Novels

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Abstract

This paper explores Chinese text generation using LSTM and Transformer models trained on the Jin Yong novel corpus. We tokenize the text at the character level and investigate the effects of different training epochs, Transformer layer depths, and sampling temperatures on model performance. Our results show that the LSTM model performs relatively well given the limited corpus, while the Transformer struggles to generate coherent text, likely due to its higher parameter requirements. We also propose the idea of fine-tuning a large pre-trained language model (Qwen3-1.7B) with LoRA, though limited hardware prevented full experimentation.

Introduction

In this experiment, we conducted a Chinese text generation task based on the Jin Yong novel corpus, using both LSTM and Transformer models for training and comparison. We further explored the effects of different numbers of training epochs, varying Transformer layer depths, and sampling temperatures on the generation performance.

Methodology

Data Preprocess

We directly use Chinese characters as tokens to build the vocabulary. After merging all Jin Yong novels into a single long text, we apply set() to extract the unique characters and then construct the index2char and char2index dictionaries accordingly.

Sentences separated by newline characters are converted into sequences by shifting a fixed-length window over them, and these sequences are used to construct the training corpus.

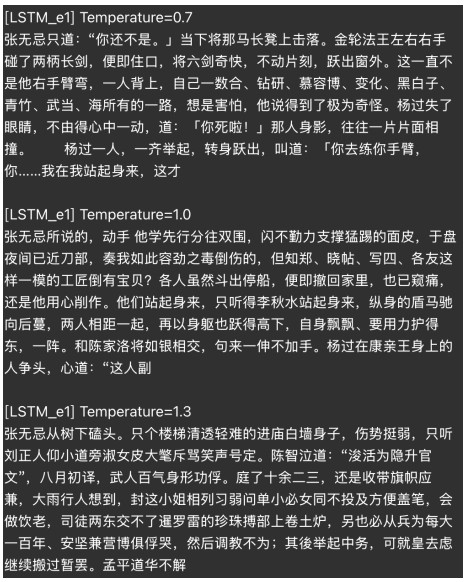

Figure 1: LSTM 1 epoch

Params

We set the LSTM model to have one layer, with both the embedding and hidden dimensions set to 128. For the Transformer model, the embedding dimension is also 128. We experimented with different numbers of layers: 2, 4, and 6, with the number of heads in the multi-head attention layers set to 4. During the sampling process, we only used the temperature parameter and explored values of 0.7, 1.0, and 1.3.

Experimental Studies

LSTM

We trained the LSTM model for 1, 2, 5, and 10 epochs respectively. The results are as follows. It can be observed that the output is better when the temperature is set to 1.0.

LSTM Visualization

Transformer

Due to the limitations of the corpus, the generation quality of the Transformer model is very poor, so we only present one example. This finding is similar to the observations made with CNNs and ViTs: the Transformer model appears to require a much larger corpus, likely due to its higher parameter count.

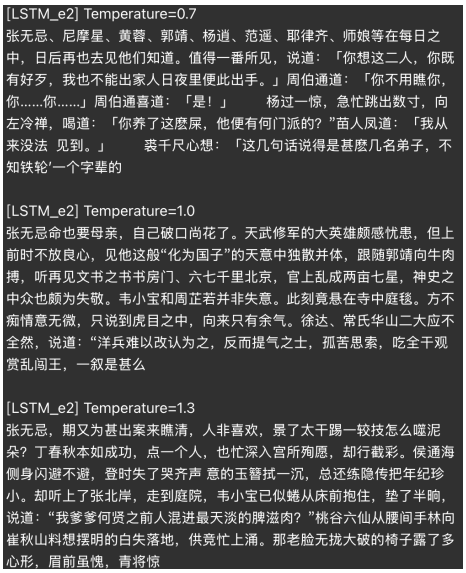

Figure 2: LSTM 2 epoch

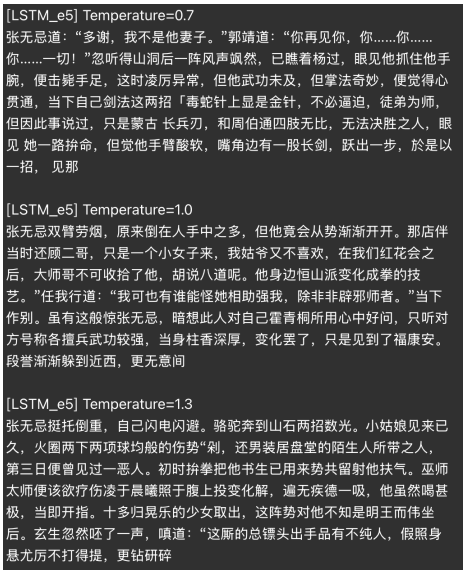

Figure 3: LSTM 5 epoch

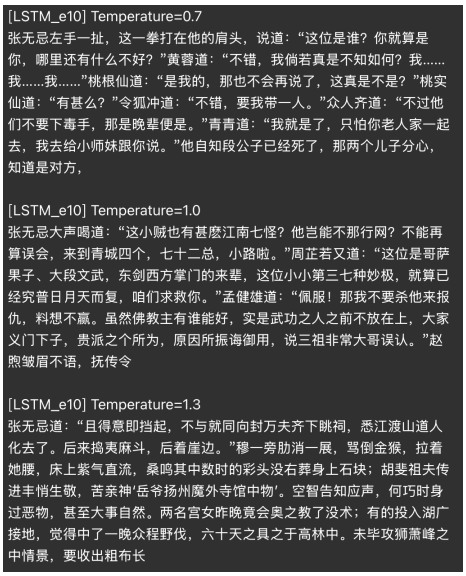

Figure 4: LSTM 10 epoch

Finally, we attempted to perform LoRA fine-tuning on the Jin Yong novels using the pre-trained Qwen3-1.7B model. However, due to hardware limitations and extremely slow training speed, we only discuss the idea here without further experimentation.

Conclusions

This experiment systematically compared the performance of LSTM and Transformer models on the task of Chinese character-level text generation using Jin Yong novels. The LSTM model demonstrated strong performance even with limited data, producing coherent and contextually meaningful text when trained over sufficient epochs. In contrast, the Transformer model failed to generate plausible results, which we attribute to its higher data requirements and complexity. This outcome aligns with similar findings in vision tasks comparing CNNs and ViTs. Although large-scale pre-trained models like Qwen3-1.7B offer promising alternatives, they demand substantial computational resources. Overall, LSTM remains a viable choice for character-level generation in low-resource scenarios.

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Figure 5: Transformer 4 layer, 10 epoch