



# Chinese Rap Generation

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## Abstract

- Develop a data mining pipeline to collect rap music with aligned lyrics and rhythmic beats
- Design a Transformer-based autoregressive language model which models rhymes and rhythms
- Generate lyrics in the reverse order with rhyme representation and constraint for rhyme enhancement

## Motivation

Rap lyrics need to be semantically meaningful and fashionable to convey interesting stories or express feelings.

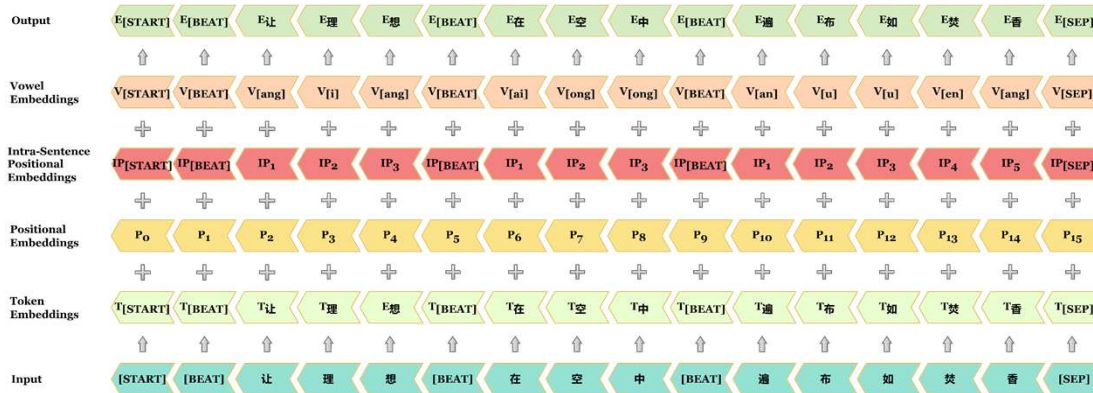
- it usually contains complex rhyme patterns among several consecutive sentences, which are the key to form a good flow
- it needs to align with the singing beat since rap lyrics are usually rapped according to some rhythmic accompaniments.

In this project, we develop a LSTM+Transformer based rap generation system which can model both rhymes and rhythms.

## Datasets

The architecture of the rap generation model:

- Word with underline means that a beat is aligned with this word.
- Sentences are separated by special token '[SEP]'. Token '[START]' represents the start of a song.



## Method

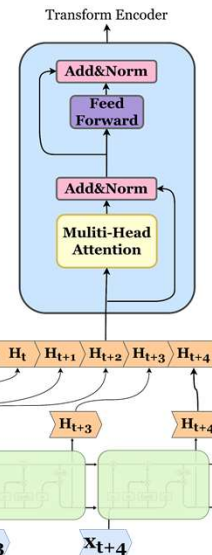
- To better model rhymes, our model generates a sentence from right to left, since rhyming words are always at the end of the sentence
- Rhythms are critical for rap performance, so we insert a special token [BEAT] for explicit beat modeling
- To generate rap lyrics rhyme with multiple consecutive tokens at the end, we proposed rhyme constraint:

We use an adjusted probability distribution

$$\tilde{p}(w | w_{<i}; \theta) = \alpha \cdot p(w | w_{<i}; \theta) + (1 - \alpha) \cdot \pi(w)$$

to generate the  $i$ -th word  $w_i$  with  $w_i = \operatorname{argmax} p(w | w_{<i}; \theta)$

$\pi(w)$  is a vowel check function,  $\pi(w)$  is 1 if the predicted  $w$  has the same vowel with the  $i$ -th token in the previous sentence, otherwise 0.



## Results

Generated Rap songs

生活不会感到太累  
 有种滋味  
 慢慢体会  
 只想在行动不间被浪费  
 不想躲避只有独自面对  
 真实的我真的累累累累  
 这就是关于原本的我  
 分不出什么错对  
 再没有谁  
 我太担心有愧  
 擦干之后带着泪水  
 我想过会懂得成熟  
 爱上自己应有的品味  
 我独自面对自认自己真伪  
 真的活很累悬崖边上却有谁  
 我太累 疲惫的我太过乏味  
 爱的这个世界我无路可退  
 想逃避却没有独自面对  
 生活不会感到太累  
 以为这很美  
 只有苦水  
 不觉累才让我失去所有防备

想逃避只有冷眼和相对  
 但毕竟谁都不能给我个机会  
 我逆着风去飞  
 竟也不能让我失去难受的悲  
 只会让我崩溃往下坠 我不能退  
 不怕黑  
 让我觉得累 向下坠  
 慢慢学会不害怕太累  
 我不想喝水  
 却害怕害怕只怕自己面对  
 敌于基本的对分不出什么错对  
 阳台的背后还有谁  
 我的死活有个误会  
 境界缺少真实生活中的负重  
 明天之后不怕天黑  
 狂风暴雨的背后都脱罪  
 我的命运总是不对  
 我不想是  
 我不累  
 似乎这是错谁对  
 我喜悦的只信自己无悔  
 它随着风在飞  
 的烟花留着奇特的香味

Method	Perplexity	Rhyme Density
Baseline	26.31	0.26
Ours	10.43	1.34

## Conclusion

- We leverage right-to-left generation, rhyme representation and rhyme constraint to better model rhyme and encourage N-gram rhyme, and explicitly model beat information by insert beat token beside the corresponding word in the lyric sequence.
- For future work, it can be extended to multilingual model.

## References

- [1] Vaswani, Ashish, et al. "Attention is all you need." *Advances in neural information processing systems*. 2017.
- [2] Sun, G., Chao Zhang, and Philip C. Woodland. "Transformer language models with lstm-based cross-utterance information representation." *ICASSP. IEEE*, 2021.