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Generating Chinese Ci with Designated Metrical Structure

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Paper and code: https://github.com/zhiyuanhubj/Generating-Chinese-Ci

Contribution

Rule-based learning traditionally belongs to the symbolist paradigm of AI

Neural networks and distributed representations belong to the connectionist paradigm of AI

Cipai: 忆江南（Yi Jiang Nan）

Rhythmic Rule:	3 characters，5 characters。 7 characters， 7 characters 。 5 characters?
Ci:	江南好，风景旧曾谙。日出江花红胜火，春来江水绿如蓝。能不忆江南?
Tonal Rule:	0 + - ，0 - - + + 。0 - 0 + + - - ，0 + + - - + + 。0 - - + + ?
Rhyming Rule:	- - - ，- - - - x 。- - - - - - - - ，- - - - - - x 。- - - - x ?
Translation:	Fair Southern shore, with scenes I adore. At sunrise riverside flowers redder than fire. In spring green waves grow as blue as sapphire. Which I cannot but admire.

Tone rule mean Ping(+) , Ze(-) or 0

Rhyming are a final, called a “rhyming foot” or Yunshe, which may take 16 different sounds.

Generating Ci(宋词) with designated metrical structure is a perfect example for investigating whether one can bridge the great divide between the connectionist and the symbolist.

Examples and Dataset

Two examples Ci’s generated by MRCG

Cipai：长相思（Chang Xiang Si）	
细帆头	The pretty hairpin I wear
等闲愁	With loneliness and boredom
泪滴红藕衬玉钩	Tears drop on the moon-lit pillow
夜来微湿秋	Lightly drenching this night of autumn
淡墨琳	Let my pen and ink
东晋游	Run through the Dynasty of Jin
百啭莺吭春梦稠	In the dream of romance, let thousands of doves chirp
秋千闲倚楼	Where on a leisureful balcony, I play on a swing

Cipai：清平乐（Qing Ping Yue）	
消魂销尽	Have you lost your mind
昨梦沈郎不	Dreaming of Mr. Shen last night?
莫惜飘茵随逝日	Don’t pity the green grass withering in the wind of time
泪雨潇湘月明	Tears like rain, you linger in the moonlight
只愁听五钩花	Sadness when you listen to an old song
白草桥外啼鸦	Resonates with the raven, crying on the bridge
别离恨愁无边	Leave behind the pain of parting
吟怀谁把年华	For an old memory, who would sacrifice youth, beautiful and shining?

Introduction of Dataset

We crawl a dataset from a Chinese poetry website: https://sou-yun.com/

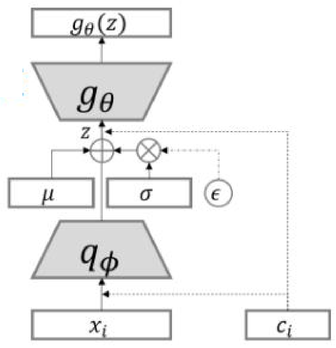
95% of the corpus are contributed by the most popular 314 Cipai’s; the most popular 20 Cipai’s contribute to about 45% of the corpus.

The dataset contains 82,724 Ci’s, written for 818 Cipai’s; on average there are 102 Ci’ per Cipai.

In total, 3,797 Ci’s in the testing set and 78,927 in the training set.

Model

We adopt the CVAE (conditional variational auto-encoder) framework for generating Ci for a given Cipai.We explicitly encode the metrical rules in the given Cipai into distributed representations and feed them to the neural networks.



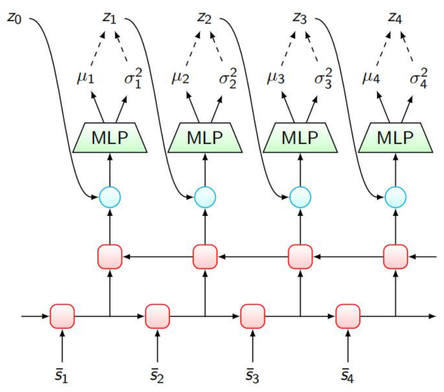
Metrically Restricted Ci Generation (MRCG)

Encoder

- Character Embedding: $\overline{w}_{l,j} := \mathbf{D}w_{l,j}$
- Line Embedding (GRU):

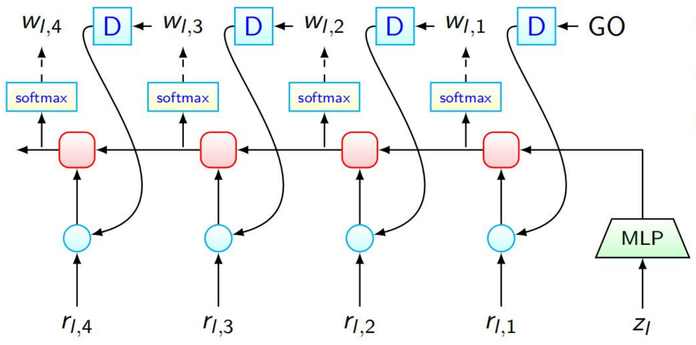
$$h^{s}_{l,j} := \mathbf{GRU}(h^{s}_{l,j-1}, \overline{w}_{l,j})$$
$$\overline{s}_l := h^{s}_{l,N(l)}$$

- Context Embedding (2-layer GRU)
- Latent Semantics Encoding (MLP)
- blue circle: concatenation
- red box: GRU



From line embedding to latent semantics

Decoder



Generate a line of characters

- blue circle: concatenation
- red box: GRU
- $r_{l,j}$: rule encoding for the j^{th} character in the l^{th} line.

$$r_{l,j} := \mathbf{concat}(\widetilde{a}_{l,j}, \widetilde{b}_{l,j})$$

a rhyme-rule vector $\widetilde{b}_{l,j}$

a tone-rule vector $\widetilde{a}_{l,j}$

Experiments

Metrical Performance

Model	Blind Generation			Guided Generation		
	Length	Tone	Rhyme	Length	Tone	Rhyme
Seq2seq	-	-	-	27.1	55.0	29.8
Attn	-	-	-	28.2	56.3	26.7
MRCG$^-$	35.49	59.43	33.34	41.96	66.21	39.77
MRCG	**99.21**	**92.03**	**96.87**	**99.37**	**93.71**	**98.28**

Seq2Seq:Seq2Seq model
Attn: Attention
MRCG- : MRCG with metrical-rule encoding removed(ablation experiment)

Semantics Performance

Model	Objective Tests		Human Evaluation			
	AST	RST	Flu	The	Aes	All
Seq2Seq	**0.242**	0.358	**2.65**	**2.8**	2.26	2.33
Attn	0.221	0.323	2.53	2.72	2.25	2.21
MRCG-	0.235	**0.541**	2.38	2.41	2.34	2.26
MRCG	0.229	0.529	2.59	2.68	**2.54**	**2.45**

Absolute Semantics Test (AST)

Relative Semantics Test (RST)

Fluency (Flu)
Theme consistency (Thm)
Aesthetics (Aes)
Overall (All)
performance are evaluated using scores {1(poor), 2, 3, 4(expert level)}

Conclusion

1.We present the first neural model, MRCG, that explicitly encodes metrical structure in Ci generation.

2. We demonstrate that MRCG generates nearly perfect metrics without sacrificing semantics.

3. This exercise suggests that it is possible to integrate the symbolist paradigm in the connectionist learning framework.

Future:
We believe that generating “human-level” semantics relies on the development of new natural language understanding models, particularly those capable of representing reasoning at a fundamental level.