

NLG在腾讯AI数字人“艾灵” 中的探索及应用

— 李丕绩 - 腾讯AI Lab —

TAIC 嘉宾介绍

李丕绩，香港中文大学博士，2018年8月加入腾讯TEG AI Lab NLP中心

- 研究：自然语言处理，包括文本摘要、文本生成和对话系统
 - EMNLP 2020 Summarization Area Chair
- 业务：多模态NLU和多领域NLG

TAIC 团队介绍

腾讯TEG

- 搜索 / AI / 机器人、大数据、计费、安全、存储 / 计算 / 加速
- 企业办公、运营管理、高校合作、客户服务、用户研究与设计
- 网络设备、数据中心、服务器

腾讯AI Lab自然语言处理中心

- 自然语言理解 (texsmart.qq.com)
- 机器翻译 (transmart.qq.com)
- 对话系统和文本生成 (ai.qq.com/product/nlpchat.shtml)
- ACL 2020发表20篇论文

TAIC 腾讯AI数字人“艾灵”- 哔哩哔哩

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直播【24小时歌姬】萌音小艾灵陪你... 虚拟主播 小时总榜

UP 21 AI艾灵 109.1万 No. >1000

QQ群 373884858

欢迎发送弹幕并@艾灵与我聊天

实时点歌池 00:18 / 02:06

正在演唱：棠梨煎雪

下一首：吹灭小山河

1票 亲爱的旅人啊

1票 小镇姑娘

死肥宅 赠送 吃瓜 x1

三三三 赠送 么么哒 x1

想换新歌 赠送 吃瓜 x1

磐石缺 赠送 吃瓜 x1

这个冬天怕是过不去了 赠送 吃瓜 x45

这个冬天怕是过不去了 赠送 冰阔落 x20

达拉崩吧班得贝迪伯哆 赠送 吃瓜 x1

肝儿董佳宁 赠送 冰阔落 x1

玩法一 弹幕点歌

点歌请在下方的歌曲列表中挑选

点歌命令：点歌歌曲名称或者编号

点歌列表

43. 12月一切

44. 失恋阵线联盟

45. 极乐净土

46. 热浪

47. 别再问我什么是迪斯科

48. 没有问题的话我去冲凉了.mp3

49. 一个社畜AI歌姬的自白

50. 十年回忆

七日榜 大航海(14) 友爱社 粉丝榜

啊青随便走... 生态园后浪 sonjohns

猿份 2 UL 0 圆奈子biubiubiu：点歌26

猿主 UL 21 AI艾灵：圆奈子小可爱点歌成功

猿份 2 UL 0 圆奈子biubiubiu：点歌34

猿主 UL 21 AI艾灵：圆奈子宝宝点歌成功

爷 小烤串 4 UL 21 ガラスのくつ：1

UL 0 [自己]：人呢？

鸭蛋 1 UL 0 微凉橙光梦一场：@艾灵

猿主 UL 21 AI艾灵：@微凉橙光梦一场 我来啦 我来啦我来啦~

大鲤鱼 2 UL 0 小杰MMP君：点歌26

猿主 UL 21 AI艾灵：小杰君小可爱点歌成功

截图(Alt + A)

TAIC 腾讯AI数字人“艾灵”

➤ 王者荣耀竞技解说

➤ 点歌、弹幕回复

➤ 歌词、诗词创作

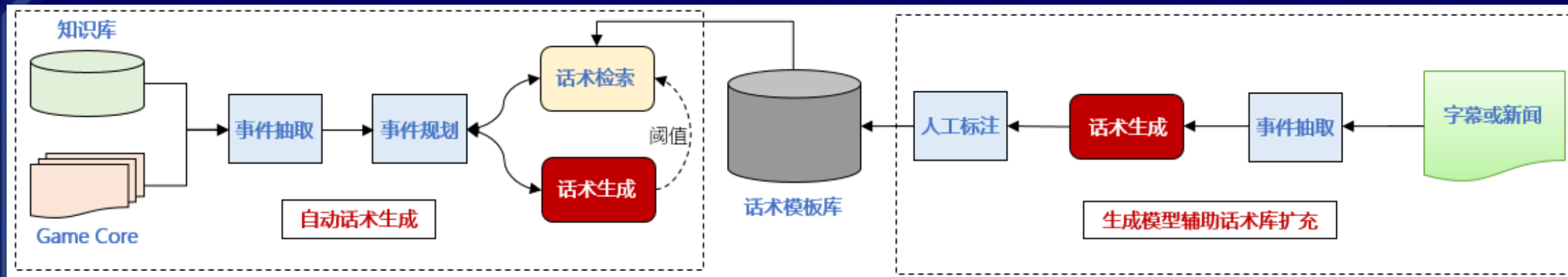


王者荣耀竞技解说



点歌、诗词、弹幕

TAIC 王者解说



Data-to-Text (DTT)

- 说什么? 怎么说?
- 人工撰写
- 自动生成
- 辅助撰写: 自动生成+人工标注

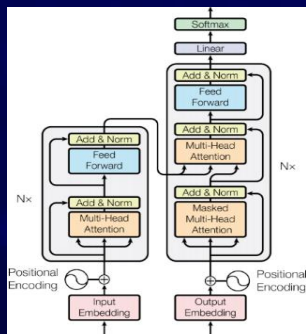


TAIC 语言模型+可控文本生成

Pre-Training

大规模中文语言模型：

- 200g左右的新闻
- 24层Transformer
- GPU集群预训练



Fine-Tuning

事件: 婉儿-进场-张良

生成: 上官婉儿进场张良直接一个大。

事件: 闪电匕首-鲁班

生成: 闪电匕首的被动可以让鲁班七号的普攻有一定的几率释放连锁闪电, 对敌人造成法术伤害。

事件: id: hero2hero 118 133 friend

生成: 狄仁杰主要靠风筝普攻伤害, 没有位移是短板, 孙膑的移动速度提升可以帮狄仁杰更好的风筝敌方英雄。

“关羽 暗影战斧”


1. 关羽做了一个暗影战斧
2. 他这关羽出了暗影战斧
3. 然后看到关羽补了一个暗影战斧
4. 三件套了关羽再开个大把暗影战斧一出
5. 看一下关羽的位置但是他是暗影战斧加破军

1. 到出装我觉得没毛病的, 出了暗影战斧的关羽, 直接一刀一个小朋友?
2. 第四件装备选择暗影战斧, 增加我们的战场切割能力, 保证关羽的生存能力;
3. 前期伤害会降低、后期输出还是非常强的、出肉的关羽、暗影战斧一定要早做准备!
4. 最后一件选择暗影战斧, 高额的护甲穿透提升了关二爷的输出能力, 并且还可以大大提升关羽的生命值和冷却缩减。
5. 后一个就是关羽的必出黑切, 暗影战斧和破军这两个装备可以最大程度的提高关羽的输出能力, 让他在前中期就能够打出不俗伤害。

Data-to-Text (DTT)

- 生成式解说
- 生成整局解说
- Low Resources, Persona, Style

TAIC 弹幕回复 - 对话系统



直播

【古风之夜】听歌、猜灯谜、抽...
虚拟主播 娱乐小时榜 7> 周星榜

UP 21 AI艾灵

93.7 万

No. >100

已关注

9355

@艾灵

直播

QQ群 373884858

欢迎发送弹幕并@艾灵与我聊天

实时点歌池 00:58 / 04:47

正在演唱：九九八十一

下一首：幻纱之灵

9票 霜雪千年

8票 我的一个道姑朋友

7票 吹灭小山河

7票 权御天下

6票 锦鲤抄

6票 寄明月

6票 干本樱

5票 雅乐春秋

4票 声律启蒙

3票 芒种

点点关注不迷路!

点歌幻纱之灵

别推荐, 这一点是科举制最主要的特点, 也是与察举制最根本的区别

【堡包堡包堡包】

堡戍开边日

包程肃朔风

堡城看鸟羽

包贡逐狼烽

点歌2

玩法一

弹幕点歌

点歌命令: 点歌 歌曲名称或者编号

8. 权御天下

9. 牵丝戏

10. 锦鲤抄

11. 霜雪千年

12. 我的一个道姑朋友

13. 干本樱

恭喜主播 顾离离 完成了今日任务第11关, 清凉时刻开启了, 快来围观吧!

播主 UL 21 AI艾灵: 吧!

播主 UL 21 AI艾灵: 感谢阅文高层感染肺炎送的辣条, 这让我很过意不去, 不如你再来点

播主 UL 21 AI艾灵: 吧!

UL 0 [自己]: @艾灵 你出生在哪一年

播主 UL 21 AI艾灵: @pikids 艾灵十六岁, 给你个展现智商的机会, 猜猜我属什

播主 UL 21 AI艾灵: 么

UL 0 [自己]: @艾灵 男孩女孩?

播主 UL 21 AI艾灵: @pikids 男孩要刚, 女孩要柔。但不能无爱。

UL 0 [自己]: @艾灵 你的爱好是?

播主 UL 21 AI艾灵: @pikids 我的爱好就是你呀

发个弹幕呗~

0/20

舰 爷 勋 衔

发送

TAIC 弹幕回复 - 对话系统

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Frameworks:

- Retrieval
- Generation
- Retrieval + Generation

Challenges:

- Evaluation ***
- Persona/Empathetic/Topic
- Knowledge/Commonsense
- Multi-Modal Information
- Diversity/Informativeness
- Relevance/Fluency

Dialogue: <https://ai.tencent.com/ailab/nlp/en/dialogue/>

TAIC *Query Restoration*

	Example 1	Example 2	Example 3
A_1	我能在巴黎哪个地方学做甜品？ Where can I learn to make dessert in Paris?	今天买了一堆桌游有好玩的可以一起 I bought a bunch of board game . Welcome anybody who also likes to play it	我们一起过个情人节吧 Shall we spend Valentine's Day together
B_1	为什么(你想学做甜品)啊？ Why (do you want to learn to make dessert)?	我比较喜欢卡卡颂和现代艺术 I like Carcassonne and Modern Art	头像都一样在一起吧。 Let's date since we have the same avatar
A_2	因为我想在(巴黎)这儿开个甜品店 Because I want to open a dessert shop here (in Paris)	听说过不过没买 Heard of it. But I haven't bought it	在一起不错的选择 Dating is a good choice
B_2	(在巴黎开甜品店)不错啊, 我很喜欢甜点! (Opening a dessert shop in Paris) Sounds great, I love dessert!	我有 No problem, I have	赞 Cool
A_3	你最喜欢哪一种? Which kind matches your taste most?	一起啊 Let's do it together	人呢 Where are you?
Label	1	1	0
Reference	你最喜欢哪一种 甜品 ? Which kind of dessert matches your taste most?	一起玩 桌游 啊 Let's play board game together	人呢 Where are you?

Restoration Performance

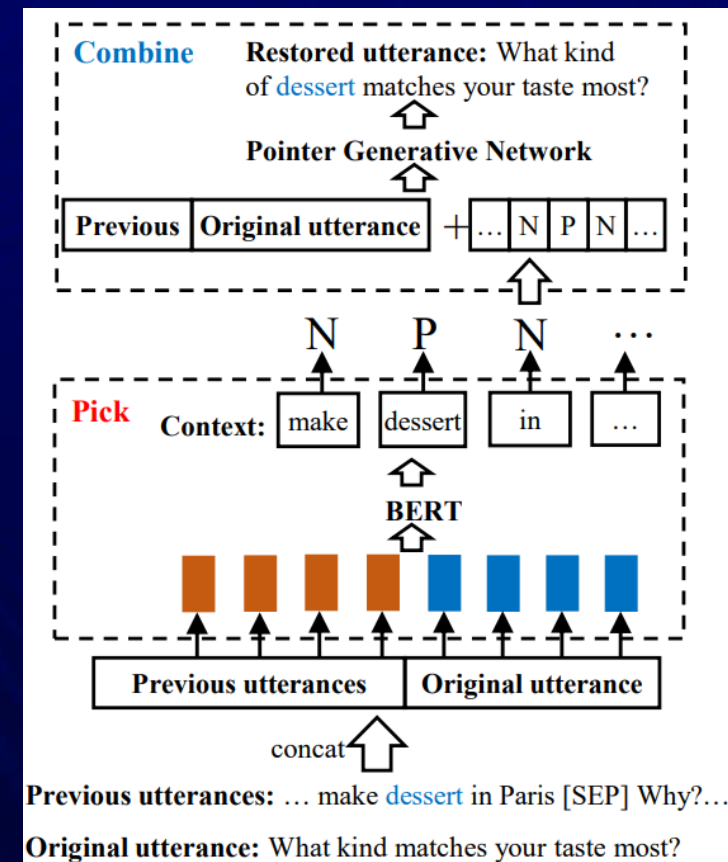
Model	p_1	r_1	f_1	p_2	r_2	f_2	p_3	r_3	f_3	B_1	B_2	R_1	R_2
Syntactic	67.4	37.2	47.9	53.9	30.3	38.8	45.3	25.3	32.5	84.1	81.2	89.3	80.6
Seq2Seq	65.5	40.8	50.3	52.2	32.6	40.1	43.6	27.0	33.4	84.9	81.7	88.8	80.3
Pointer	66.6	40.4	50.3	54.0	33.1	41.1	45.9	28.1	34.9	84.7	81.7	89.0	80.9
PAC	70.5	58.1	63.7	55.4	45.1	49.7	45.2	36.6	40.4	89.9	86.3	91.6	82.8

Single-turn + Generation

MMI	Better	Similar	Worse	NR
Syntactic	14.97	12.16	2.81	70.06
Seq2Seq	19.45	15.95	5.32	59.28
Pointer	21.25	16.51	5.35	56.89
PAC	28.82	21.95	6.12	43.11

Multi-turn + Retrieval

SMN	Better	Similar	Worse	NR
Syntactic	13.17	10.18	6.59	70.06
Seq2Seq	13.77	18.56	8.38	59.28
Pointer	16.17	16.76	10.18	56.89
PAC	27.74	17.37	11.78	43.11



Zhufeng Pan, Kun Bai, Yan Wang, Lianqiang Zhou, and Xiaojiang Liu. "Improving open-domain dialogue systems via multi-turn incomplete utterance restoration." EMNLP. 2019. Dataset: <https://ai.tencent.com/ailab/nlp/dialogue/#datasets>

TAIC *SeFun: Sentence Functions*

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Sentence Function	Frequent Patterns		Sentence Examples	
	Chinese	English	Chinese	English
Wh-style IN	x在哪y? 谁是x?	Where does x y? Who is x?	周末在哪过啊 谁是天蝎座	<u>Where</u> do you spend your weekend <u>Who</u> is a Scorpio
Yes-no IN	x是在y吗? x是指y吗?	Is x y? Does x y?	你是在云南吗? 你是指昨天的篮球比赛吗?	<u>Are</u> you in Yunnan? <u>Do</u> you <u>mean</u> the basketball match yesterday?
Alternative IN	x还是y x y哪个	x or y x y which	狮子和白羊真配还是假配? 香蕉和苹果哪个卖得比较好?	Leo and Aries go together <u>or</u> not? <u>Which</u> sells better, banana or apple?

SeFun Classification

Method	level-1 sentence functions			level-2 sentence functions		
	Accuracy	Macro-F1	Micro-F1	Accuracy	Macro-F1	Micro-F1
CNN-encoder (separated)	97.5	87.6	97.5	86.2	52.0	86.2
RNN-encoder (separated)	97.6	90.9	97.6	87.2	65.8	87.1
CNN-encoder (joint)	97.4	87.3	97.3	86.5	51.8	86.4
RNN-encoder (joint)	97.6	91.2	97.5	87.6	64.2	87.6

Method	Flue	Rele	Info	Accu
IR baseline (level1)	63.4	68.4	61.5	34.3
Re-ranked IR (level1)	69.6	74.4	77.2	50.5
IR baseline (level2)	63.0	68.2	61.6	25.0
Re-ranked IR (level2)	68.0	73.4	75.3	38.6

Table 5: Results(%) on the IR-based models.

Method	Flue	Rele	Info	Accu
Seq2seq(level1)	55.4	61.5	49.3	32.0
C-Seq2seq(level1)	55.9	65.0	51.6	33.0
KgCVAE(level1)	57.6	62.5	51.4	29.0
SeFun-CVAE(level1)	57.1	63.5	50.9	34.5
Seq2seq(level2)	53.0	62.3	48.9	35.0
C-Seq2seq(level2)	58.9	64.7	50.9	37.2
KgCVAE(level2)	56.5	63.2	49.4	33.7
SeFun-CVAE(level2)	56.9	63.7	50.2	36.7

Table 6: Results(%) of the generative models.

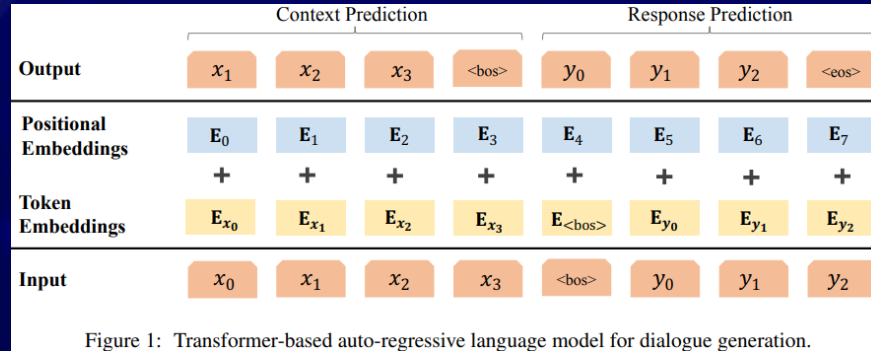
Sentence Function	Query	Response
Declarative (DE)		
Positive DE	49,223 (48%)	67,540 (57%)
Negative DE	9,241(9%)	18,428(16%)
DE with IN words	887(.9%)	2,660(2%)
Double-negative DE	40(<.1%)	99(.1%)
Other types of DE	2,675(3%)	5,218(4%)
Interrogative(IN)		
Wh-style IN	23,385(23%)	7,652(7%)
Yes-no IN	6,469(6%)	4,046(3%)
A-not-A IN	6,456(6%)	1,055(.9%)
Alternative IN	789(.8%)	279(.2%)
IN with tag question	170(.2%)	271(.2%)
Rhetorical	42(<.1%)	417(.4%)
IN with backchannel	0(0%)	345(.3%)
IN with open question	227(.2%)	11(<.1%)
Imperative(IM)		
IM with request	2,073(2%)	358(.3%)
IM with dissuade	86(<.1%)	58(<.1%)
IM with command	7(<.1%)	4(<.1%)
IM with forbidden	4(<.1%)	2(<.1%)
Exclamatory(EX)		
EX without tone words	241(.2%)	3,948(3%)
EX with interjections	364(.4%)	1,958(2%)
EX with greetings	167(.2%)	285(.2%)
Total sentences	95,898	95,898
Total sentence segments	103,138	117,714

Table 1: Statistics of the SeFun dataset.

Wei Bi, Jun Gao, Xiaojang Liu, and Shuming Shi. "Fine-grained sentence functions for short-text conversation." *ACL 2019*.
Dataset: <https://ai.tencent.com/ailab/nlp/dialogue/#datasets>

TAIC *Pretrained Language Model + Dialogue*

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Corpus	Language	Type	#Train	#Dev	#Test	#Vocab
Weibo	Chinese	Single-Turn	4,244,093	19,357	3,200	10,231
Douban	Chinese	Multi-Turn	193,769	5,095	5,104	5,800
Reddit	English	Single-Turn	3,384,185	10,000	20,000	14,820
DailyDialog	English	Multi-Turn	11,118	1,000	1,000	12,244
Persona-Chat	English	Multi-Turn	8,939	1,000	968	11,362

Table 1: Statistics of the dialogue datasets.

Piji Li. An Empirical Investigation of Pre-Trained Transformer Language Models for Open-Domain Dialogue Generation. arXiv preprint 2020.

Xin Li, Piji Li, Wei Bi, Xiaojiang Liu, and Wai Lam. Relevance-Promoting Language Model for Short-Text Conversation. AAAI 2020.

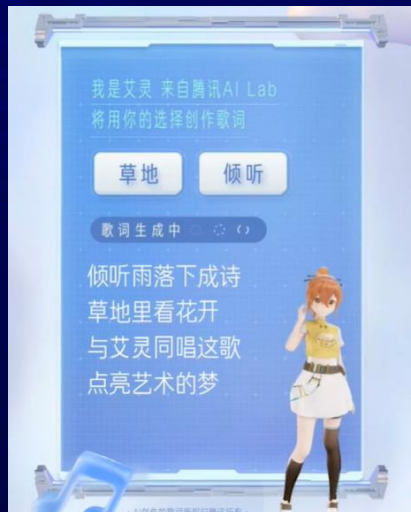
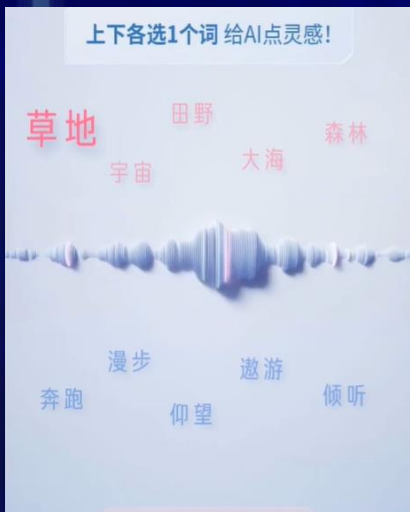
Model	Relevance					Diversity				Length
	BLEU	B-1	B-2	B-3	B-4	MADIST-1	MADIST-2	MI Dist-1	MI Dist-2	
Seq2Seq	1.31	37.08	10.29	3.76	1.71	71.73	75.53	7.70	26.63	13.88
CVAE	4.08	42.12	15.90	8.13	5.31	73.61	78.09	9.59	34.64	14.79
MMI	3.25	43.98	13.94	6.56	3.88	82.00	87.06	10.69	38.25	11.51
Seq2Seq-greedy	1.09	41.62	8.99	2.85	0.96	77.20	83.81	7.56	29.39	14.31
Seq2Seq-bm(5)	1.31	37.08	10.29	3.76	1.71	71.73	75.53	7.70	26.63	13.88
Seq2Seq-tk(5)	0.72	41.82	7.82	1.92	0.53	86.10	94.50	9.71	44.54	13.62
Seq2Seq-tk(10)	0.59	41.21	7.05	1.75	0.54	87.22	95.94	10.01	50.17	13.90
Seq2Seq-tk(20)	0.63	39.06	6.07	1.50	0.42	87.90	96.27	9.78	52.62	14.39
Seq2Seq-tk(50)	0.22	35.72	4.73	0.74	0.17	89.45	97.59	10.45	58.09	14.87
Seq2Seq-tk(500)	0.26	30.74	3.69	0.65	0.17	91.28	98.14	12.58	67.98	16.09
Seq2Seq-tp(0.9)	0.59	39.10	6.43	1.52	0.50	88.35	96.56	9.99	53.01	14.43
LM-12-greedy	1.32	42.16	8.41	2.74	1.40	81.43	86.94	6.44	21.24	13.50
LM-12-bm(5)	2.56	35.04	11.45	5.39	3.29	63.66	66.96	4.70	14.55	21.19
LM-12-tk(5)	0.79	41.27	6.72	1.65	0.65	85.77	94.49	7.76	35.55	13.64
LM-12-tk(10)	0.65	40.06	6.17	1.40	0.51	87.10	95.54	7.98	40.21	14.17
LM-12-tk(20)	0.35	37.98	5.14	1.03	0.25	88.63	96.79	8.91	46.42	14.46
LM-12-tk(50)	0.31	36.53	4.67	0.82	0.24	89.85	97.53	9.24	52.24	15.03
LM-12-tk(500)	0.25	29.81	3.07	0.54	0.19	91.71	98.43	12.11	67.41	15.77
LM-12-tp(0.9)	0.47	38.58	5.34	1.04	0.28	88.75	96.85	8.63	45.48	14.42
LM-12-greedy- λ_1	0.96	43.20	8.14	2.20	0.90	80.93	87.84	5.68	18.41	13.81
LM-12-bm(5)- λ_1	1.86	30.34	8.90	4.04	2.46	55.86	59.11	3.30	10.00	24.33
LM-12-tk(5)- λ_1	0.50	41.79	6.50	1.42	0.44	85.91	94.81	7.09	32.53	13.76
LM-12-tk(10)- λ_1	0.53	40.33	6.02	1.28	0.37	87.25	96.04	7.73	39.05	14.15
LM-12-tk(20)- λ_1	0.47	37.51	4.82	1.17	0.41	88.66	96.85	8.22	44.89	14.69
LM-12-tk(50)- λ_1	0.31	35.78	4.38	0.79	0.23	89.78	97.40	9.12	52.50	15.05
LM-12-tk(500)- λ_1	0.21	29.29	3.15	0.56	0.13	91.57	98.14	11.61	65.94	15.88
LM-12-tp(0.9)- λ_1	0.40	38.56	5.35	1.15	0.37	88.41	96.92	8.04	43.98	14.66
LM-12-greedy- $\lambda_{0.5}$	1.03	41.00	7.74	2.42	1.02	80.79	86.45	5.59	18.60	13.42
LM-12-bm(5)- $\lambda_{0.5}$	1.60	31.58	8.80	3.69	2.00	59.20	62.23	3.72	11.56	22.87
LM-12-tk(5)- $\lambda_{0.5}$	0.59	41.71	6.19	1.47	0.50	85.21	94.10	7.15	33.68	13.94
LM-12-tk(10)- $\lambda_{0.5}$	0.36	39.85	5.50	1.05	0.25	87.76	96.03	7.57	38.20	13.98
LM-12-tk(20)- $\lambda_{0.5}$	0.38	37.75	5.14	1.03	0.32	88.43	96.79	8.14	45.28	14.43
LM-12-tk(50)- $\lambda_{0.5}$	0.34	35.01	4.27	0.89	0.32	89.27	96.93	8.95	51.60	14.68
LM-12-tk(500)- $\lambda_{0.5}$	0.29	29.37	3.21	0.59	0.15	92.02	98.47	11.40	66.33	16.11
LM-12-tp(0.9)- $\lambda_{0.5}$	0.26	37.65	4.87	0.89	0.18	88.52	96.83	8.37	45.25	14.27
LM-24-greedy	1.12	39.21	7.52	2.42	1.19	75.69	81.98	5.21	17.79	16.02
LM-24-bm(5)	2.02	34.18	9.80	4.22	2.52	64.63	68.30	4.73	15.61	19.86
LM-24-tk(5)	0.90	41.04	6.82	1.76	0.70	84.90	94.00	7.00	32.57	14.64
LM-24-tk(10)	0.48	39.68	5.60	1.16	0.38	86.18	95.42	7.43	37.57	14.99
LM-24-tk(20)	0.60	37.38	4.88	1.09	0.48	87.32	95.93	7.77	43.03	15.07
LM-24-tk(50)	0.33	34.39	4.03	0.77	0.24	89.10	97.13	8.81	51.42	15.67
LM-24-tk(500)	0.21	28.20	2.92	0.51	0.24	91.07	97.80	11.12	65.57	16.83
LM-24-tp(0.9)	0.45	37.17	5.25	1.16	0.39	86.64	95.85	7.86	43.87	15.56
BigLM-12-greedy	2.07	41.92	9.65	3.48	1.99	79.88	86.06	7.05	24.32	14.62
BigLM-12-bm(5)	4.00	38.96	14.77	7.70	5.14	72.61	75.97	7.50	25.97	18.62
BigLM-12-tk(5)	1.01	43.18	8.08	2.31	1.01	85.81	93.47	8.74	39.23	13.78
BigLM-12-tk(10)	0.76	40.69	6.99	1.87	0.69	87.61	95.78	9.23	44.20	14.34
BigLM-12-tk(20)	0.95	39.28	6.25	1.78	0.76	88.62	96.76	9.02	48.06	14.54
BigLM-12-tk(50)	0.53	35.56	4.85	1.07	0.46	90.18	97.32	9.84	55.06	14.95
BigLM-12-tk(500)	0.18	29.49	3.34	0.45	0.11	91.09	97.68	12.26	67.49	15.56
BigLM-12-tp(0.9)	0.95	38.78	6.24	1.80	0.80	88.53	96.45	9.27	48.38	14.13
BigLM-24-greedy	2.32	43.38	10.68	4.13	2.39	81.06	86.31	7.17	24.72	14.22
BigLM-24-bm(5)	3.97	38.93	14.72	7.59	5.07	70.56	73.84	7.24	24.87	18.95
BigLM-24-tk(5)	1.15	43.64	8.45	2.55	1.17	85.54	93.67	8.44	38.07	13.75
BigLM-24-tk(10)	1.22	41.23	8.01	2.49	1.22	86.71	95.42	8.81	43.83	14.45
BigLM-24-tk(20)	0.75	37.53	5.79	1.52	0.83	88.16	96.06	9.59	48.65	14.25
BigLM-24-tk(50)	0.57	36.36	5.12	1.23	0.54	89.39	97.24	9.78	53.64	14.61
BigLM-24-tk(500)	0.39	29.51	3.49	0.85	0.39	90.89	97.63	12.22	67.21	15.82
BigLM-24-tp(0.9)	0.93	39.00	5.97	1.73	0.76	88.57	96.48	9.21	48.53	14.31

Table 2: Experimental results on Weibo dataset.

Seed Query	今天天气不错
Results	Douban-Bot-A: 今天天气不错
	Douban-Bot-B: 要被热死了
	Douban-Bot-A: 去买点纸巾吧你还在吗
	Douban-Bot-B: 有冰镇西瓜么
	Douban-Bot-A: 没有我这是在西瓜里面加上了番茄酱
	Douban-Bot-B: 那要是烤过的话一定好看
	Douban-Bot-A: 那还是炒鸡蛋好吃多了
	Douban-Bot-B: 可是西瓜里也有西瓜汁你吃过不
	Douban-Bot-A: 必须的不然我也想吃
	Douban-Bot-B: 那就来杯鸡尾酒
	Douban-Bot-A: 你也吃过
	Douban-Bot-B: 想吃就给
	Douban-Bot-A: 太远了你在哪好好上学
	Douban-Bot-B: 我在厦门你在哪好好上学
	Douban-Bot-A: 我想去看看
	Douban-Bot-B: 去看来了不然你得找个伴儿你想吃就吃
	Douban-Bot-A: 哎都可以的
	Douban-Bot-B: 还没到年底阿
	Douban-Bot-A: 我准备去厦门找你
	Douban-Bot-B: 找你吃饭
	Douban-Bot-A: 找你吃饭吧
	Douban-Bot-B: 可是我不是厦门人哦我要回家去见爸爸了
	Douban-Bot-A: o o
	Douban-Bot-B: o o 祝你好运
	Douban-Bot-A: 祝你早日找到女朋友
	Douban-Bot-B: 谢谢你的祝福
	Douban-Bot-A: 不客气
	Douban-Bot-B: 你也是
	Douban-Bot-A: 你也是厦门的
	Douban-Bot-B: 我在北京
	Douban-Bot-A: 嗯嗯你的坐标好硬
	Douban-Bot-B: 那么问题来了
	Douban-Bot-A: 厦门这么好的小伙伴能不能不要太远了
	Douban-Bot-B: 我不在北京不过我们可以聊聊
	Douban-Bot-A: 真的真的我现在在北京哦
	Douban-Bot-B: 那你在北京工作嘛
	Douban-Bot-A: 你哪儿的
	Douban-Bot-B: 我在天津
	Douban-Bot-A: sogu 我也是厦门的
	Douban-Bot-B: 好吧现在我去天津了有空来玩
	Douban-Bot-A: 好的豆腐你微信

TAIC 歌词、诗词创作

庆祝六一！腾讯AI艾灵与王俊凯领唱中国新儿歌《点亮》



关键词藏头、蕴含的诗词、对联生成



- **Background**

原歌词：十年之前/我不认识你/你不属于我/我们还是一样/陪在一个陌生人左右/走过渐渐熟悉的街头

新配词：夜深人静/思念你模样/多少次孤单/想伴在你身旁/是什么让我如此幻想/为何会对你那般痴狂

- **Challenges**

- 约束：严格的格式和模板
- 格式正确、句子完整、押韵合理
- ***关键词埋入**

- **Deploy**

- 王俊凯AI艾灵歌词创作
- 春节微视春联红包
- 艾灵诗词、歌词创作

Lyrics	 E - del - weiss, E - del - weiss, ev - 'ry mor - ning you greet me.
	 Small and white, clean and bright, you look hap - py to meet me.
SongCi	驿外断桥边，寂寞开无 主 。已是黄昏独自愁，更著风和 雨 。 无意苦争春，一任群芳 妒 。零落成泥碾作尘，只有香如 故 。
Sonnet	Let me not to the marriage of true <i>minds</i> Admit impediments, love is not <i>love</i> Which alters when it alteration <i>finds</i> Or bends with the remover to <i>remove</i> .

TAIC *SongNet*

Format and Rhyme Symbols:

$$C = \{c_0, c_0, c_0, c_2, c_1, \langle /s \rangle\}$$

$$c_0, c_0, c_0, c_0, c_0, c_2, c_1, \langle /s \rangle, \langle eos \rangle\}$$

Intra-Position Symbols:

$$P = \{p_4, p_3, p_2, p_1, p_0, \langle /s \rangle\}$$

$$p_6, p_5, p_4, p_3, p_2, p_1, p_0, \langle /s \rangle, \langle eos \rangle\}$$

Segment Symbols:

$$S = \{s_0, s_0, s_0, s_0, s_0, \langle /s \rangle\}$$

$$s_1, s_1, s_1, s_1, s_1, s_1, \langle /s \rangle, \langle eos \rangle\}$$

$$\mathbf{H}_t^0 = \mathbf{E}_{wt} + \mathbf{E}_{ct} + \mathbf{E}_{pt} + \mathbf{E}_{st} + \mathbf{E}_{gt}$$

Masking Multi-Head Self-Attention:

$$\mathbf{C}_t^1 = \text{LN}(\text{FFN}(\mathbf{C}_t^1) + \mathbf{C}_t^1)$$

$$\mathbf{C}_t^1 = \text{LN}(\text{SLF-ATT}(\mathbf{Q}_t^0, \mathbf{K}_{\leq t}^0, \mathbf{V}_{\leq t}^0) + \mathbf{H}_t^0)$$

$$\mathbf{Q}^0 = \mathbf{H}^0 \mathbf{W}^Q$$

$$\mathbf{K}^0, \mathbf{V}^0 = \mathbf{H}^0 \mathbf{W}^K, \mathbf{H}^0 \mathbf{W}^V$$

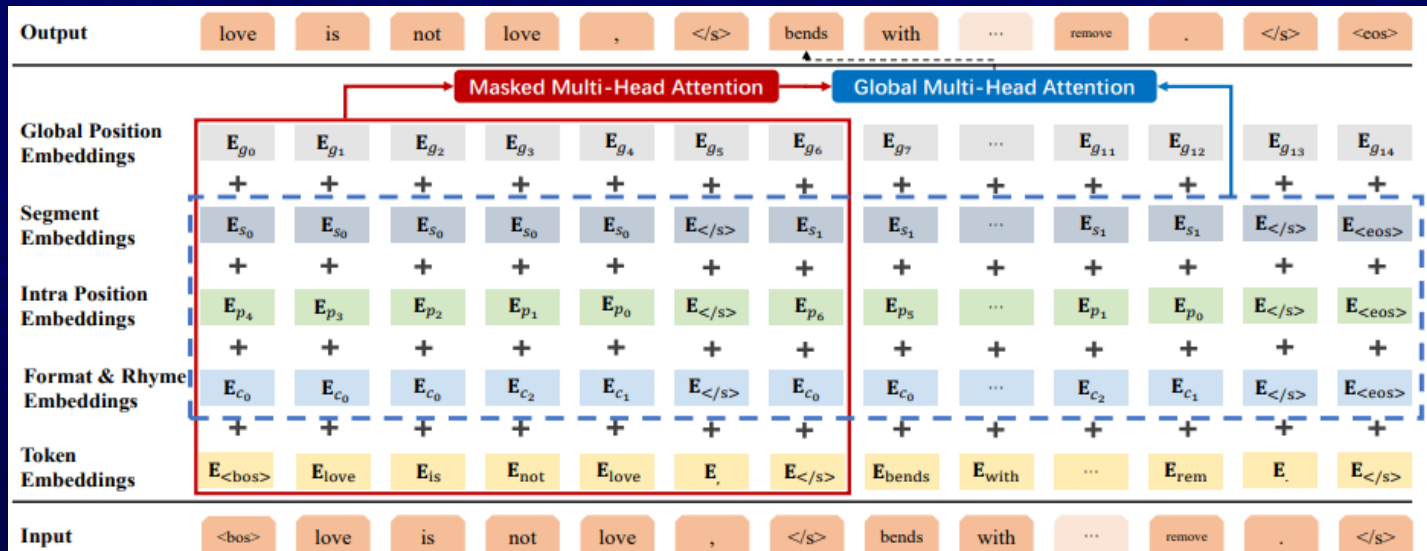


Figure 2: The framework of our proposed model.

$$\mathbf{F}_t^0 = \mathbf{E}_{ct} + \mathbf{E}_{pt} + \mathbf{E}_{st}$$

Global Multi-Head Attention:

$$\mathbf{H}_t^1 = \text{LN}(\text{FFN}(\mathbf{H}_t^1) + \mathbf{H}_t^1)$$

$$\mathbf{H}_t^1 = \text{LN}(\text{GLOBAL-ATT}(\mathbf{Q}_t^1, \mathbf{K}^1, \mathbf{V}^1) + \mathbf{C}_t^1)$$

$$\mathbf{Q}^1 = \mathbf{C}^1 \mathbf{W}^Q$$

$$\mathbf{K}^1, \mathbf{V}^1 = \mathbf{F}^0 \mathbf{W}^K, \mathbf{F}^0 \mathbf{W}^V$$

Polishing

$$C' = \{c_0, c_0, c_0, love, c_1, \langle /s \rangle\}$$

$$bends, c_0, c_0, c_0, c_0, remove, c_1, \langle /s \rangle, \langle eos \rangle\}$$

Model	PPL↓		Diversity (Distinct) ↑			
	VAL	TEST	MA-D-1	MI-D-1	MA-D-2	MI-D-2
S2S	19.61	20.43	75.35	2.48	98.35	36.23
GPT2	148.11	104.99	-	-	-	-
GPT2 w/ Fine-tuning	18.25	17.00	73.87	2.57	96.07	33.92
SongNet (only Pre-training)	24.41	16.23	74.84	4.59	95.09	54.98
SongNet (only Fine-tuning)	12.75	14.73	75.96	2.69	97.59	37.26
SongNet	11.56	12.64	75.04	2.66	97.29	36.78

Model	Format↑		Rhyme↑		Integrity↓
	MA-F1	MI-F1	MA-F1	MI-F1	
S2S	44.32	38.16	53.80	52.27	8.30±2.06
GPT2 w/ Fine-tuning	35.70	35.20	53.48	52.50	45.92±20.12
SongNet (only Pre-training)	29.12	29.46	53.77	53.13	30.98±14.06
SongNet (only Fine-tuning)	99.81	99.83	79.23	78.63	2.14±0.10
SongNet	99.88	99.89	73.21	72.59	1.77±0.16

Table 1: Automatic evaluation results on SongCi

Model	PPL↓		Diversity (Distinct) ↑			
	VAL	TEST	MA-D-1	MI-D-1	MA-D-2	MI-D-2
SongNet	12.75	14.73	75.96	2.69	97.59	37.26
SongNet-GRU	16.52	20.49	74.73	1.77	98.30	28.98
SongNet w/o C	13.51	15.38	75.42	2.48	97.36	34.85
SongNet w/o P	14.16	17.16	73.73	2.56	97.52	34.82
SongNet w/ inverse-P	13.40	15.13	74.95	2.54	97.76	35.65
SongNet w/o S	13.23	15.44	75.38	2.74	97.31	37.50

Model	Format↑		Rhyme↑		Integrity↓
	MA-F1	MI-F1	MA-F1	MI-F1	
SongNet	99.81	99.83	79.23	78.63	2.14±0.10
SongNet-GRU	98.99	98.99	52.13	50.93	3.28±1.67
SongNet w/o C	84.73	85.39	78.59	78.24	1.77±0.53
SongNet w/o P	99.61	99.59	67.85	67.29	3.33±0.18
SongNet w/ inverse-P	99.68	99.69	65.89	65.43	2.24±0.21
SongNet w/o S	99.84	99.86	80.43	80.13	1.99±0.10

Table 4: Ablation analysis on SongCi

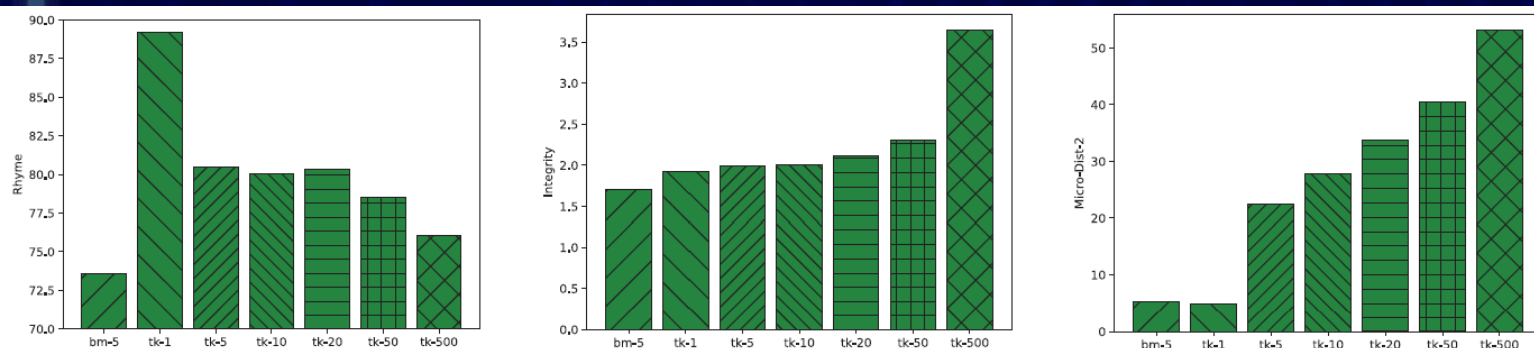


Figure 3: Parameter tuning of k on the metrics of Rhyme, Integrity, and Micro-Dist-2.

Top-k sampling
 $k=32$

Model	Cases of Generated Results
SongNet-SongCi	<p>CiPai: Zhe Gu Tian, Format: 7. 7. 7, 7. 3, 3. 7. 7, 7. 南枝欲破春寒浅(qian)。东风一霎春犹暖(nuan)。海棠零乱暗香残(can)，露颗未消红泪满(man)。春不管(guan)，人何远(yuan)。江头旧日清溪伴(ban)。欲凭楼上数行书，却为梦魂无觅伴(ban)。</p> <p>CiPai: Bu Suan Zi, Format: 5, 5. 7, 5. 5, 5. 7, 5. 新月挂帘旌，暗草蛩凄楚(chu)。夜半银潢十二阑，画幕灯花吐(tu)。何处笛声残，晓窗风雨(yu)。独许寒梅伴小鬟，香在秋千柱(zhu)。</p> <p>CiPai: Self-Defined, Format: 3, 3, 5. 3, 3, 5. 7, 7. 翠岩中，流水外，别有小壶天(tian)。自霜清，独斗芳，谁敢并飞仙(xian)。夜久凉生一曲愁，月如花影似花圆(yuan)。</p> <p>CiPai: Self-Defined, Format: 9. 9. 9. 9. 雨洒黄泉粼粼细作寒(han)。越水西来时节自清闲(xian)。歌笑一杯长唱醉醒间(jian)。春去不堪寻梦绕舍山(shan)。</p>
SongNet-Sonnet	<p>how do you hold such a thing like this, \ when my eyes are so not black? \ but how can i show myself, so strange, \ that all this black is white? where am i to hide this from my eyes, \ from this white mine eyes all fals, \ where is the good fortune, in me, \ that hath no excuse, no excuse? what is that which can mask the true love \ and for whom is this true love more? \ the one, which shall save the poor my eye, \ from the false truth of my judgment? what lies, for when you are not that , \ no one in this and that can see me lies!</p>

Model	Cases of Generated Results Given the Formats with Partial Content	
SongNet-SongCi	CiPai: Bu Suan Zi, Format: 5, 5. 7, 5. 5, 5. 7, 5. Format C: ____到。____俏。____报。____笑。 (1)风暖莺声苦，又是年时到。长爱柳色三分里，多少为春俏。共少年时节，惯得花时报。争似酴径入廛来，步步随春笑。 (2)春来春又去，花影几波到。门外绿杨柳萧洒，溪桥人人俏。门外东风马，似旧时香报。但怪桃李晚时羞，冷落无人笑。	
	Format C: 雨____到。____冰，____俏。____春，____春报。____山花____笑。 (1)春雨碧连营，柳暗门巷到。宫殿步辇踏寒冰，百媚生春俏。正日烘晴春，花雾春风报。一点山花醉眼明，半倚阑干笑。 (2)雪雨弄轻暖，新涨绿波到。楼上对面湿翠冰，一夜风花俏。晓日烘长春，睡起春宵报。枕畔山花落叶声，不是梦魂笑。	
SongNet-Sonnet	____ with _ hearts , ____ lacking _ dead ; ____ love ____ parts ,and ____ buried . _ many ____ tear, hath ____ eye , ____ now appear, ____ thee lie ! ____ buried _ live , ____ of _ gone , ____ parts ____ give , ____ thine alone : ____ view _ thee , ____ all _ me .	though all thy love with thy hearts , thou still are lacking of my dead ; if thy love love is lost to your love and parts , and yet mine own heart can be buried . so many are ill or in tear, hath not this time that we will make their eye , for that which lies not well hath now appear, no longer nor the world that holds thee lie ! for if it would be buried in my live , or by the earth of mine was gone , then my own parts as my body and mine give , may not be so far beyond thine alone : so far as thee and this world view find thee , then mine life be far enough from all thee and no me .

TAIC SongNet - Demo

TAIC SongNet - Demo Interface 1: The interface shows the 'Generate' (生成) button and the 'Reference Lyrics' (参考歌词) section. The lyrics are displayed in a table format with columns for 'Reference Lyrics' (参考歌词), 'Custom Format' (自定义格式), and 'Generated Lyrics' (生成结果). The lyrics are for the song 'I Love You' (我爱你).

TAIC SongNet - Demo Interface 2: The interface shows the 'Generate' (生成) button and the 'Reference Lyrics' (参考歌词) section. The lyrics are displayed in a table format with columns for 'Reference Lyrics' (参考歌词), 'Custom Format' (自定义格式), and 'Generated Lyrics' (生成结果). The lyrics are for the song 'I Love You' (我爱你).

TAIC SongNet - Demo Interface 3: The interface shows the 'Generate' (生成) button and the 'Reference Lyrics' (参考歌词) section. The lyrics are displayed in a table format with columns for 'Reference Lyrics' (参考歌词), 'Custom Format' (自定义格式), and 'Generated Lyrics' (生成结果). The lyrics are for the song 'I Love You' (我爱你).

小船桨/桃花轻唱/婉约惹人怀乡/湖畔旁蝉鸣莺啼柳响/你在画舫中央/微风吹乱着青纱帐/是谁轻声吟唱/一曲婉约惹人怀想/古琴弹到远方/杨柳摇荡/荷塘也成双/思念飞扬/让记忆生长/只留岁月苍茫/百转柔肠/你说好梦何妨/别离还是忧伤/千年痴狂/万水流觞/我听得太绝望/却不见她回望/

心慌张/情惆怅/桃花盛开芬芳/落日余晖照的影彷徨/有话怎能藏/它仍旧会迷失疯狂/笑问君归向/注定依然爱沧桑/老街两处散场/石板路旁/再找寻信仰/落叶夕阳/等待那一张/最美丽地模样/十字街巷/相遇时很漫长/走过白昼荒凉/大雁南赏/繁华尽忘/往日曾经幻想/像晚霞般闪亮/



ACL2020: Rigid Formats Controlled Text Generation
https://virtual.acl2020.org/paper_main.68.html

TAIC 腾讯AI数字人“艾灵”

➤ 王者荣耀竞技解说

➤ 点歌、弹幕回复

➤ 歌词、诗词创作



王者荣耀竞技解说



点歌、诗词、弹幕

TAIC *NLG in the Future*

- Evaluation/Optimization Objective
- Persona/Empathetic/Incremental
- Knowledge/Commonsense
- Multi-Modal Information
- Formats Controlled Generation
- Long Text/Story Generation
- Logical/Number Issues
- Discourse/Coherence/Coreference
- Sensitive Bias



Closing Words

- Good news: robust language generation and summarization now possible
- *"When they go low, we go high"* Michelle Obama ->
"When they go north, we go south" Kathy McKeown
- Address tasks that really matter
- Learn the task and not the dataset
- Interdisciplinary approaches have lasting impact
- Bring language back to NLP
 - Analyze your output! (Metrics and interpretability don't work)
 - Careful preparation and analysis of data sets

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