Creative and Artistic Text Generation

Li Juntao and Yan Rui
Peking University

URL: https://lijuntaopku.github.io/AAAI2020-tutorial/

What Contents Are Included in This Tutorial?

- Poetry Generation
- Story Generation
- Multi-Modal Generation
  - Visual Storytelling
  - Visual Poetry Generation
- Other Genres
  - Couplet
  - Lyrics

Target Audience

- Ph.D. **students** or **researchers** who are working on artistic text generation.

- Anyone who wants to learn how neural approaches (i.e., **deep learning techniques**) can be applied to artistic text generation.

- Anyone who wants to **build** an artistic text generation **system** (e.g., story, poetry, couplet) with state-of-the-art neural techniques.

Outline

- Introduction
- Background Knowledge
- Existing Methods
  - Poetry Generation
  - Story Generation
  - Multi-Modal Generation
  - Other Genres
- Recent Trends and Future Direction
- Q&A

Roadmap

- Introduction
- Background Knowledge
- Existing Methods
  - Poetry Generation
  - Story Generation
  - Multi-Modal Generation
  - Other Genres
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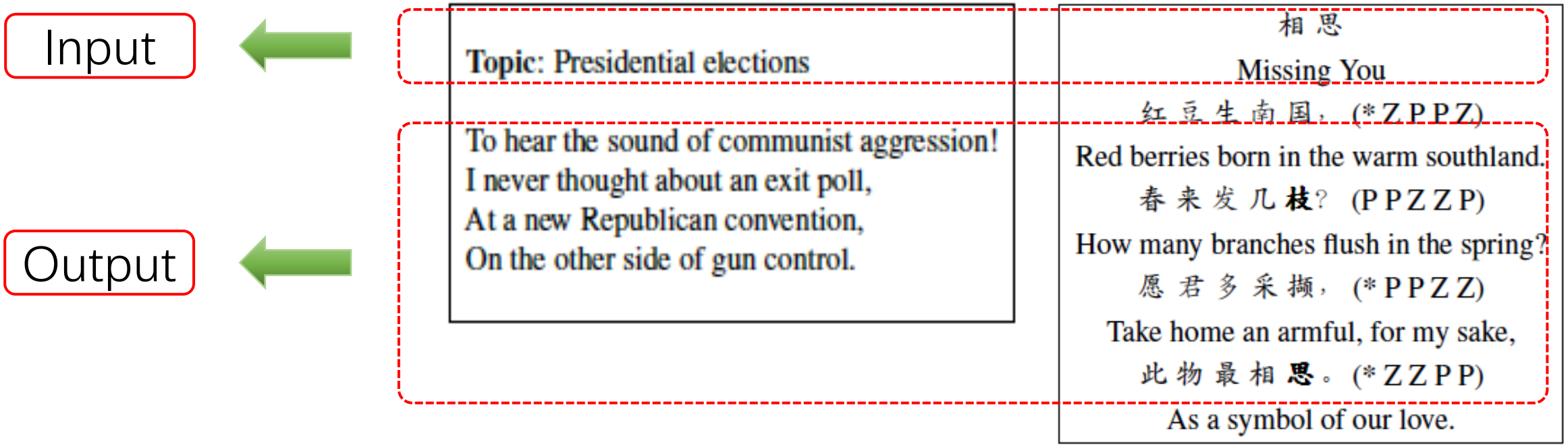
Task Description of Poetry Generation



- Input: a piece of text
- Output: a poem that meets given constraints

Marjan Ghazvininejad et al. ACL' 17
Xingxing Zhang et al. EMNLP' 14

Example System: Jiuge

Settings

Input

Output

https://jiuge.thunlp.cn/jueju_en.html

Task Description of Story Generation

- Definition 1: [Martin et al. AAAI' 18]

  Automated story generation is the problem of automatically **selecting** a sequence of **events**, **actions**, or **words** that can be told as a story.

- Definition 2: [Xu et al. EMNLP' 18]

  Input: A short description of a scene or an event.

  Output: A relevant narrative story following the input.

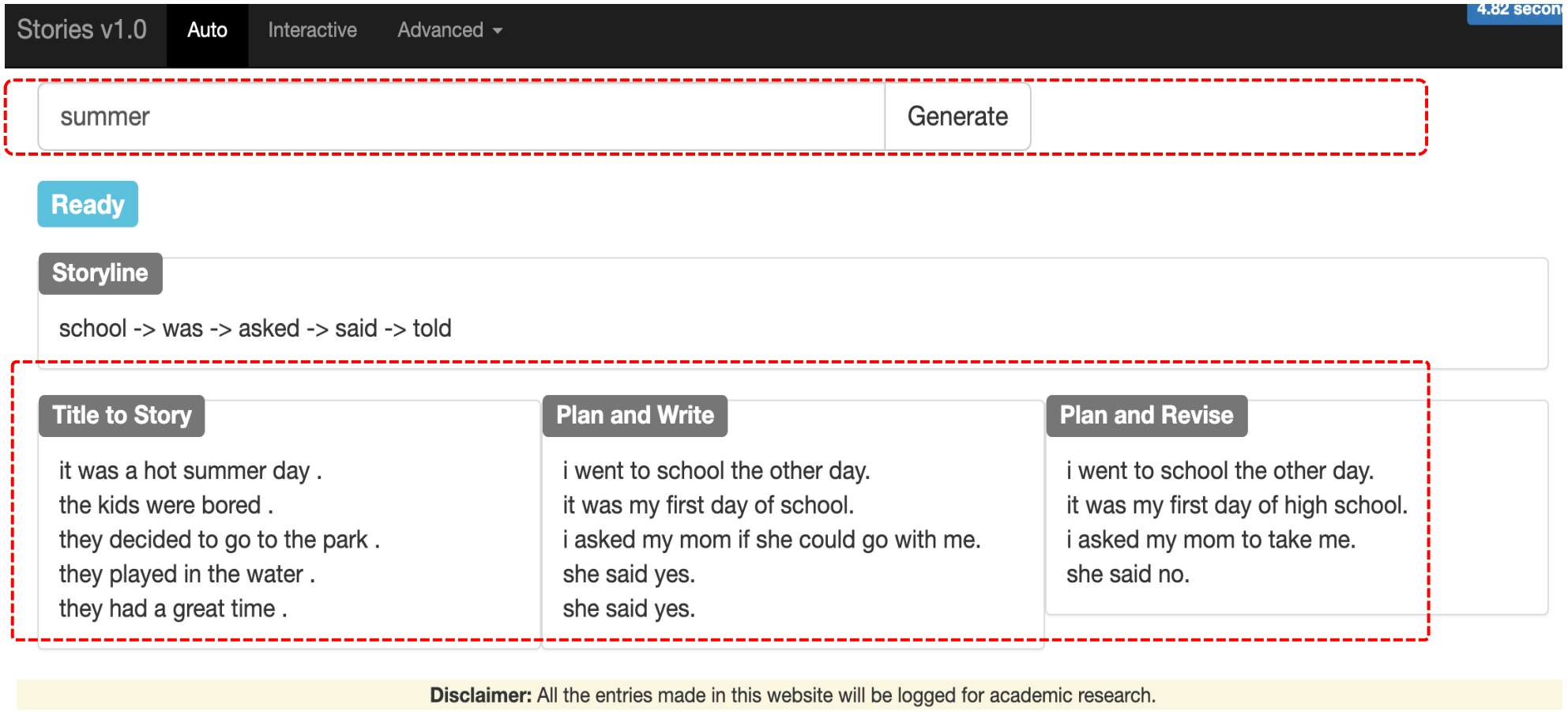
Examples
Input: *Fans came together to celebrate the opening of a new studio for an artist.* **Output**: *The artist provided champagne in flutes for everyone. Friends toasted and cheered the artist as she opened her new studio.*
Input: *Last week I attended a wedding for the first time.* **Output**: *There were a lot of families there. They were all taking pictures together. Everyone was very happy. The bride and groom got to ride in a limo that they rented.*

Table 1: An illustration of narrative story generation.

Demo Story Generation System

Input

Output



http://cwc-story.isi.edu/

Goldfarb-Tarrant et al., *NAACL-HLT' 2019*

Image-Inspired Poetry Generation

Input

Output

扁舟一曲水平堤，
I sing a fishing song on a boat in the lake overflowing its bank,
一棹渔舟日向西。
rowing oars with the sun setting in the west.
长忆西湖水中月，
I often miss the moon reflected in the West Lake,
东风吹过武陵溪。
and the east breeze blowing across the WuLing River.

春风庭院养花姿，
Breeze blows beautiful flowers in the courtyard,
春入帘栊叶满枝。
Spring comes into my window, with leaves covering the branches.
堪笑门前青草树，
Glad to see green grass and trees in front of my door,
谁家芳节几多时。
However spring will not last very long.

Linli Xu et al. AAAI' 18

Visual Storytelling

Input

Output

Captions:
(a) A small boy and a girl are sitting together.
(b) Two kids sitting on a porch with their backpacks on.
(c) Two young kids with backpacks sitting on the porch.
(d) Two young children that are very close to one another.
(e) A boy and a girl smiling at the camera together.

Story #1: The brother and sister were ready for the first day of school. They were excited to go to their first day and meet new friends. They told their mom how happy they were. They said they were going to make a lot of new friends . Then they got up and got ready to get in the car .

Story #2: The brother did not want to talk to his sister. The siblings made up. They started to talk and smile. Their parents showed up. They were happy to see them.

Album Storytelling	1) After a long summer day of playing hard. 2) Swinging and playing and playing with friends. 3) Making up dances and helping clean up after the picnic. 4) We headed for the city fireworks. 5) What a great ending to a great day!
Image Captioning	1) The picture is of a little boy sitting in a swing. 2) A young blonde girl soaking wet holding onto a ladder. 3) Two young girls wearing pink and posing the same for the picture. 4) The fireworks are shot off in the distance. 5) A large firework exploding in the sky on a dark night.

Xin Wang et al., ACL' 18
Bairui Wang et al., AAAI' 19

Others

Couplet

Verse

And humble and their fit *flees* are wits size
but that one made and made thy step me lies

Cool light the golden dark in any way
the birds a *shade* a laughter turn away

Then adding wastes retreating white as thine
She watched what eyes are breathing awe what shine

But sometimes shines so covered how the beak
Alone in pleasant skies no more to seek

虞美人
Beauty Yu
春花秋月何时**了**， (*P*ZPPZ)
Flowers bloom and wither, the moon rises and sets.
When can it end?
往事知多少。 (*ZPPZ)
As for stories buried in the past, who will really attend?
小楼昨夜又东**风**， (*P*ZZPP)
Wind blew over my attic last night,
故国不堪回首月明**中**。(***P*ZZPP)
How is my home country now, in the same moonlight?
雕阑玉砌应犹**在**， (*P*ZPPZ)
I bet the jade banisters and steps
are as exquisite as they were,
只是朱颜**改**。 (*ZPPZ)
I guess it is only the people who changed for sure.
问君能有几多**愁**， (*P*ZZPP)
My sorrow,
恰是一江春水向东**流**。(***P*ZZPP)
Flows like the river. It never ends.

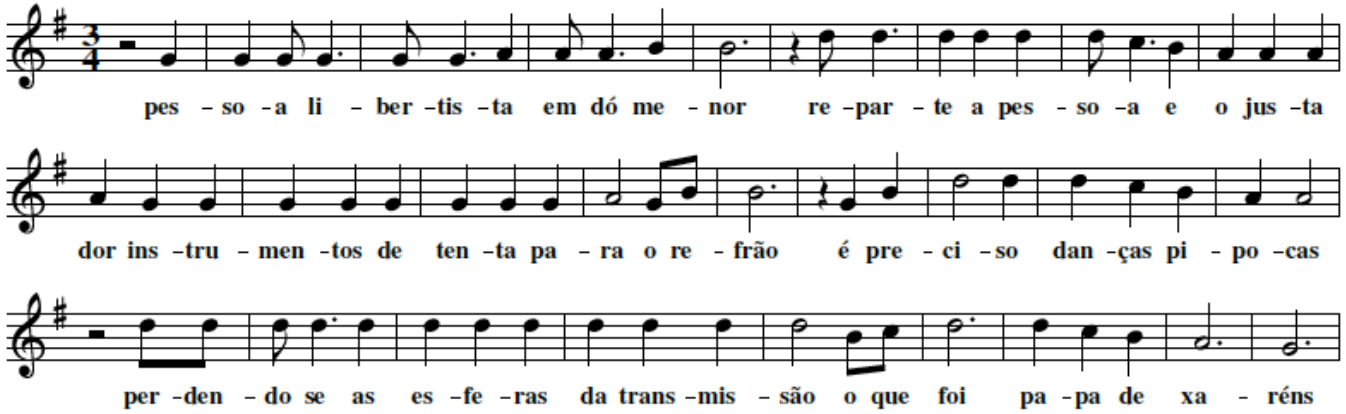
Iambics

Others

But she fell in love with him
Girl when they feel the same
The princess was in love with the priest
Can't let go and it never goes out

She also abominated what he did
Be the things they said
The princess was shocked by the priest's actions
And though her heart cant take it all happens[1]

Ballads



pessoa libertista em dó menor
reparte a pessoa e o justador
instrumentos de tenta para o refrão
é preciso danças pipocas
perdendo-se as esferas da transmissão
o que foi papa de xaréns

libertarian person in C minor
redistributes the person and the fighter
instrument of probe to the chorus
it takes dances popcorn
if lost the transmission domains
what was xarém food

Song Lyrics

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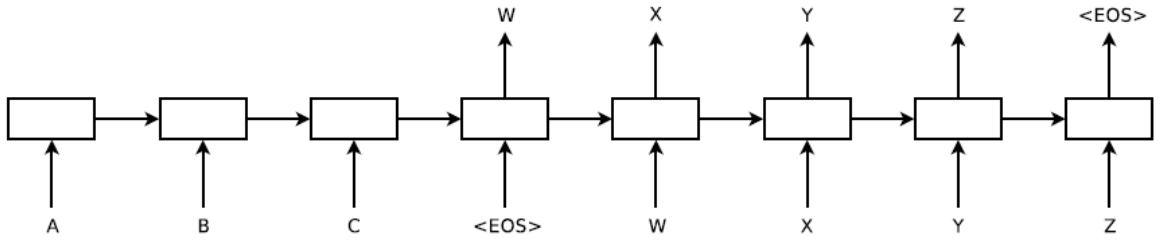
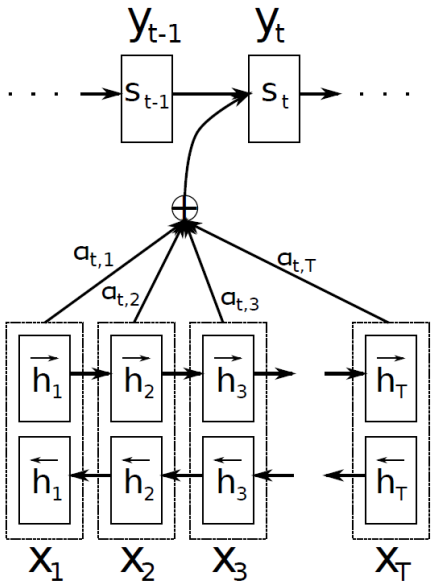
Sequence to Sequence Model

- Common Used Sequence Generation Method
- Stable and Easy for Training
- Flexibility



Encoder-Decoder

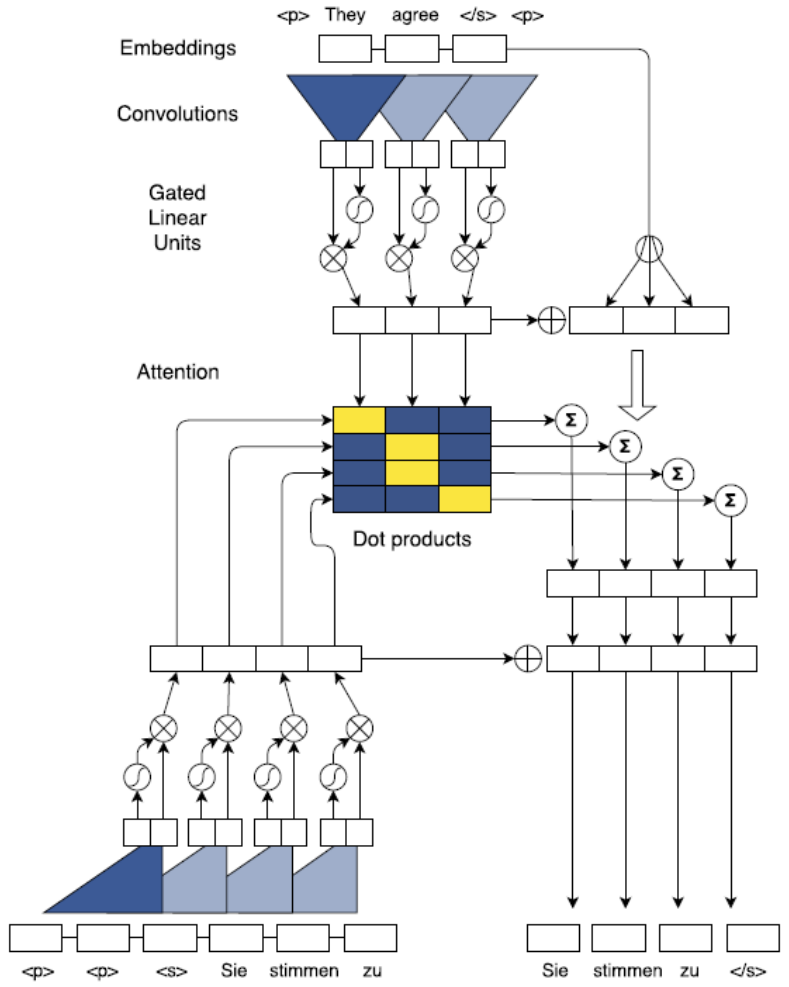


Attention

Sutskever, Ilya et al. NIPS, 2014
Bahdanau, Dzmitry et al., ICLR, 2015

Convolutional Sequence to Sequence

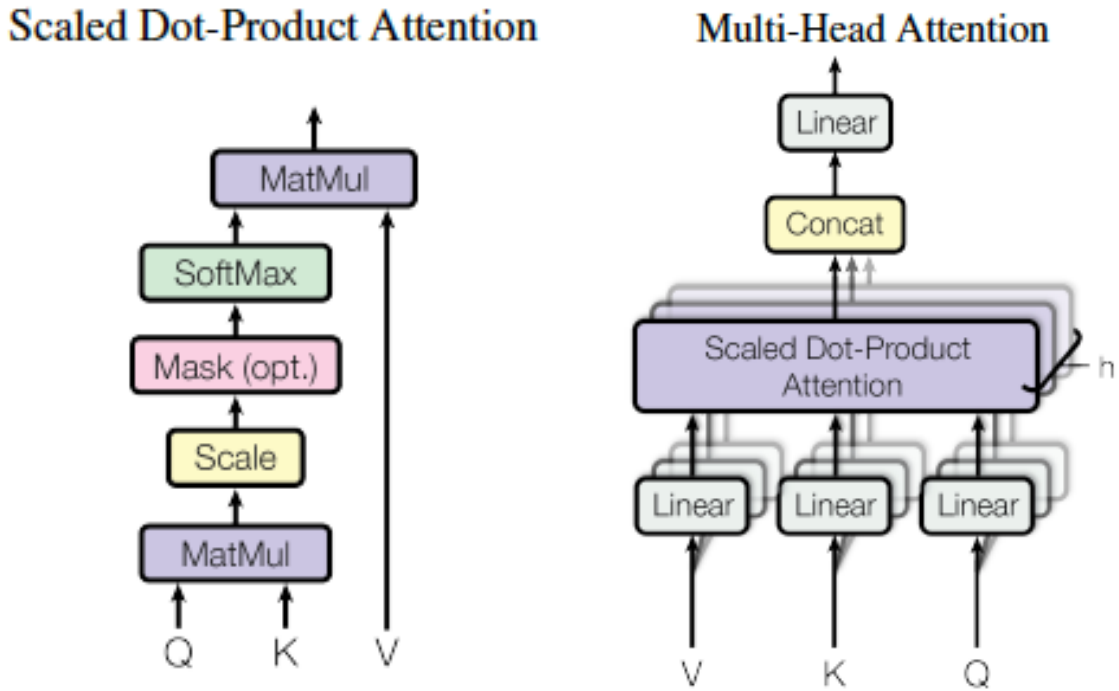
- Fast Training
- Strong Language Model for Capturing Long-Range Dependencies
- Bounded CNN Context Window



Gehring, Jonas, et al., ICML, 2017

Transformer

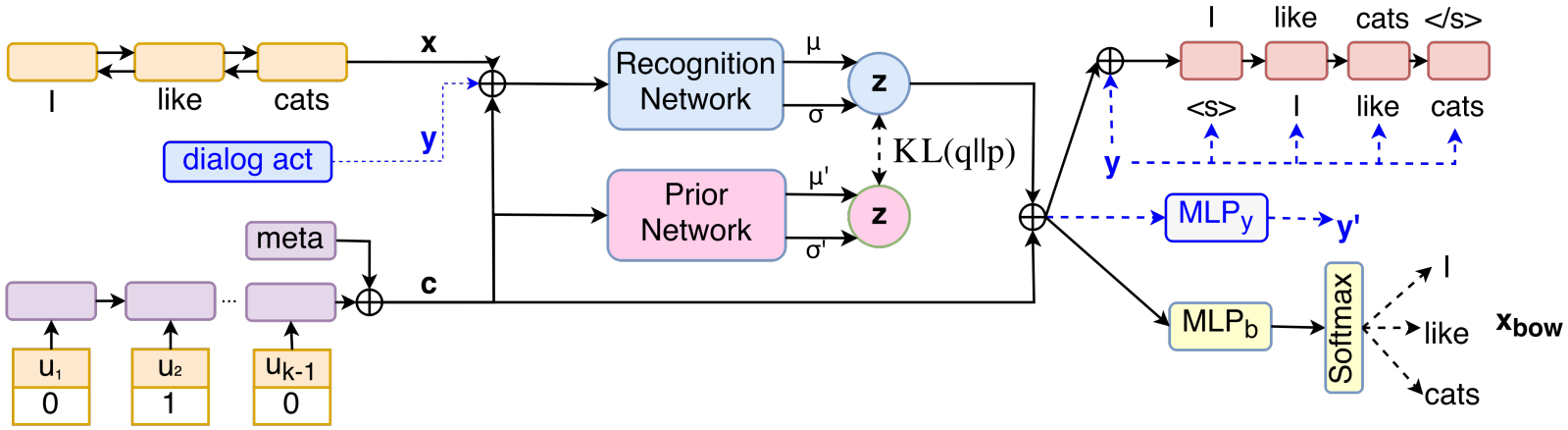
- Fast Training
- Strong Language Model for Capturing Long-Range Dependencies
- Correlations Learning
- The SOTA Language Model



Ashish, et al., NIPS, 2017

Variational Autoencoder

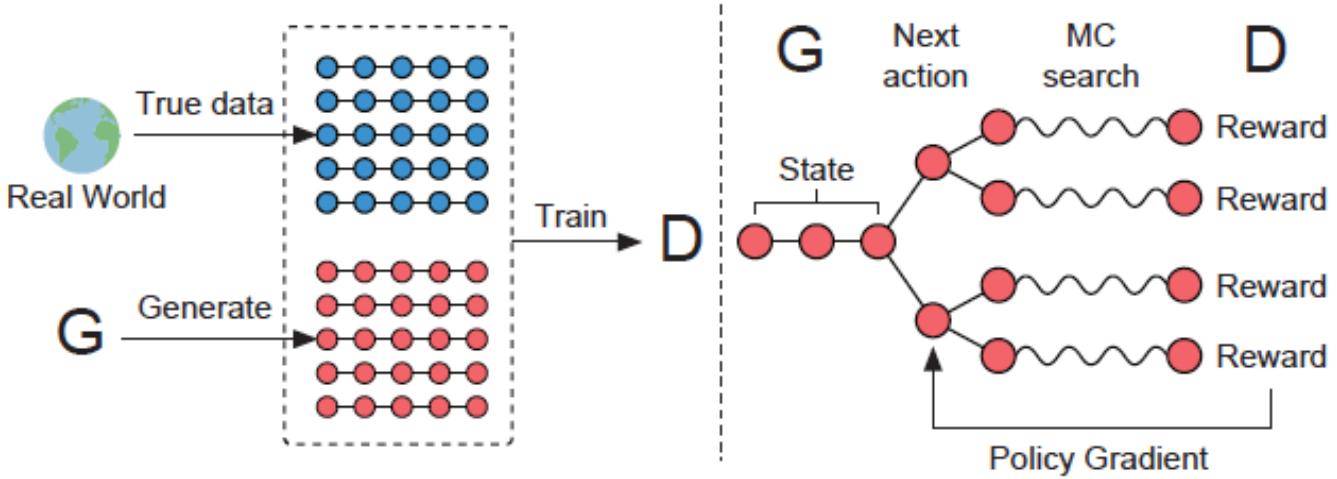
- Generative Model
- Wording Diversity
- Intra-Sentence Consistency
- Address Sparsity



Zhao, Tiancheng et al., ACL, 2017

Generative Adversarial Nets

- One-to-Many Generation
- Enhancing Generator
- Supervision Signal



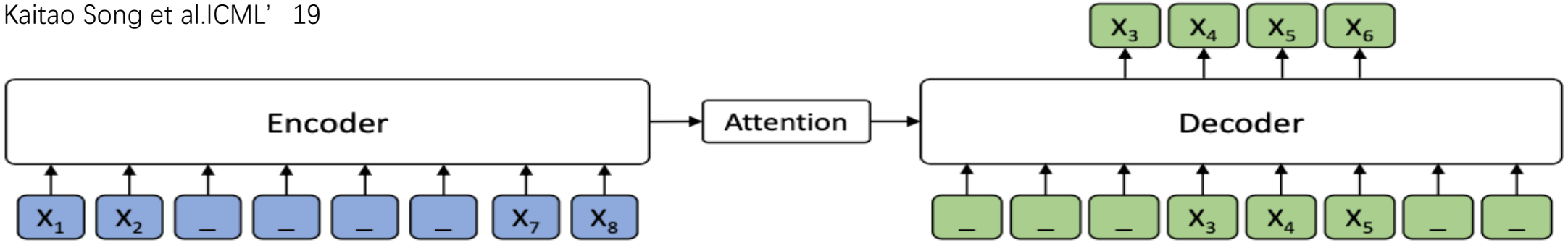
Yu, Lantao, et al., AAAI, 2017

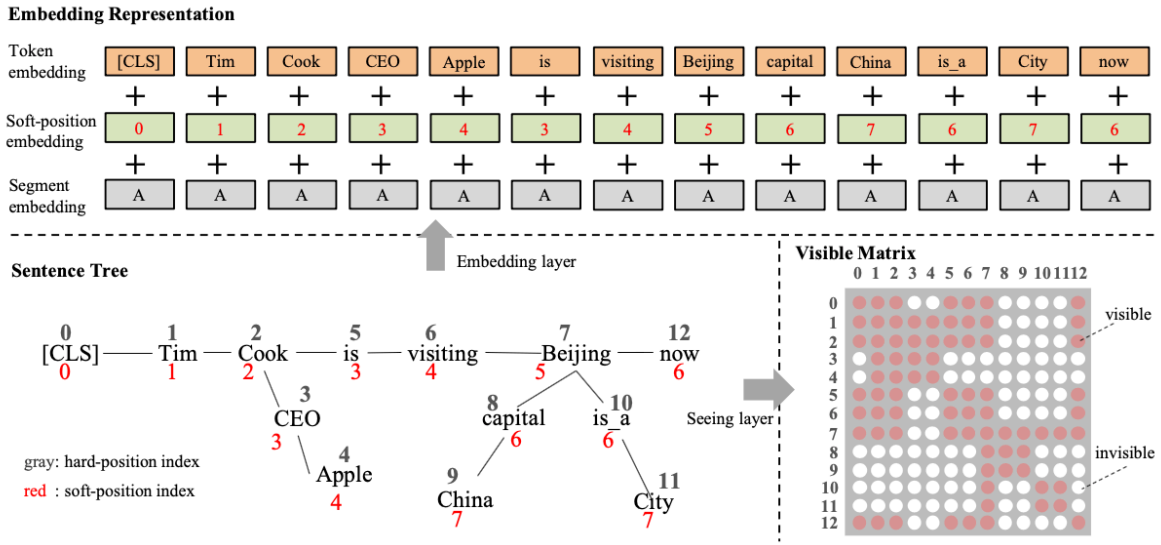
Reinforcement Learning

- Directly Model Discrete Sequence
- Address Loss-Evaluation Mismatch

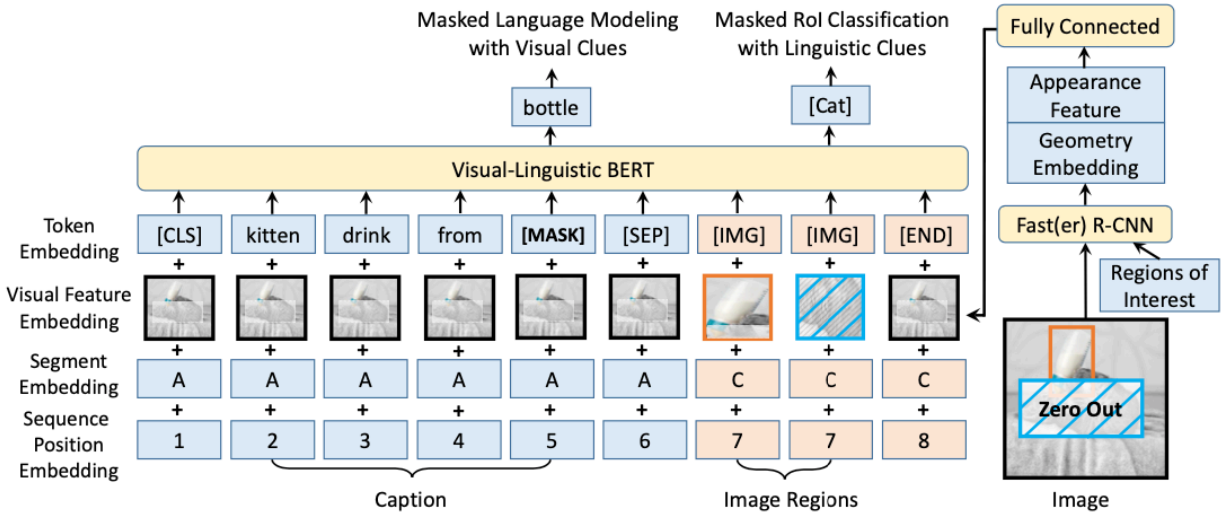
Pretraining Methods

Kaitao Song et al.ICML' 19





Weijie Liu et al. AAAI' 20.



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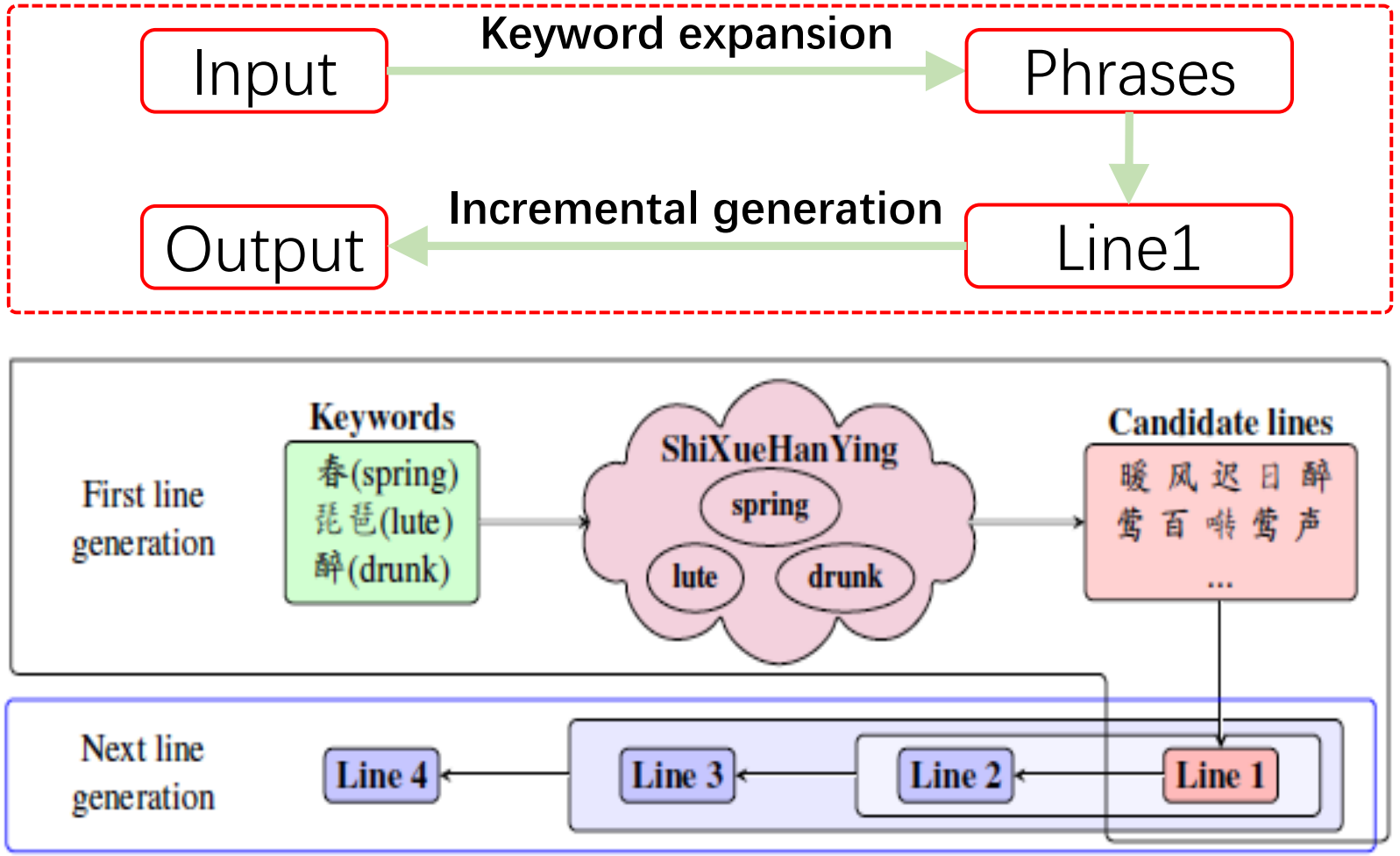
Recurrent Neural Model

- Task
  - Chinese Quatrain
- Generation Process
  - Keywords
  - Keywords expansion
  - Incremental generation



Xingxing Zhang et al. EMNLP' 14

Recurrent Neural Model

- Convolutional Sentence Model (CSM)

$$v_i = \mathrm{CSM}(S_i)$$

- Recurrent Context Model (RCM)

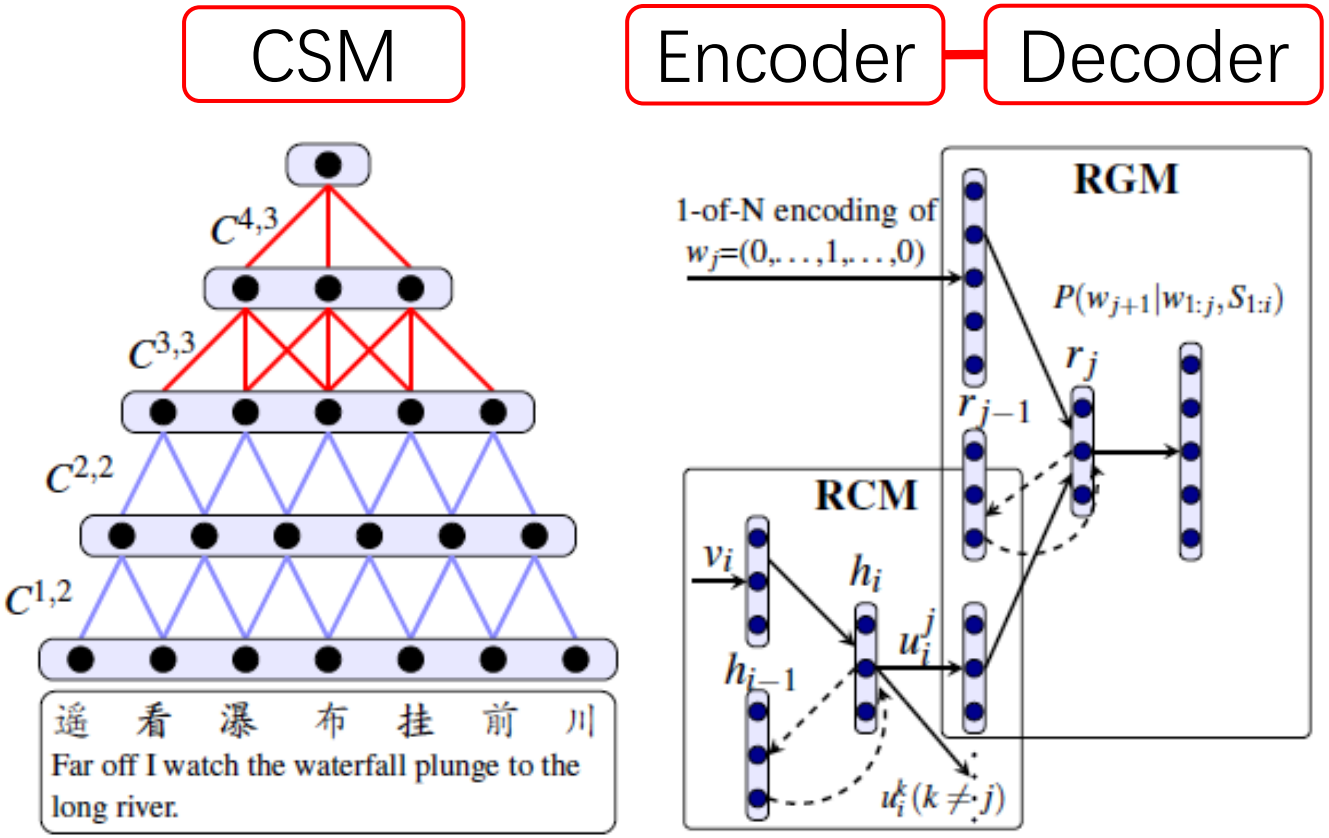
$$u_i^j = \mathrm{RCM}(v_{1:i}, j)$$

- Recurrent Generation Model (RGM)

$$P(w_{j+1}|w_{1:j}, S_{1:i}) = \mathrm{RGM}(w_{1:j+1}, u_i^{1:j})$$

- Training

  Cross Entropy Errors



Xingxing Zhang et al. EMNLP' 14

Planning-Based Recurrent Neural Model

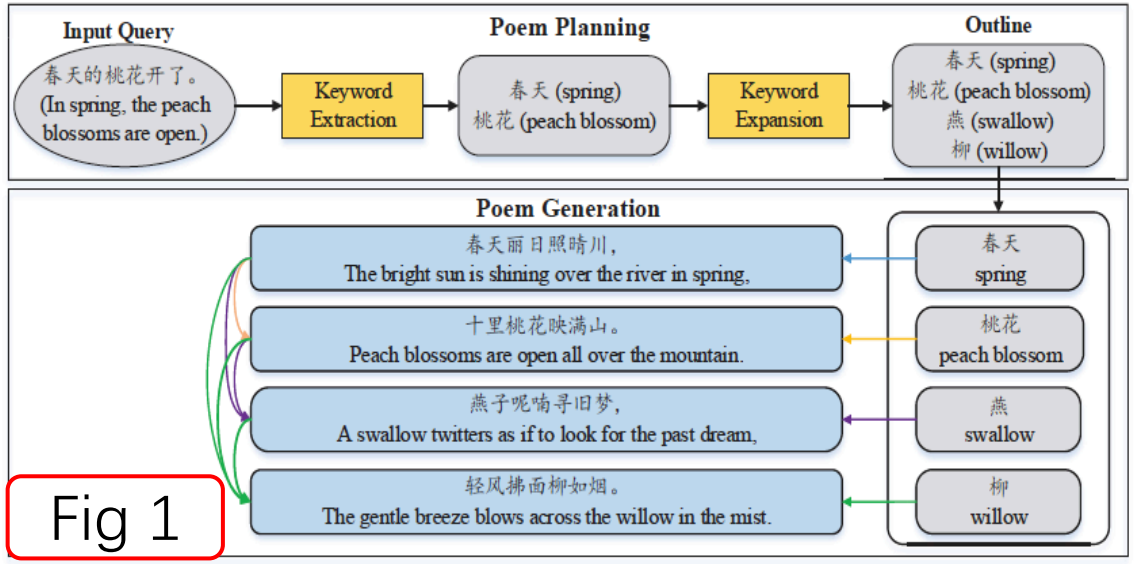


Fig 1

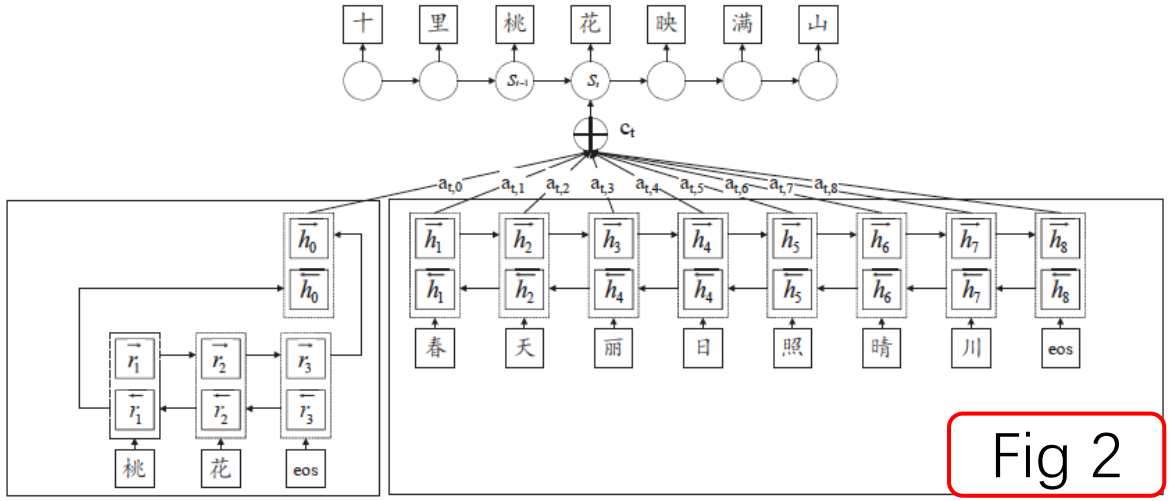


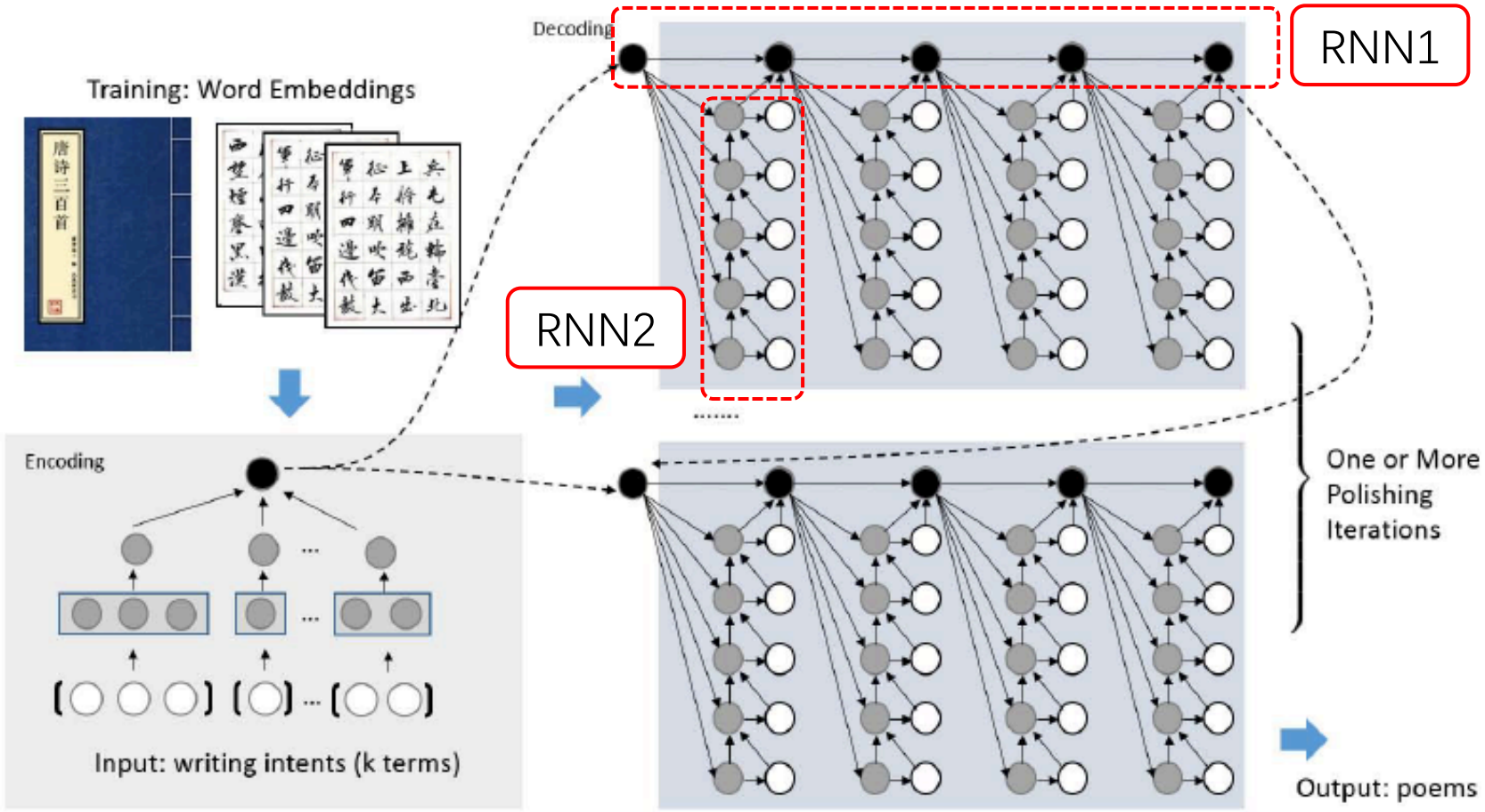
Fig 2

- **Keyword Extraction**: TextRank Algorithm
- **Keyword Expansion**: RNNLM-Based Method; Knowledge-Based Method
- **Poetry generation**: Bidirectional RNN (GRU) Encoder; Attention; RNN (GRU) Decoder

Zhe Wang et al. COLING' 16.

Iterative Polishing

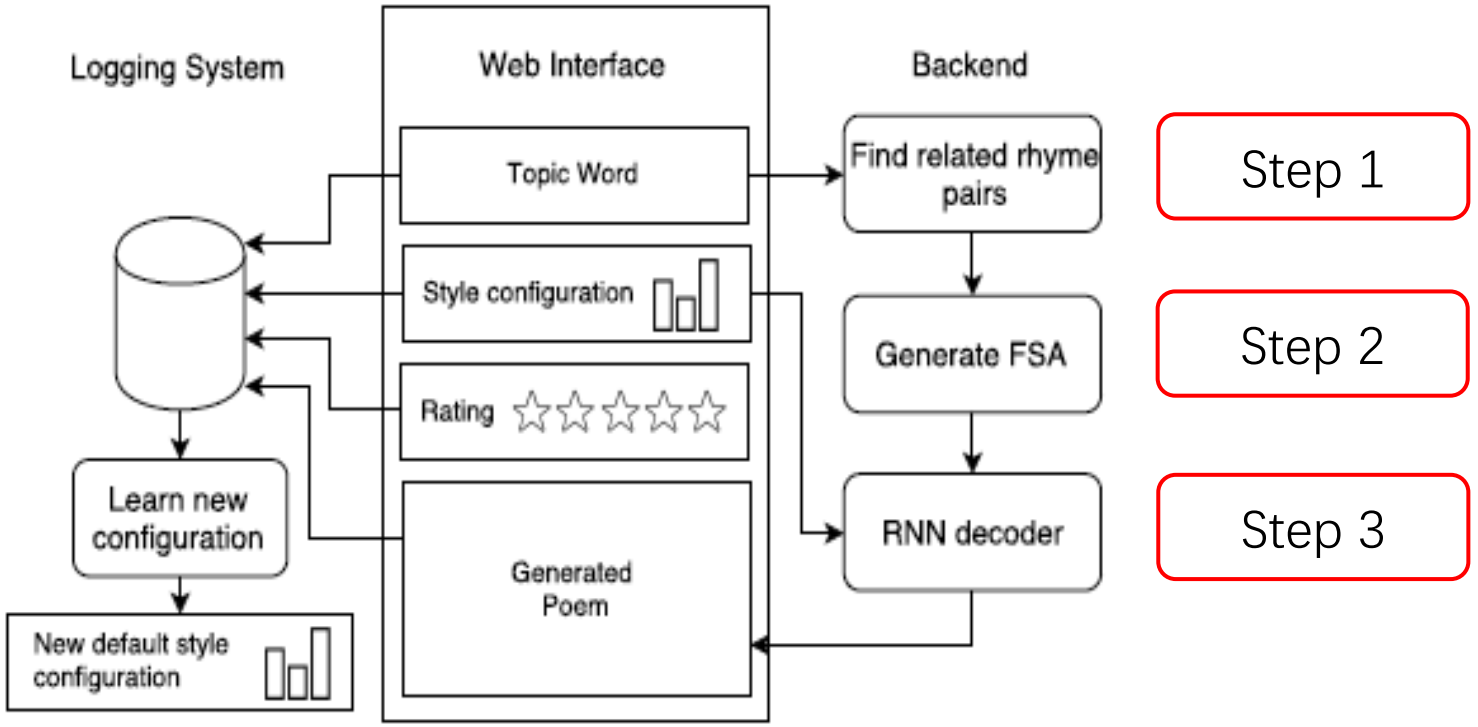
- Intention Representation
  - CNN
  - RNN
- Sequential Generation
  - Hierarchical RNN
  - Character by Character
- Iterative Polishing
  - Re-Generation



Rui Yan et al. IJCAI' 16.

Interactive Poetry Generation

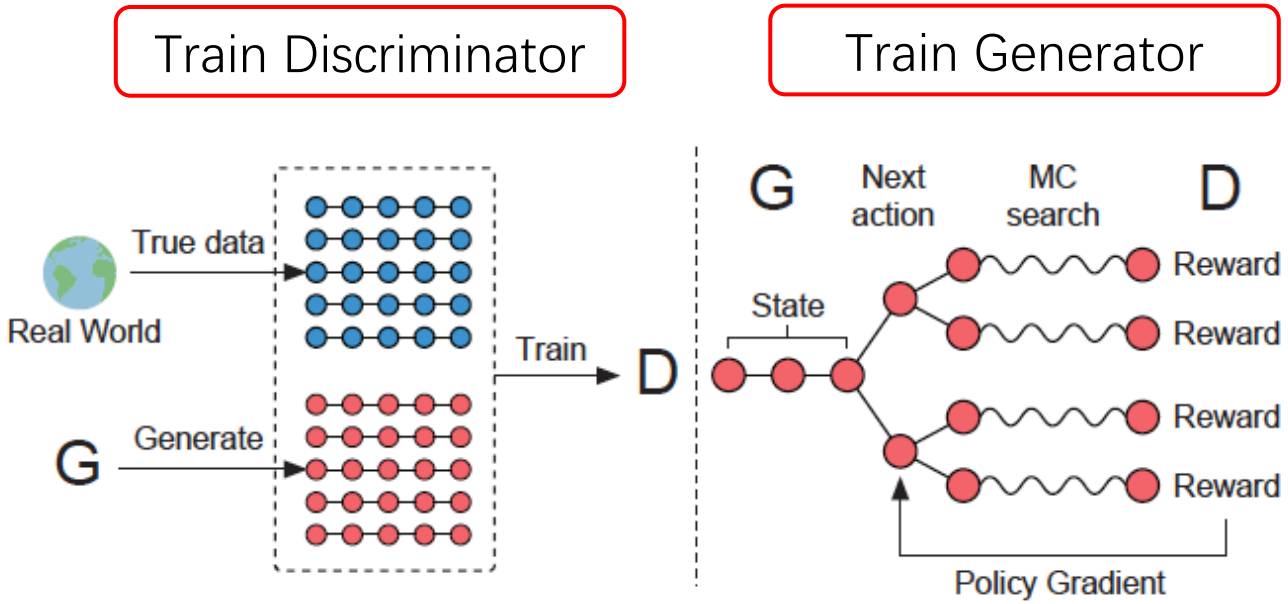
- Step 1
  Search related rhyme words
- Step 2
  Create a finite-state acceptor (FSA)
- Step 3
  RNN guided by FSA



Marjan Ghazvininejad et al., ACL' 17

GAN for Poetry Generation

- GAN
  Min-Max Game
- Generator
  Reinforcement learning
  MC search
- Discriminator



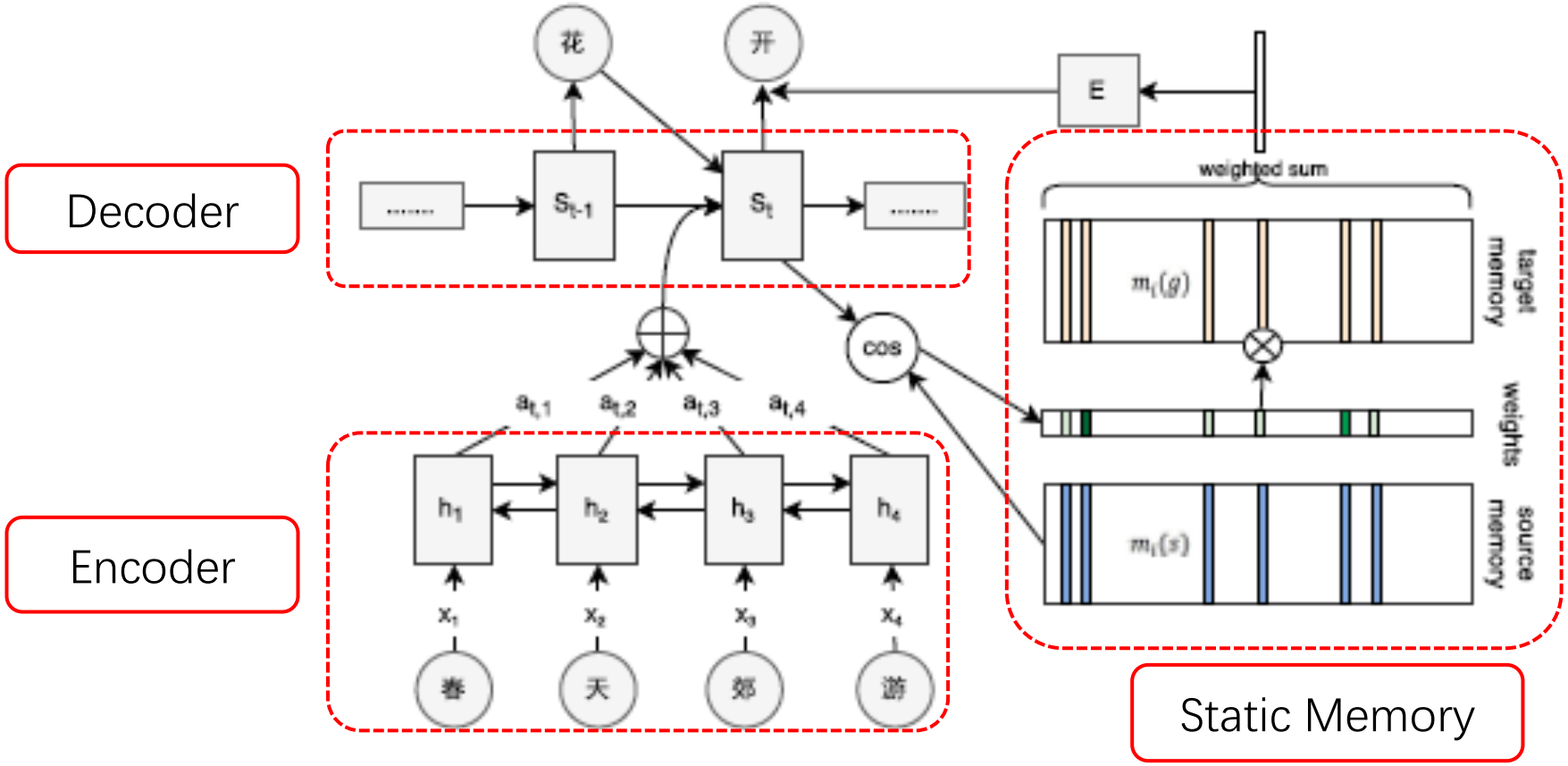
Algorithm	Human score	p-value	BLEU-2	p-value
MLE	0.4165	0.0034	0.6670	$< 10^{-6}$
SeqGAN	**0.5356**		**0.7389**	
Real data	0.6011		0.746	

Lantao Yu et al, AAAI' 17

Static Memory Model

- Encoder
  Bidirectional RNN
- Decoder
  One-Layer RNN
- Memory Contents
  Poem Cases
- Memory Index
  Hidden States
- Memory Combing

$$v_t = \sum_{i=1}^{K} cos(s_t, m_i(s)) m_i(g)$$



Jiyuan Zhang et al., ACL' 17

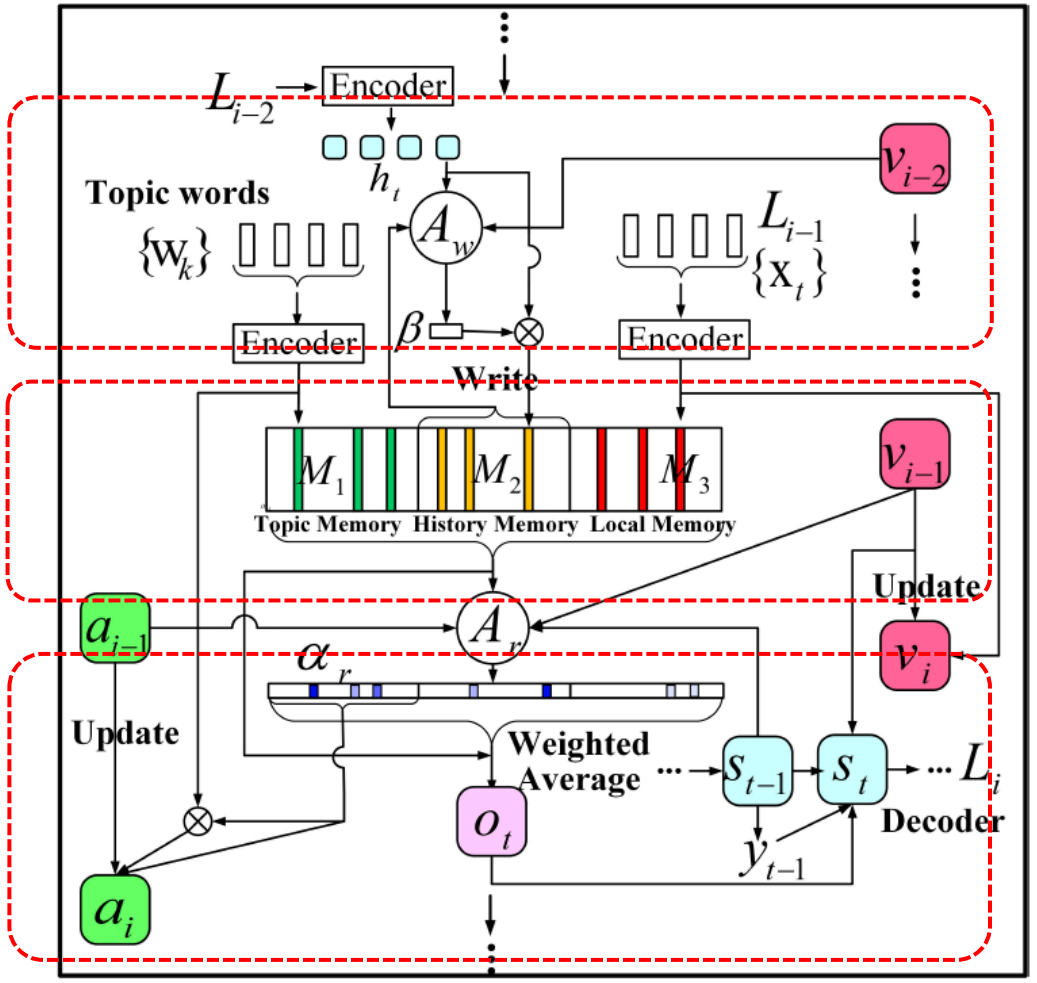
Working Memory Model

- Line-by-Line Generation
- Bidirectional Encoder and GRU Decoder
- Memory
  - Topic Memory
  - History Memory
  - Local Memory
  - Memory Reading
  - Memory Writing

Encoder

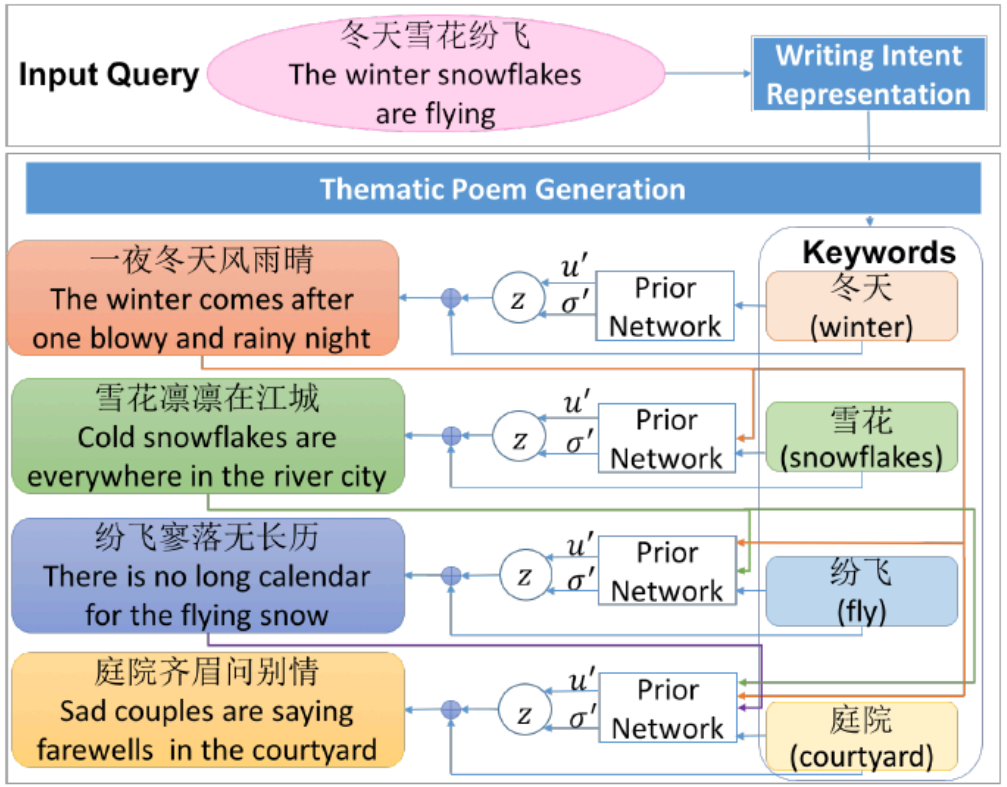
Memory

Decoder

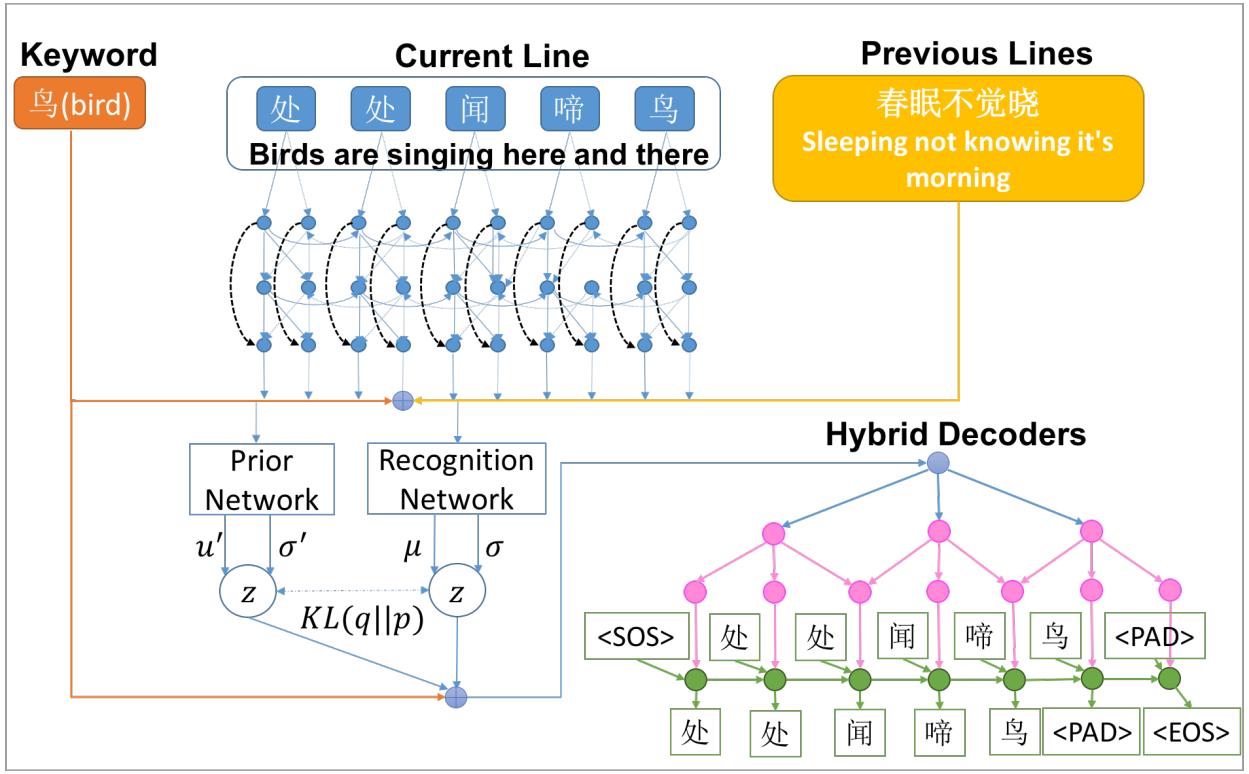


Xiaoyuan Yi et al., IJCAI' 18

Conditional Variational Autoencoder



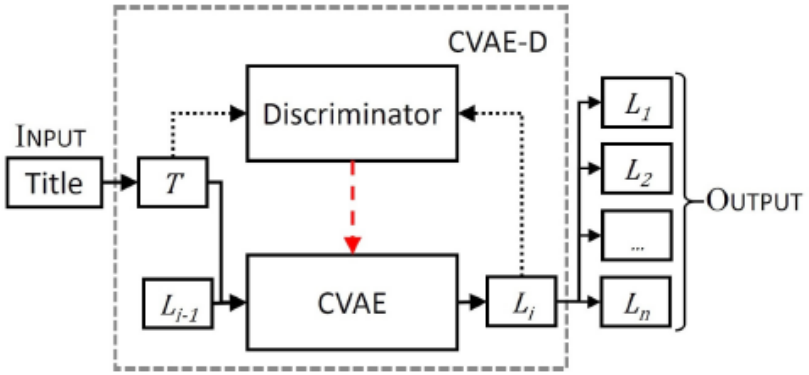
Generation Pipeline

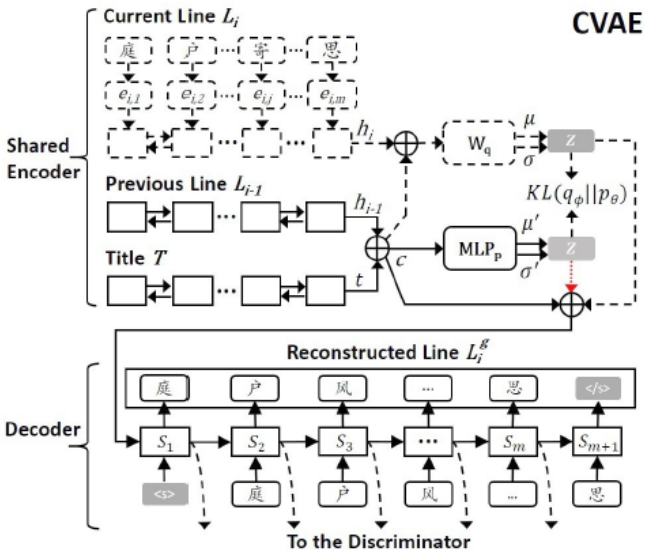


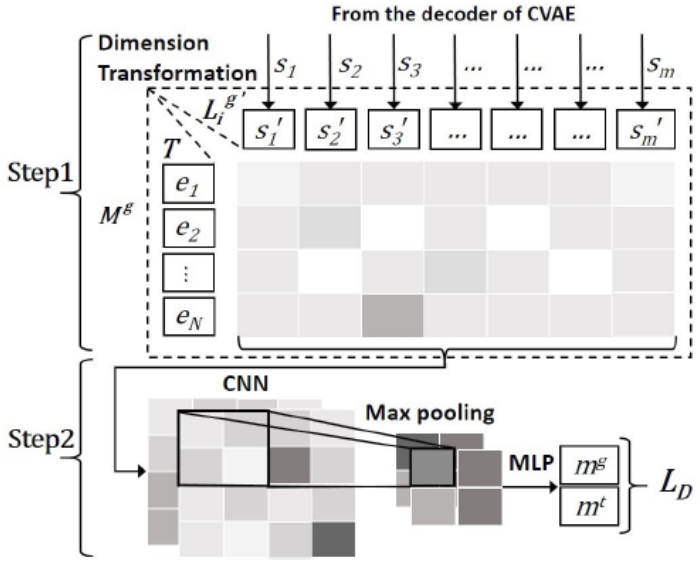
CVAE Model

Xiaopeng Yang et al,. IJCAI' 18

CVAE-GAN Model







Overall Framework

CVAE Generator

Discriminator

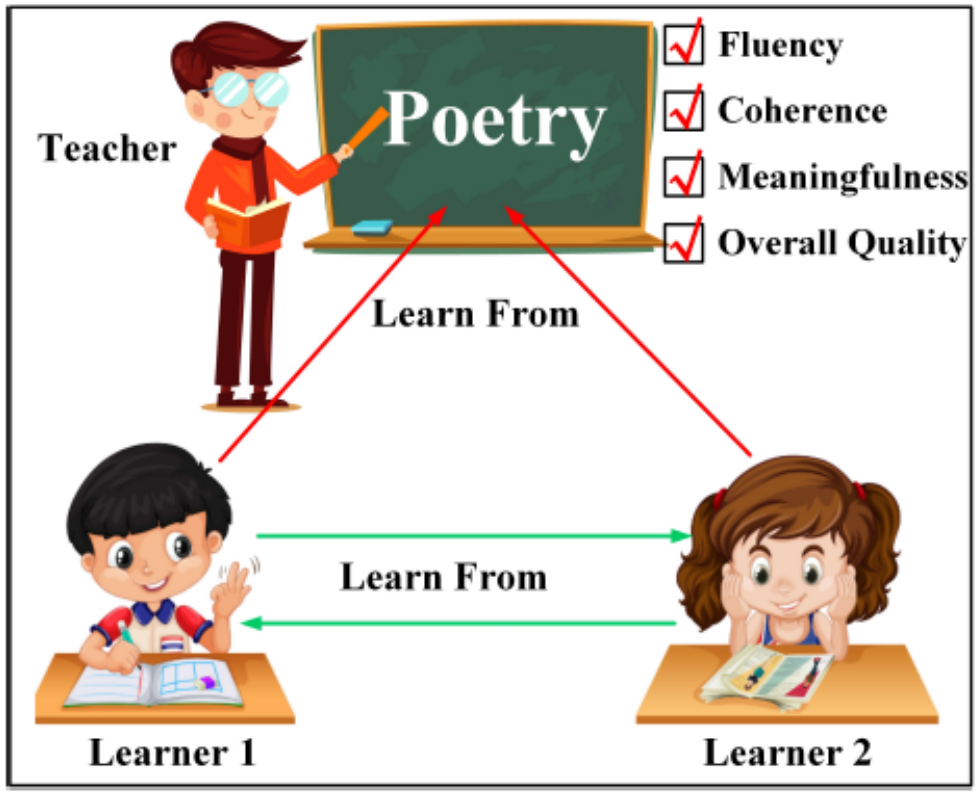
Juntao Li et al., EMNLP' 18

Mutual Reinforcement Learning

- Modeling Poetry Generation as RL Problem

- Fine-Grained Reward Designing
  - Fluency Rewarder (LM)
  - Coherence Rewarder (MI)
  - Meaningfulness Rewarder (TF-IDF)
  - Overall Quality Rewarder (Classifier)

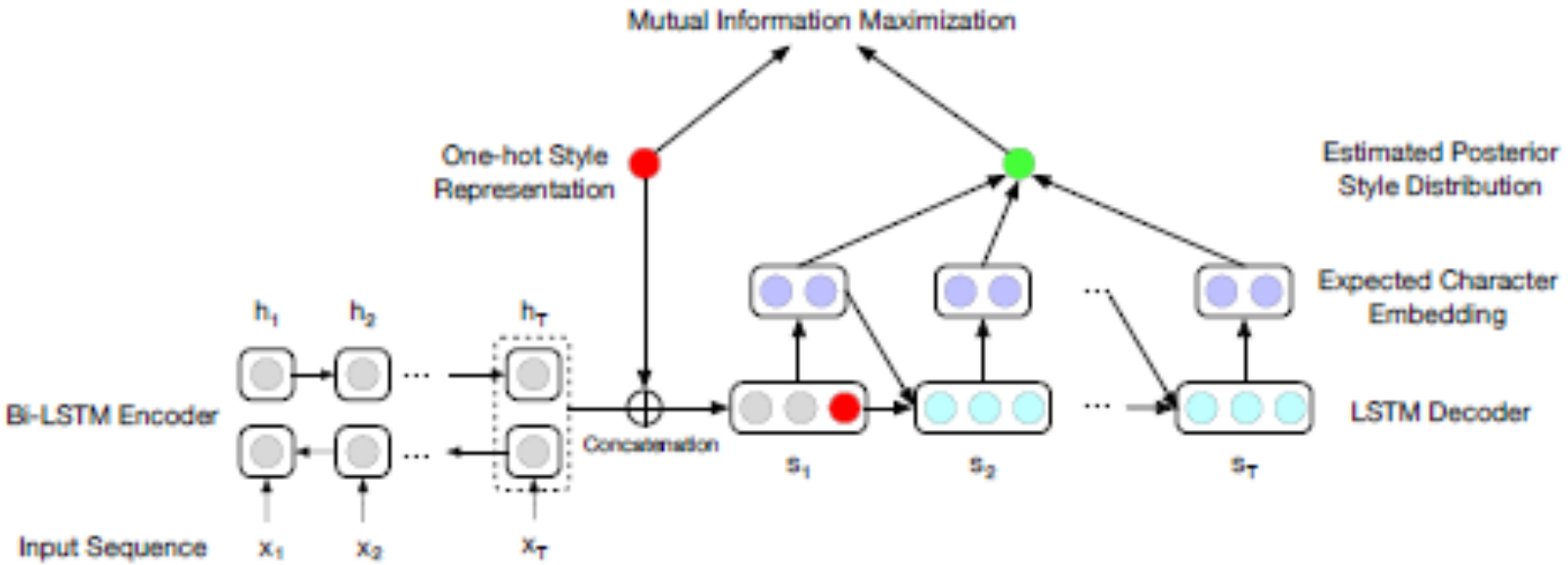
- Mutual Reinforcement Learning
  - Two Generators
  - Instance-Based Method
  - Distribution Level Mutual learning



Xiaoyuan Yi et al., EMNLP' 18

Stylistic Poetry Generation

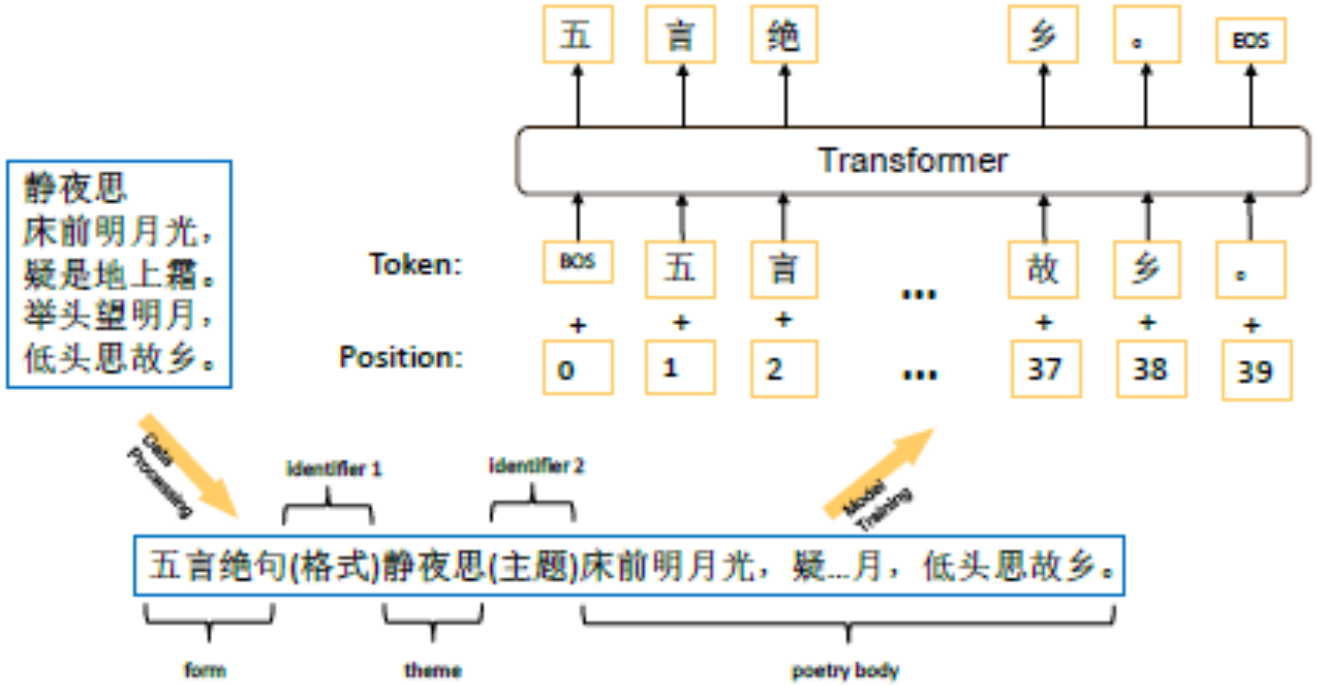
- Input
  - Input sentence
  - Style id
- Encoder-Decoder
- Mutual Information
  - Dependency of variables



Cheng Yang et al., EMNLP' 18

Pretraining-Based Model

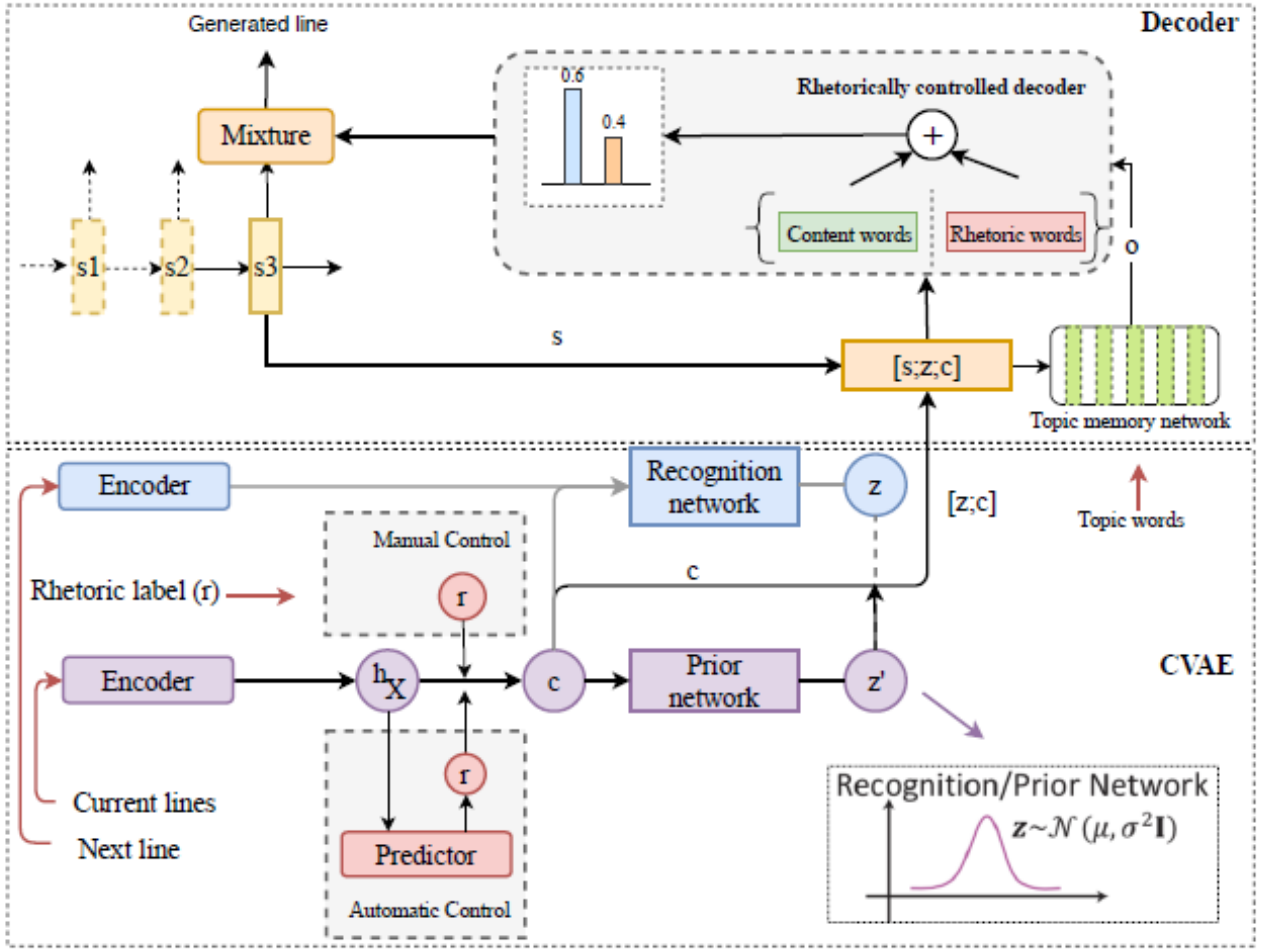
- Pre-trained Model
  - GPT
- Genres
  - Quatrain
  - Iambics
  - Couplet
- Fine-Tuning Model
  - Transformer
  - Auto-regressive Language Model



Yi Liao et al., arXiv:1907.00151

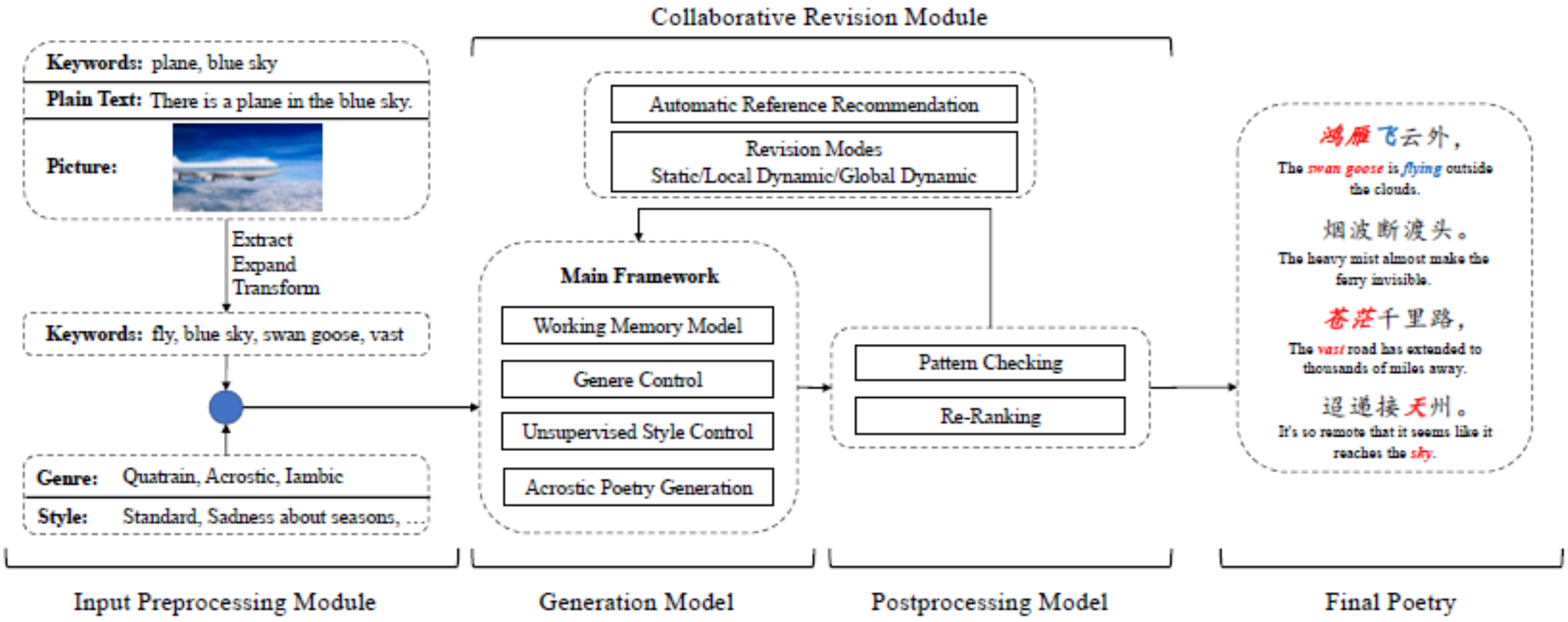
Rhetorically Controlled Generation

- Modern Poetry Generation
- Manual Control CVAE Model
  Process User Input As Rhetorical Label
- Automatic Control CVAE
  Predict *When* Use Rhetoric Label
- Topic Memory
  Store Topic Information
- Rhetorically Controlled Decoder
  Generate Sentence with Forms of Rhetoric



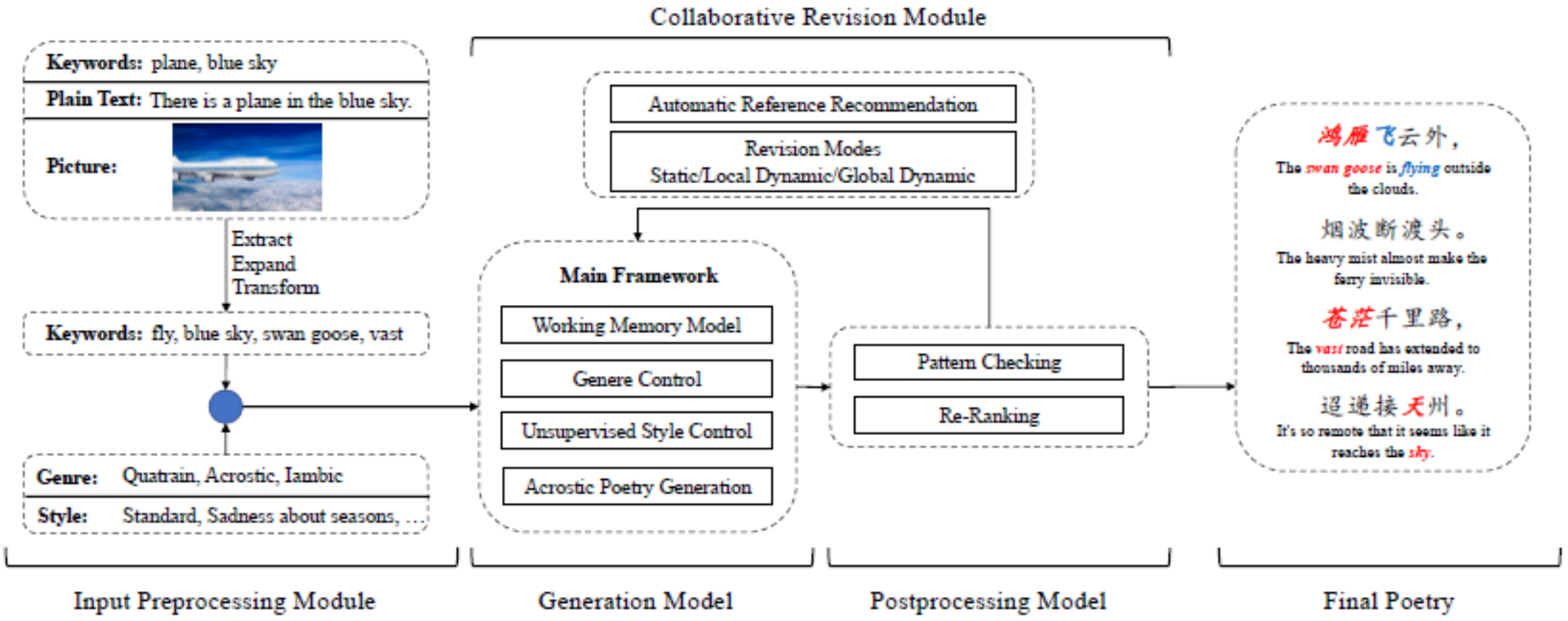
Zhiqiang Liu et al., ACL' 19

Human-Machine Collaborative Generation



Zhipeng Guo et al., ACL' 19

Human-Machine Collaborative Generation



Zhipeng Guo et al., ACL' 19

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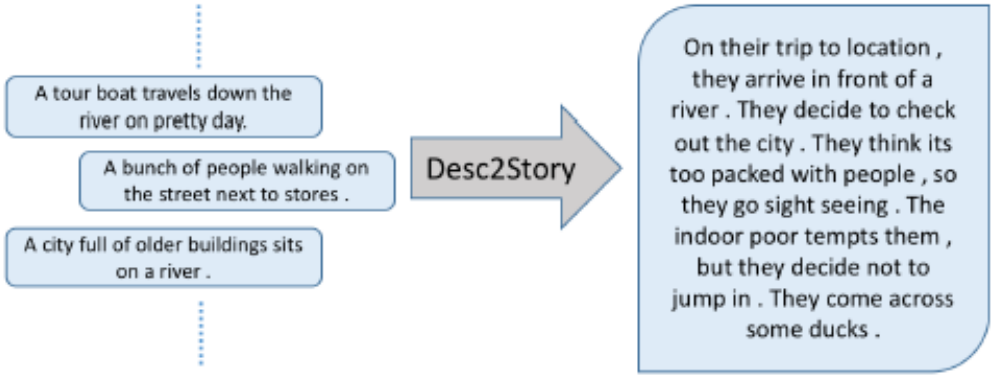
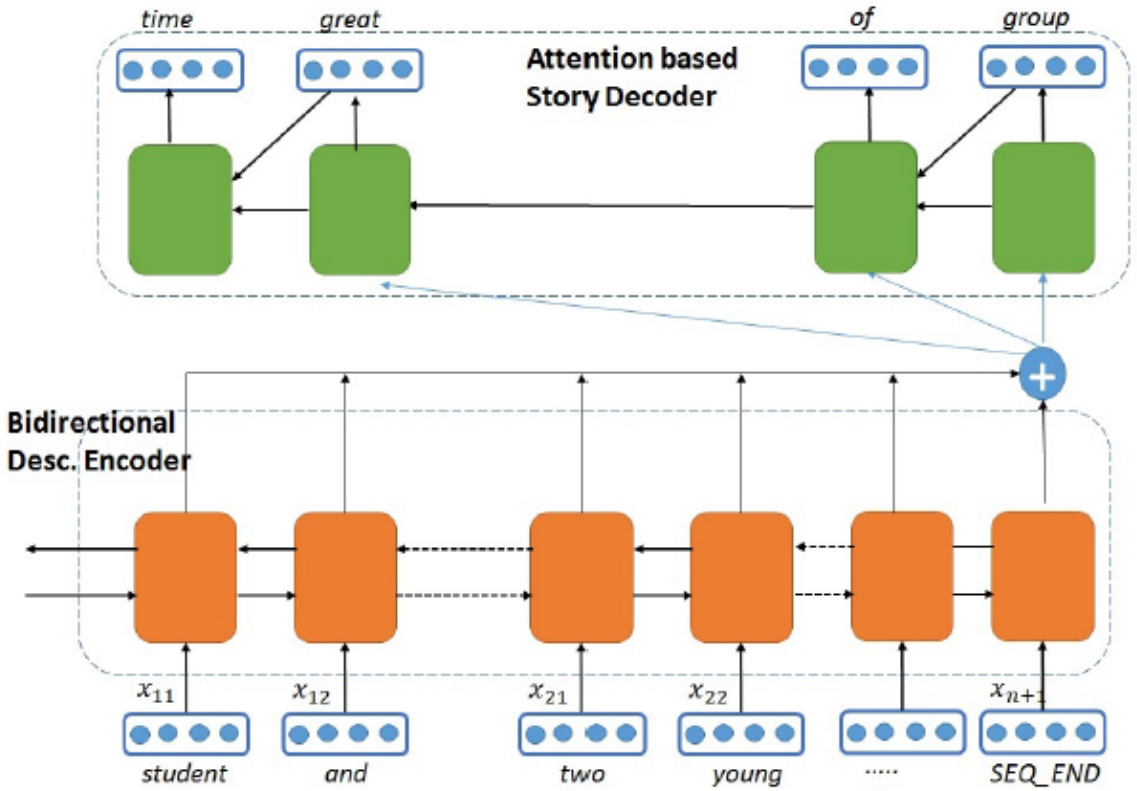
Roadmap

- Introduction
- Background Knowledge
- Existing Methods
  - Poetry Generation
  - Story Generation
  - Multi-Modal Generation
  - Other Genres
- Recent Trends and Future Direction
- Q&A

Coherent Story Generation



Task Description

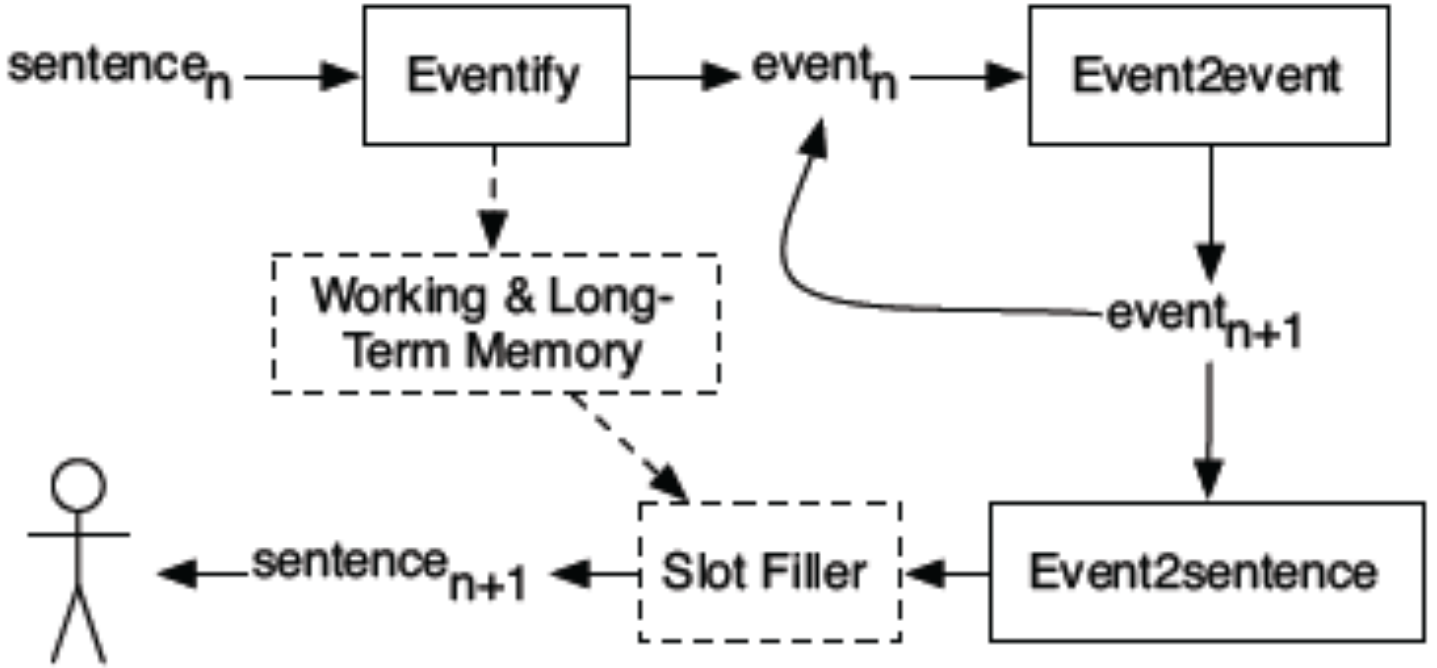


Model

Jain, Parag, et al., arXiv:1707.05501, 2017

Event Representations

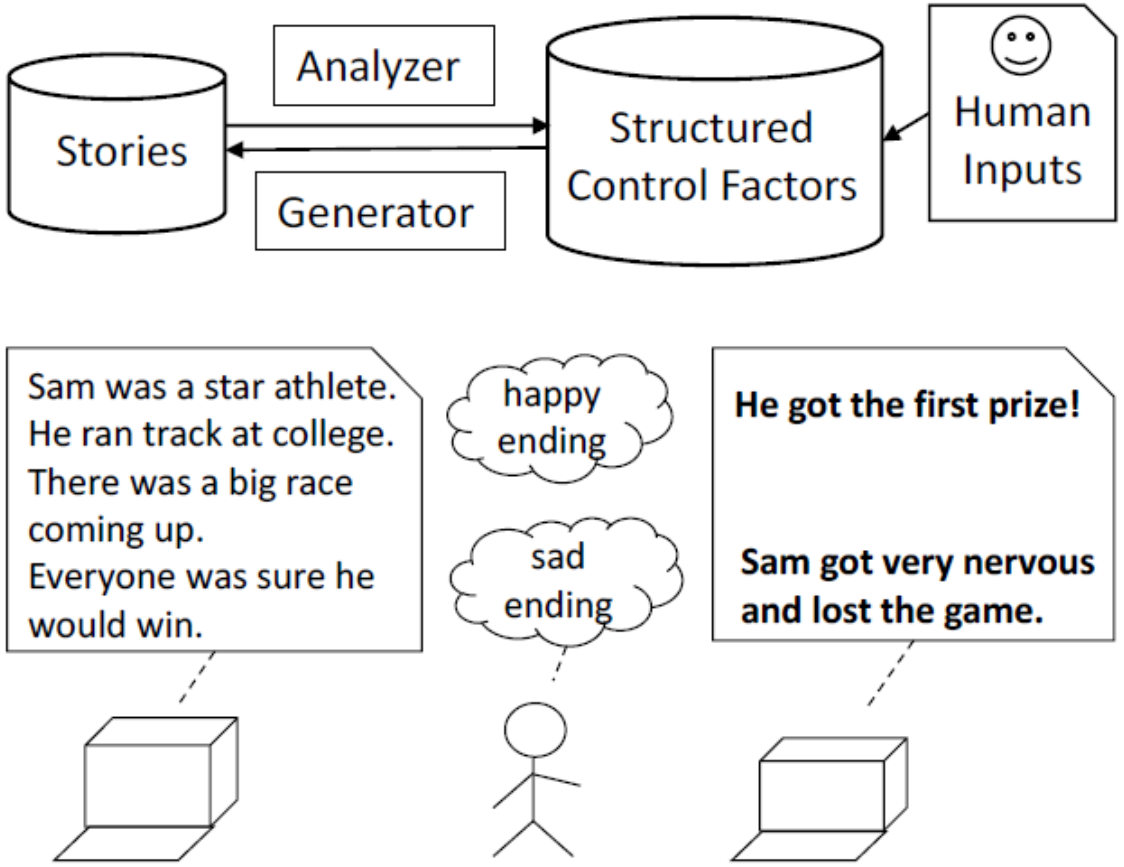
- Story to Event Sequences
  5-tuple Event Representations
- Event to Event Generation
  Event-Level Seq2seq
- Event to Story Generation
  Seq2seq



Lara J. Martin et al., AAAI' 18

Controllable Story Generation

- Input
  - Human inputs
  - Controllable factors
- Output
  - A story that coherent to human inputs
- Ending Valence Control
  - Data labeling
  - Supervised classifier
  - Conditional LM for generation
- Storyline Control
  - Keywords extractor
  - Conditional LM for generation



Peng, Nanyun, et al., Workshop, 2018

Hierarchical Story Generation

- Hierarchical Generation Pipeline
  Generating Prompts---Story

- Convolutional Seq2seq For Generating Prompts
  Conventional Convolutional Seq2seq Model

Prompt: The Mage, the Warrior, and the Priest

Story: A light breeze swept the ground, and carried with it still the distant scents of dust and time-worn stone. The Warrior led the way, heaving her mass of armour and muscle over the uneven terrain. She soon crested the last of the low embankments, which still bore the unmistakable fingerprints of haste and fear. She lifted herself up onto the top the rise, and looked out at the scene before her. [...]

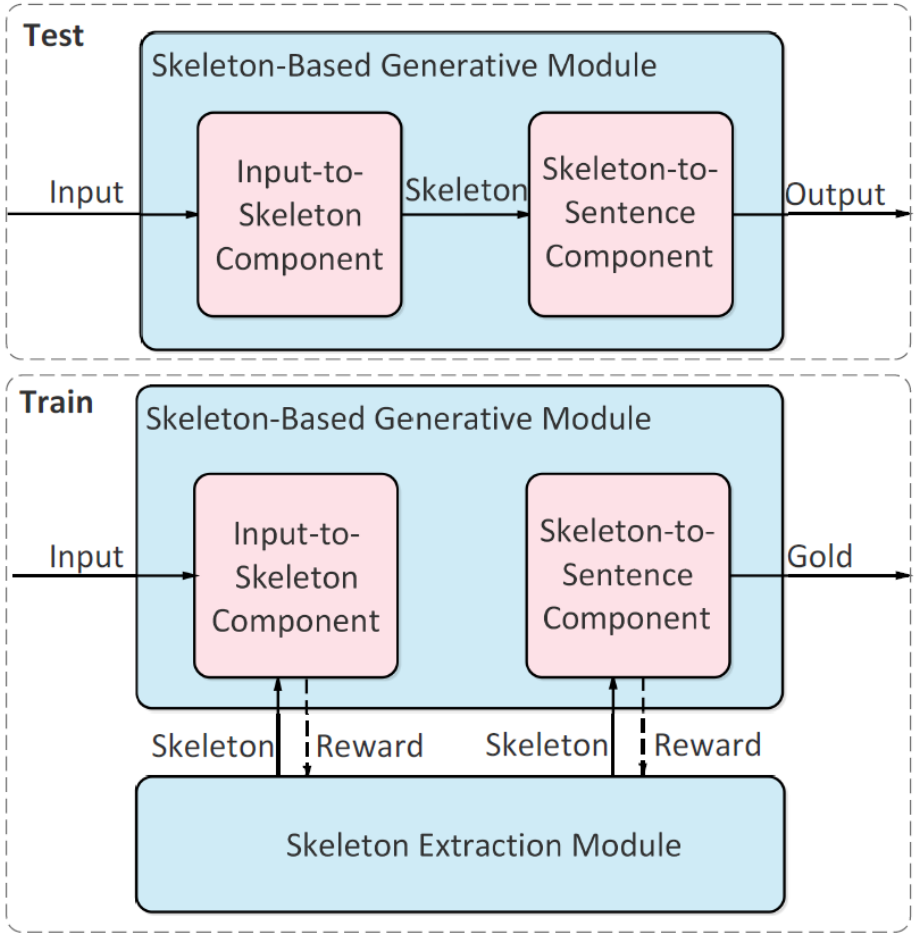
- Gated Multi-Scale Attention
  Gated self-attention to attend Information at different position
  Multi-scale attention to attend information at different granularity

- Prompts Fusion
  Residual Learning Upon pre-trained Convolutional seq2seq model

Fan Angela et al., ACL, 2018

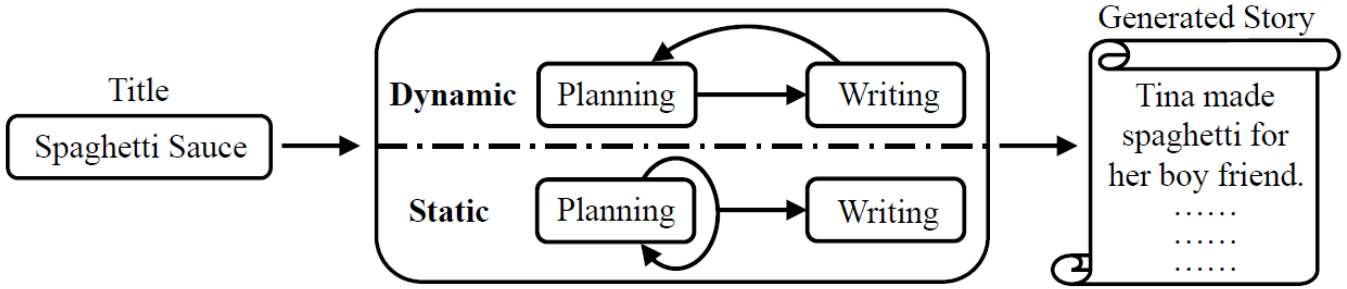
Skeleton to Story Generation

- Skelton-Based Generative Module
  - Input-to-Skeleton
  - Skeleton-to-Sentence
- Skeleton Extraction Module
  - Pretraining on Sentence Compression Dataset
  - Reinforcement Learning Training
  - Two Entropy Loss Reward
  - Iterative Optimization

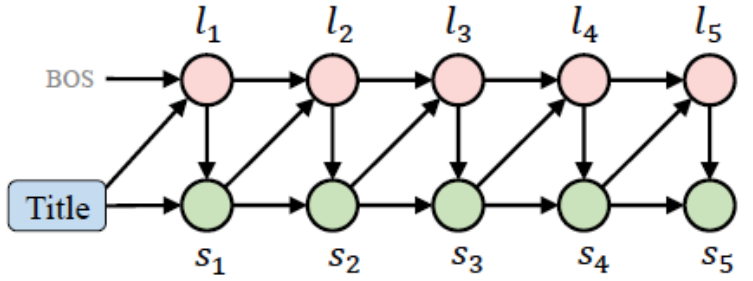


Xu, Jingjing, et al., EMNLP, 2018

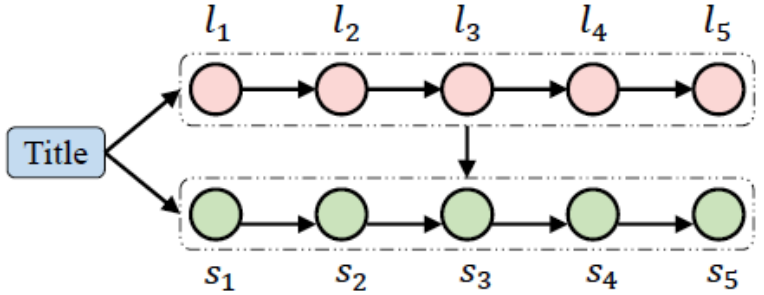
Planning-Based Method



System Overview



(a) Dynamic schema work-flow.



(b) Static schema work-flow.

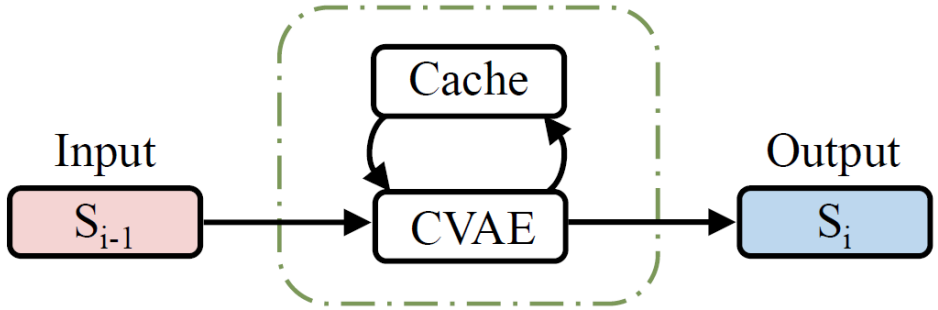
Planning Method

- Plan and Write
- Static Planning
- Dynamic Planning

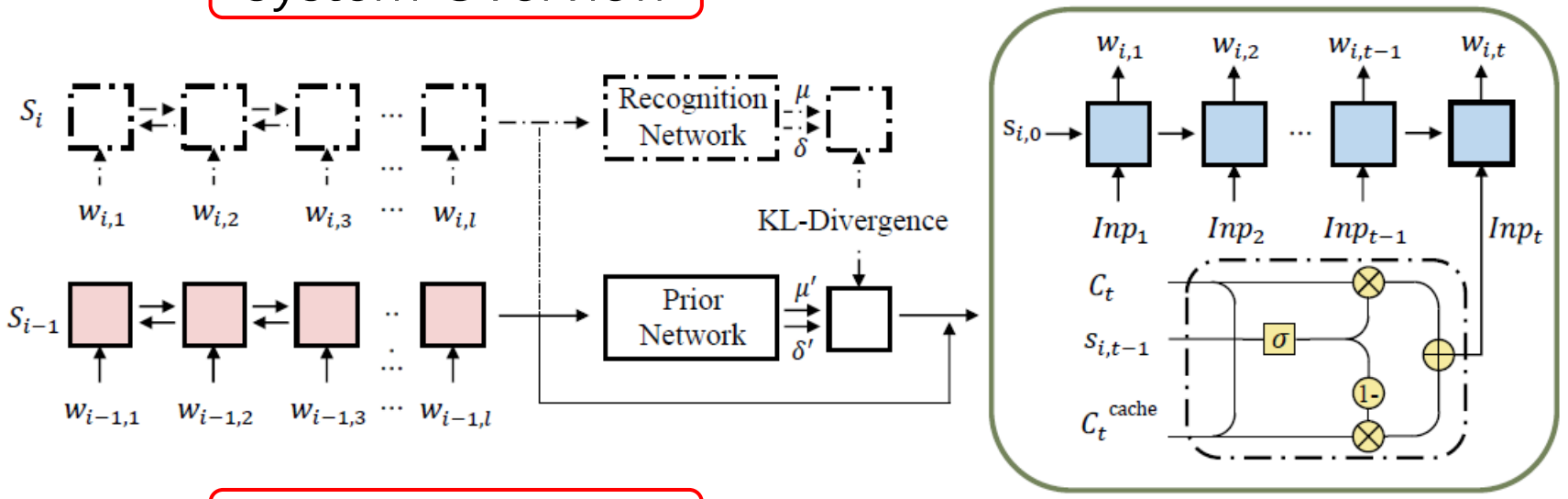
Yao, Lili, et al., AAAI, 2019

CVAE and Memory Network

- CVAE
  Wording Novelty
- Cache
  Coherence



System Overview

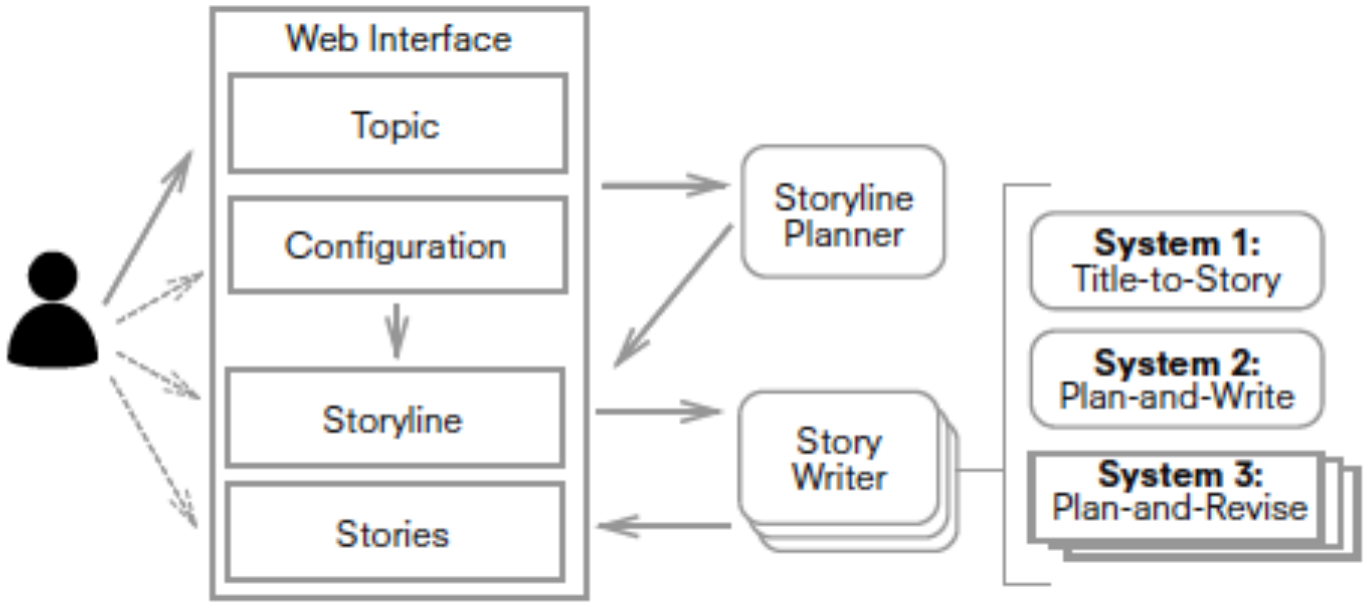


Model

Li, Juntao, et al., AAAI, 2019

Plan Write and Revise

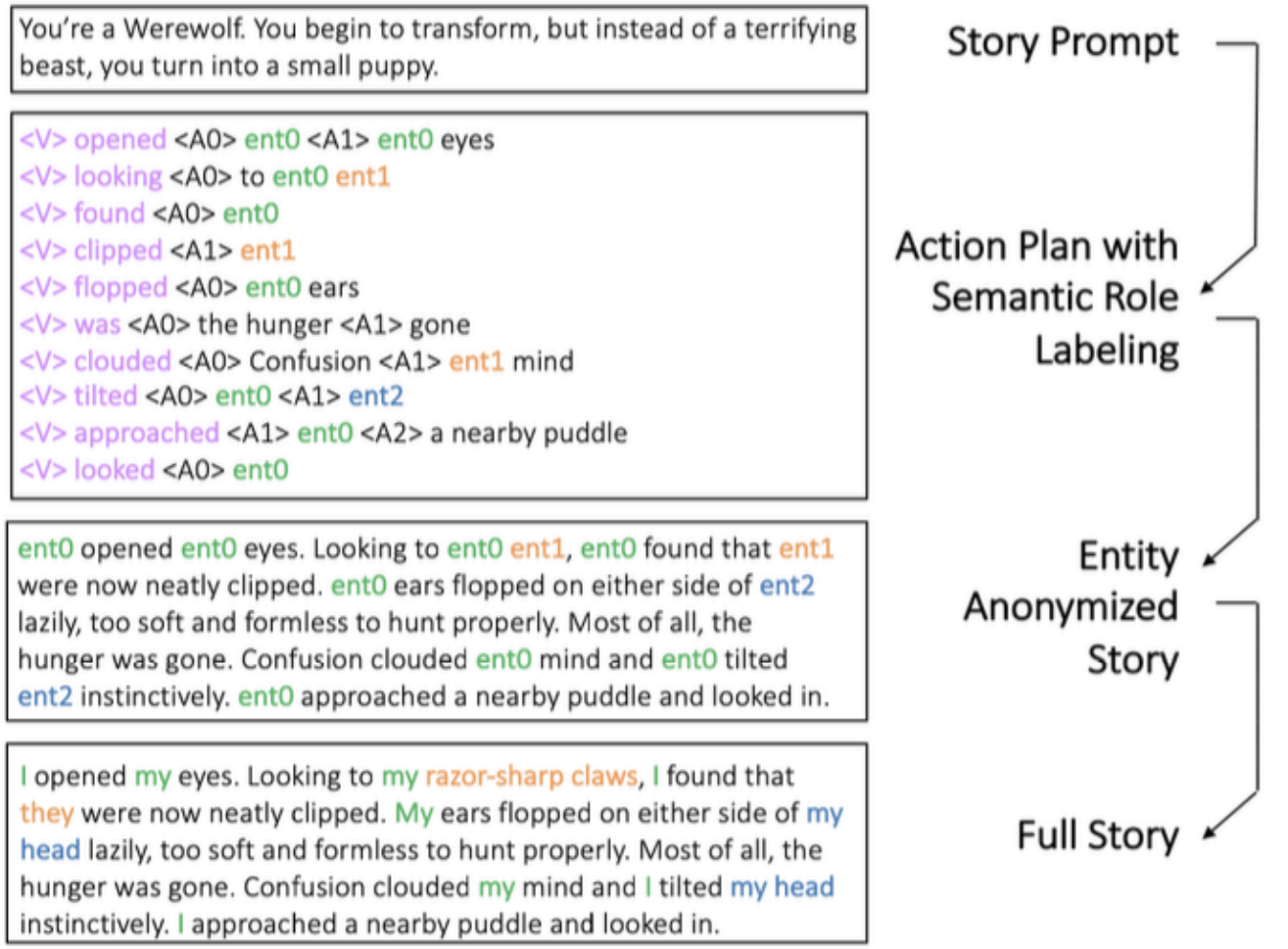
- System Combination
- Cross-Model Mode
- Intra-Model Mode
- Story Writer
  - Title-to-Story
  - Plan-and-Write
  - Plan-and-Revise



Goldfarb-Tarrant, Seraphina et al., NAACL-HLT, 2019

Structured Story Generation

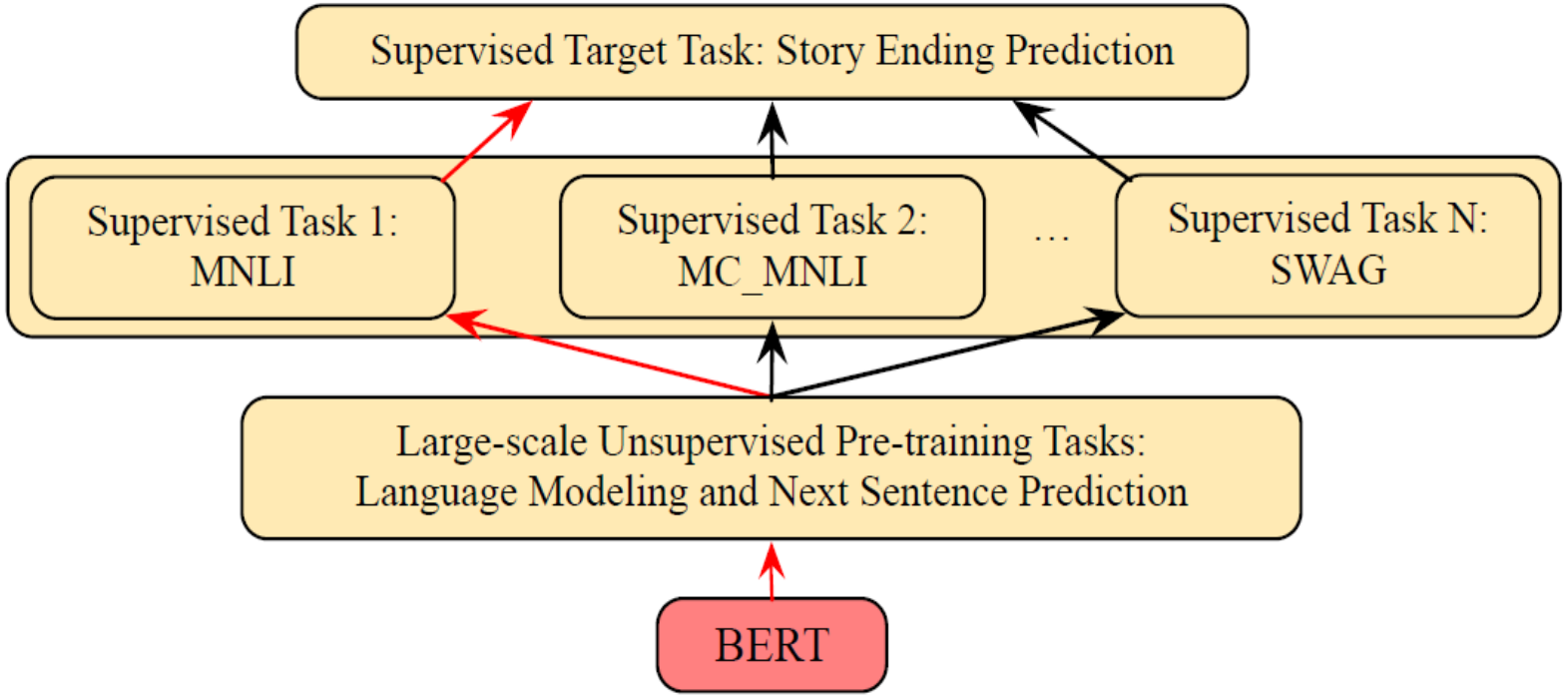
- Input: story prompt
- Action plan with semantic labeling
- Entity Anonymized Story
- Full Story



Angela Fan et al., ACL, 2019

BERT Augmented Story Ending Prediction

- Unsupervised Pre-Training
- Supervised Pre-Training
- Supervised Fine-Tuning

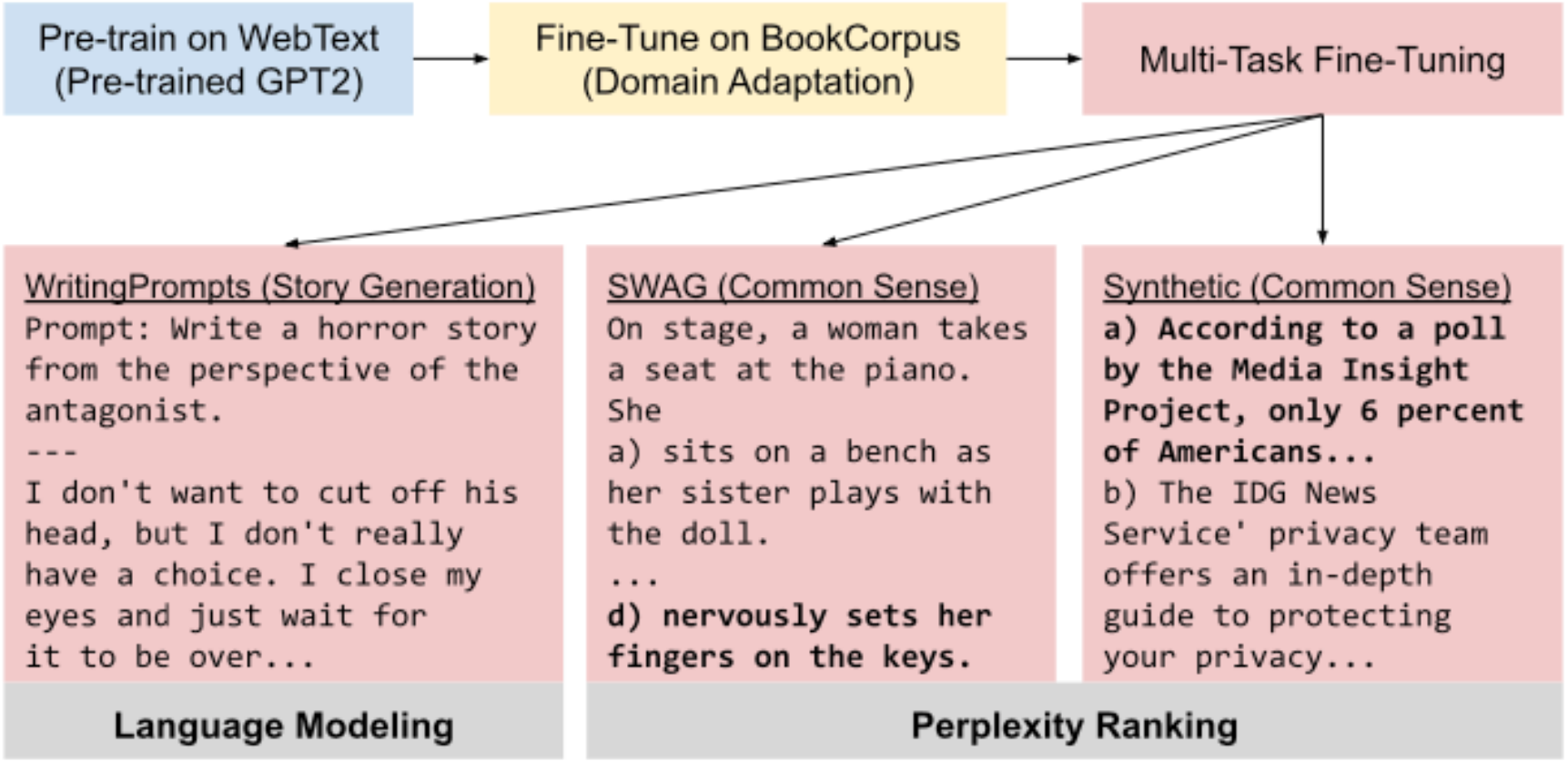


Training Framework

Li, Zhongyang et al., IJCAI, 2019

Common Sense Grounding

- Intermediate Fine-Tuning
- Multi-Task Fine-Tuning
  - Language Modeling
  - Perplexity Ranking



Huanru Henry Mao et al., EMNLPI, 2019

Counterfactual Story Reasoning and Generation

Data from ROCStories

Premise:

1) Jaris wanted to pick some wildflowers for his vase.

Initial:

2) He went to the state park.

Original Ending:

3) He picked many kinds of flowers.
4) Little did Jaris realize that it was a national park.
5) Jaris got in trouble and apologized profusely.

Data Collection

Step1 - Workers Produce a Counterfactual given original story

(One counterfactual for 98,159 examples)

2') He went to the local playground area.

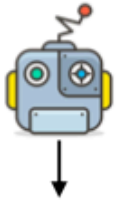
Step2 - Workers Edit Ending given the above

(One ending for 16,752 training examples
Three endings for 1,871 dev examples
Four endings for 1,871 test examples)

3') He picked many kinds of flowers.
4') Little did Jaris realize that he was trespassing on private property.
5') Jaris got in trouble and apologized profusely.

Task Flow

Input:
Premise + Initial + Original Ending + Counterfactual



Output:

3') He found a very large bush of wildflowers.
4') He picked them up with his hands.
5') He carried them home and planted them in his vase.

Lianhui Qin et al., EMNLP, 2019

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Roadmap

- Introduction
- Background Knowledge
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  - Poetry Generation
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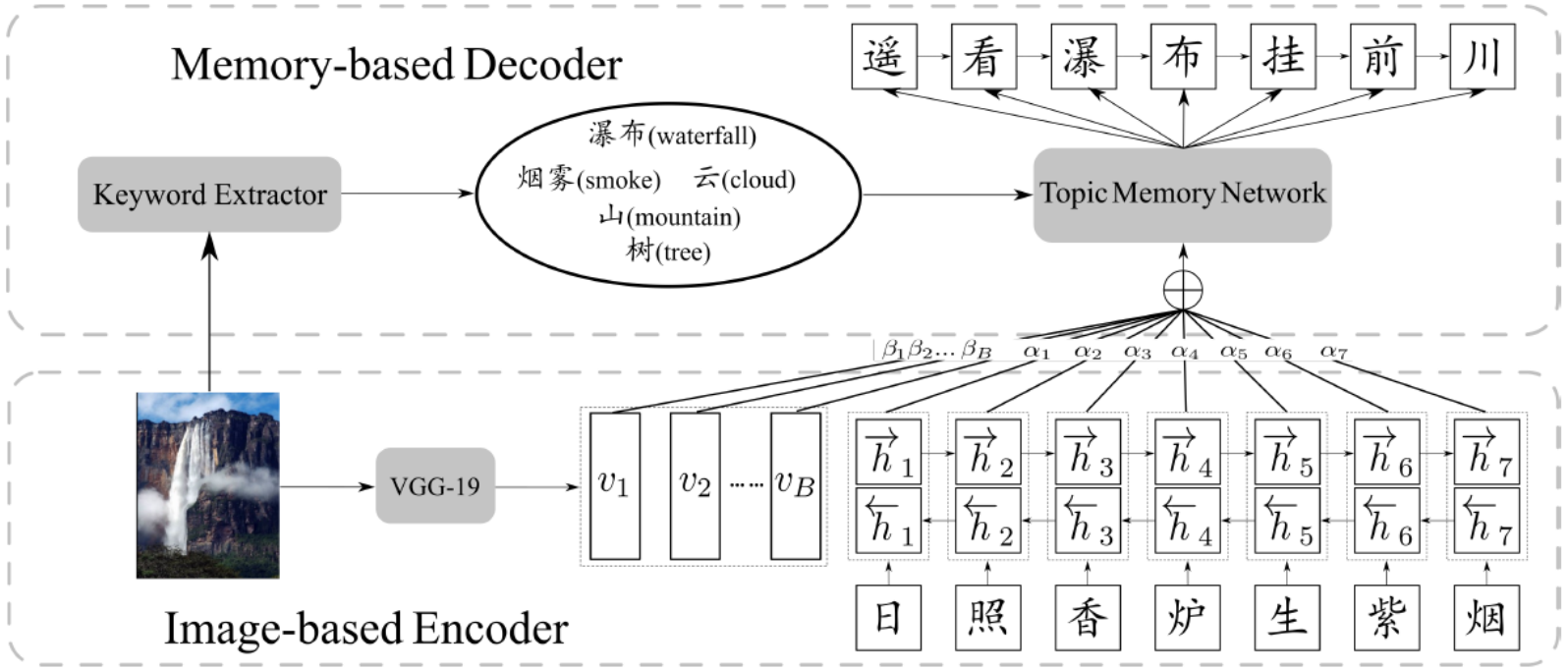
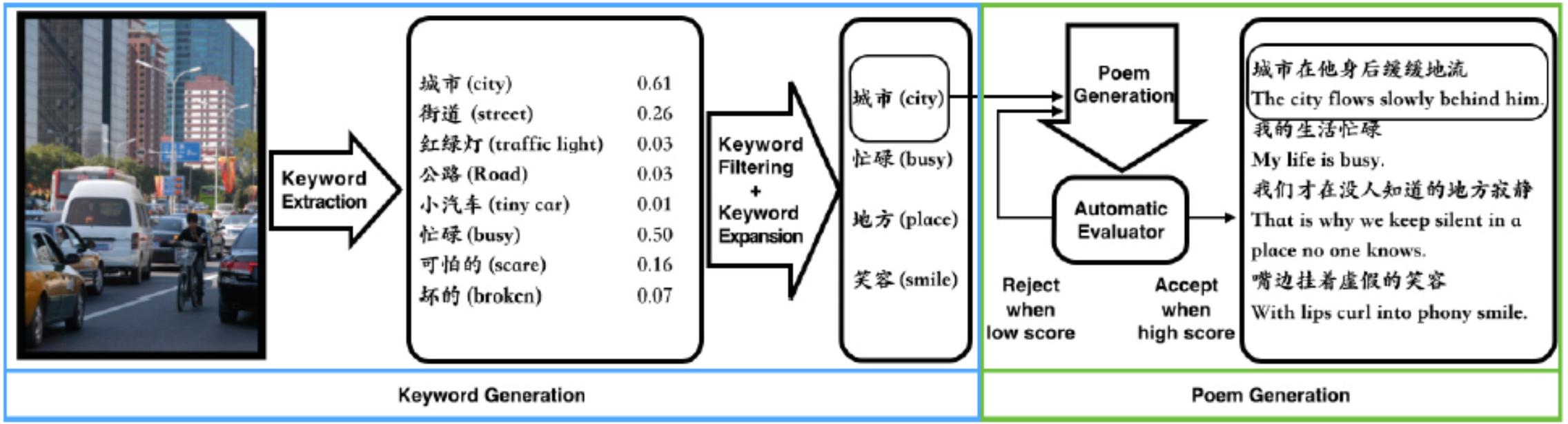
Image Inspired Poetry Generation

- Image-Based Encoder
  - CNN
  - Bidirectional RNN
- Memory-Based Decoder
  - Keyword Extractor
  - Vector Representations



Xu, Linli, et al., AAAI, 2018

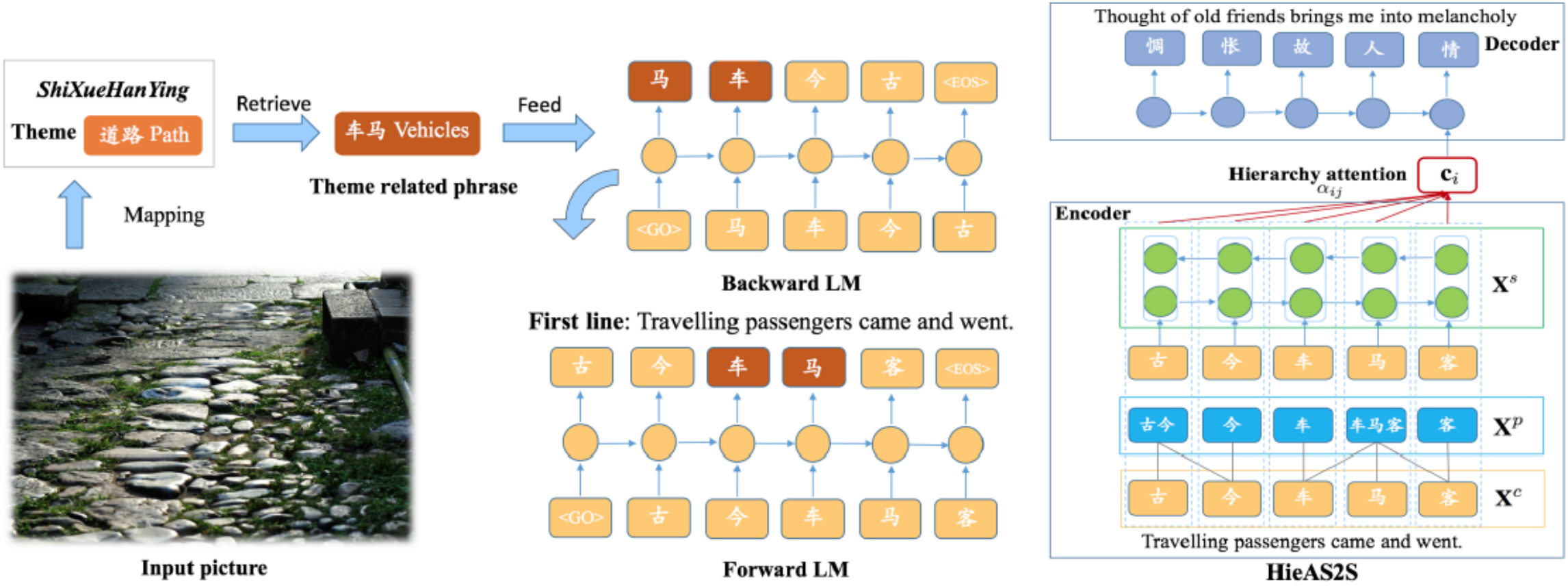
Visual Poetry Generation of Xiaolce



Framework

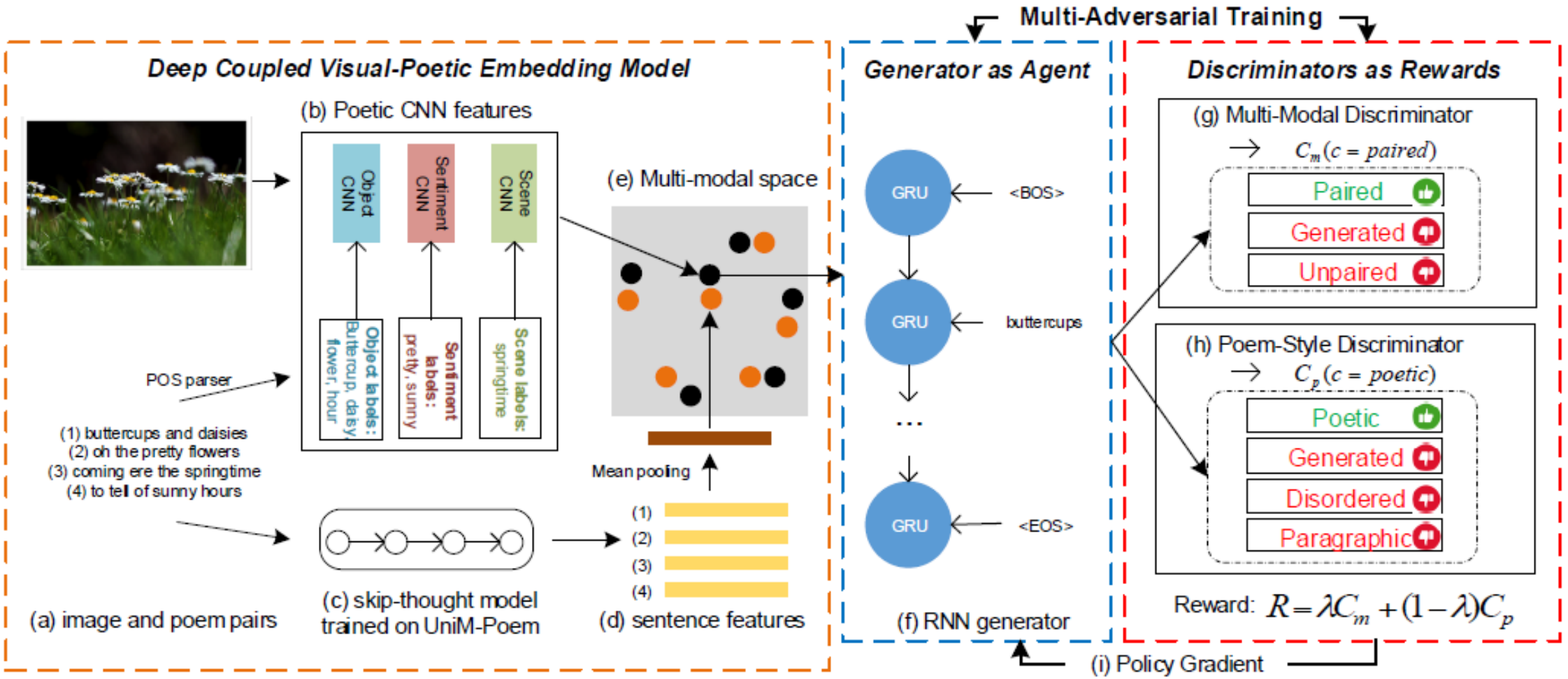
Cheng, Wen-Feng, et al., arXiv:1808.03090, 2018

Multi-Modal Poetry Generation



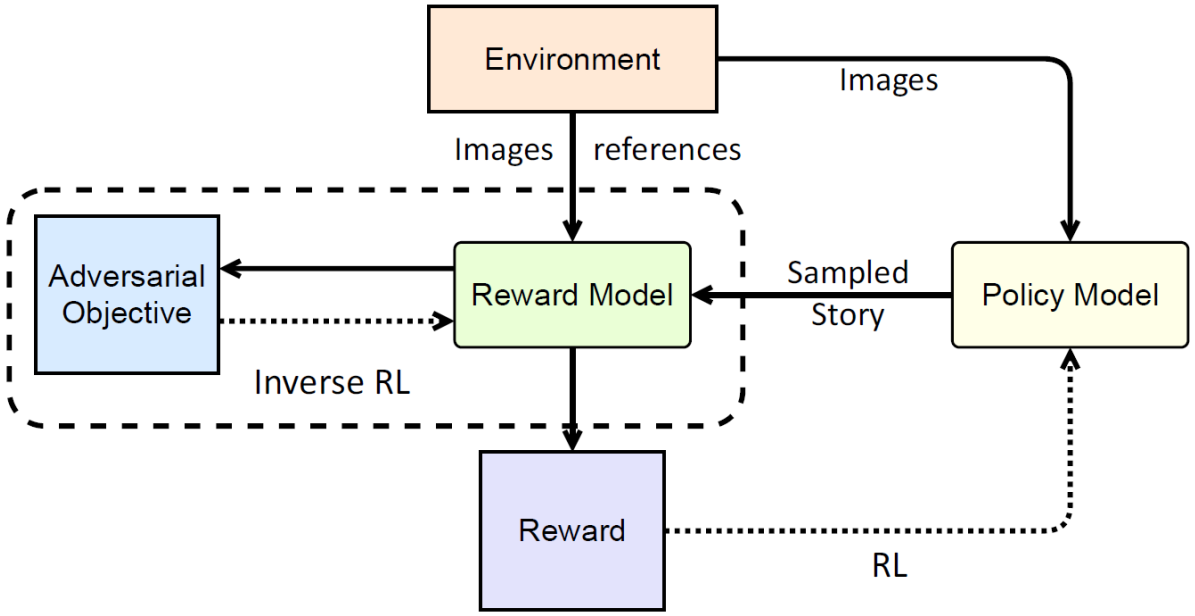
Liu, Dayiheng, et al., IJCNN, 2018

Multi-Adversarial Training

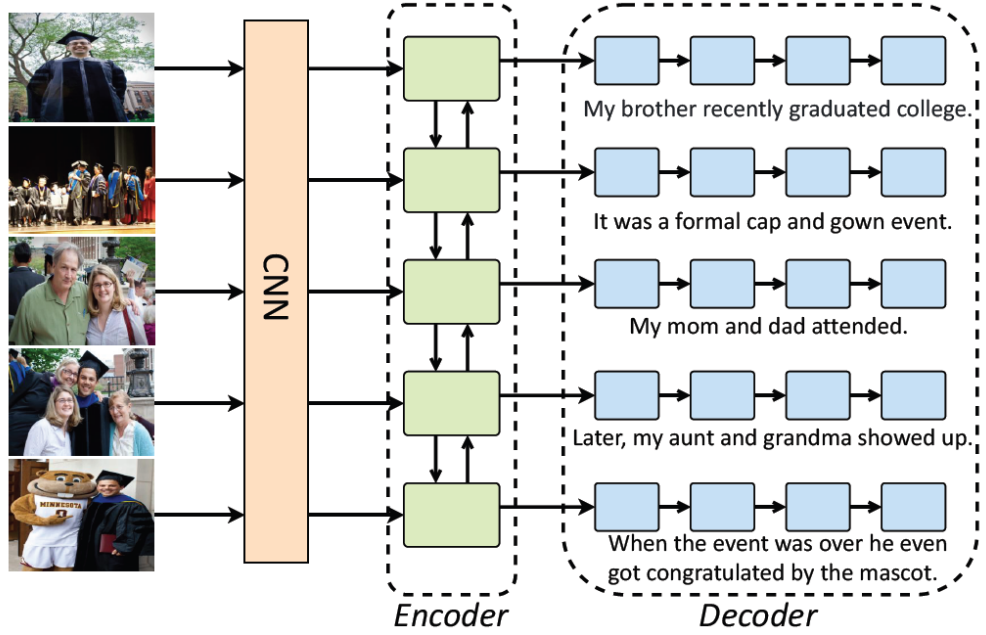


Liu, Bei, et al., ACM, MM, 2018

Inverse Reinforcement Learning



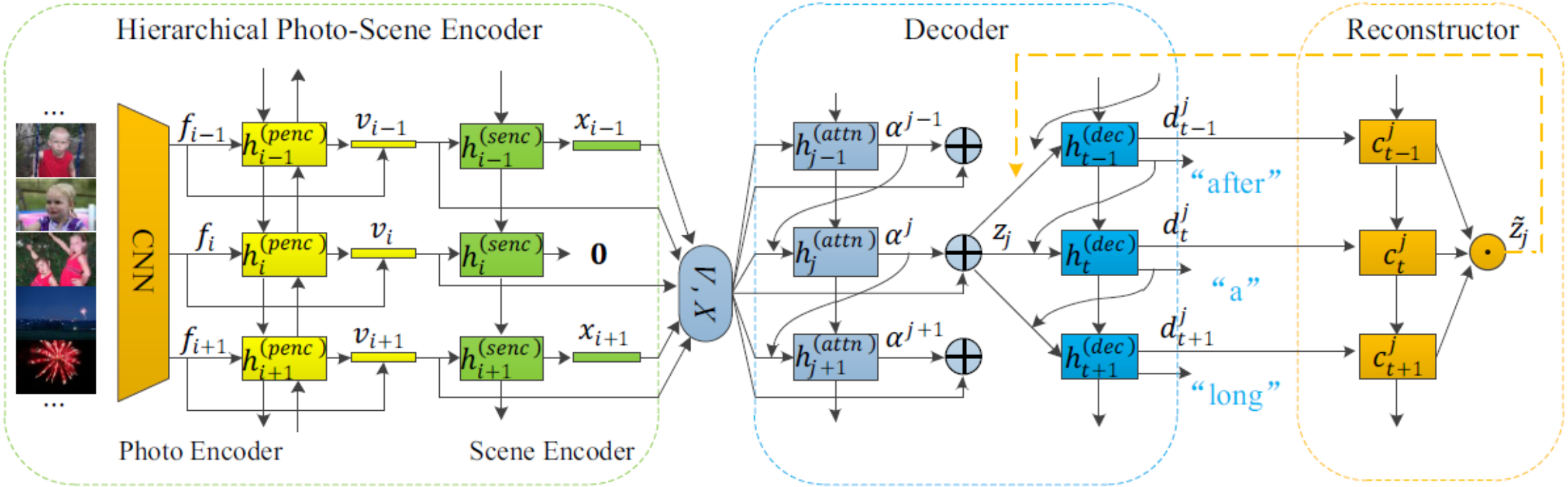
Overall Framework



Policy Model

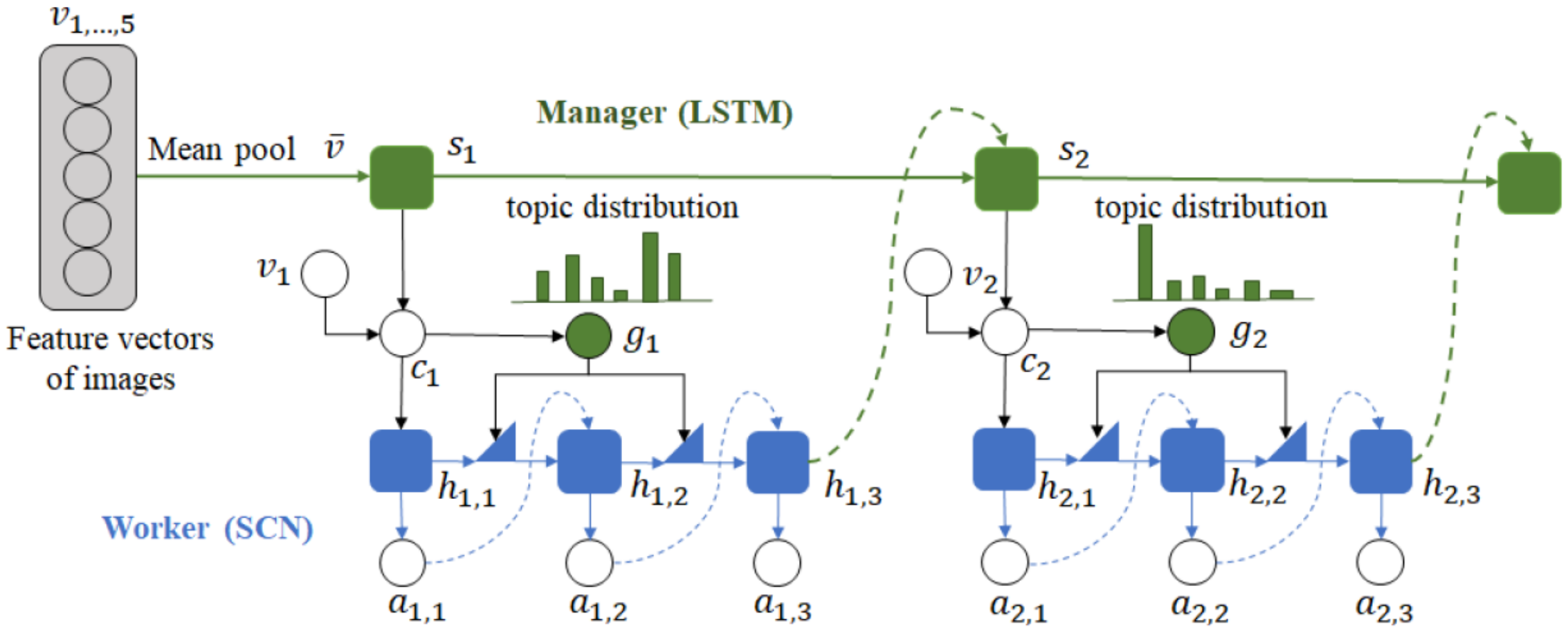
Wang, Xin, et al., ACL, 2018

Hierarchical Photo-Scene Encoder



Wang, Bairui, et al., AAAI, 2019

Hierarchically Structured Reinforcement Learning



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Overview

Tasks	Main Techniques
Rap Lyric Generation [Potash Peter et al.,15]	LSTM + Explicit Templates
Rap Lyric Generation [Malmi Eric et al., 16]	Information Retrieval Task
Chinese Song Iambics Generation [Wang et al.,16]	Attention-Based Seq2seq
Chinese Couplet Generation [Yan Rui et al., 16]	Seq2seq + Attention + Polishing
Rhythmic Verse Generation [Hopkins Jack, 17]	Multi-LSTM LM + Finite State Transducers
Theme-Aware Lyrics Generation [Wang Jie, 19]	Multi-Channel Seq2seq + LDA

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Conventional Line

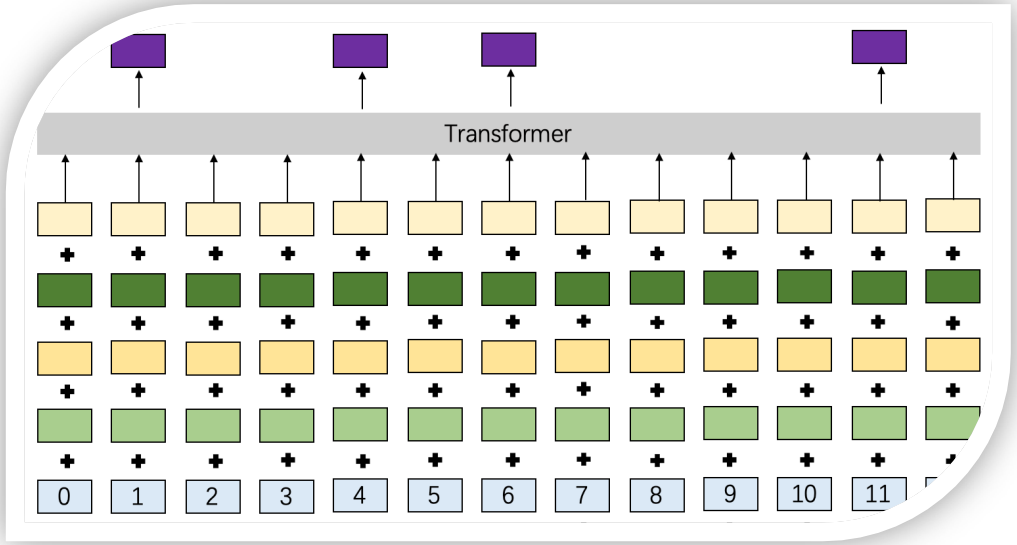
- Better Methods and Techniques
  - Inverse Reinforcement Learning
  - Mutual Learning
  - Imitation Learning
  - Mutual Information Estimation

- New Datasets and New Attributes
  - Counterfactual story reasoning
  - Common sense
  - Modern poetry in different languages

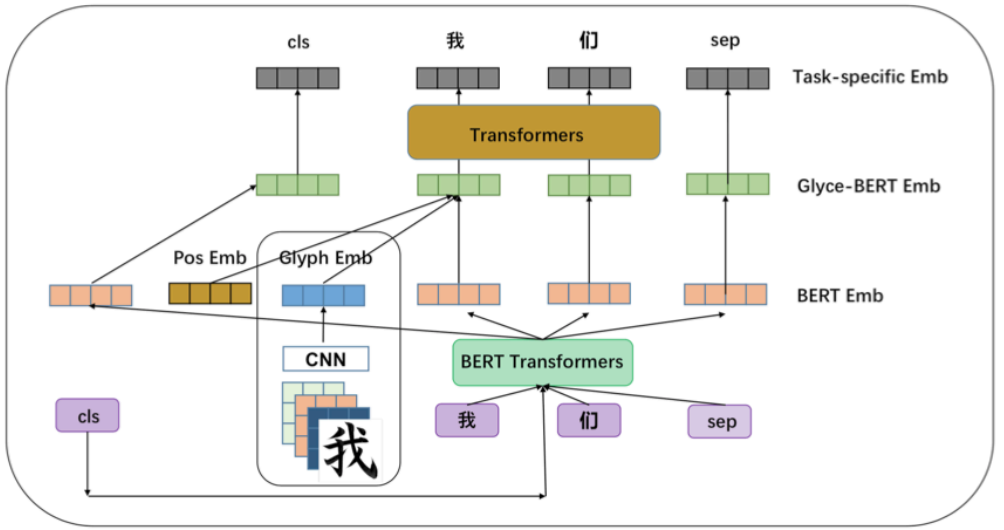
- Task-Specific Settings
  - Character-centric story generation
  - Topic-aware

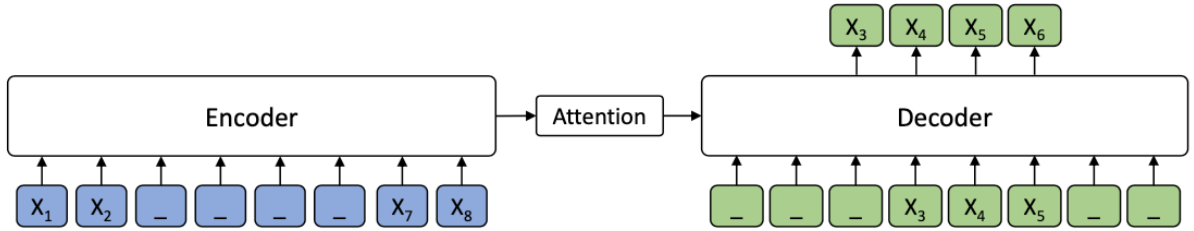
Pretraining-Based Methods

Rhythm
Glyph
Tonal
Writer

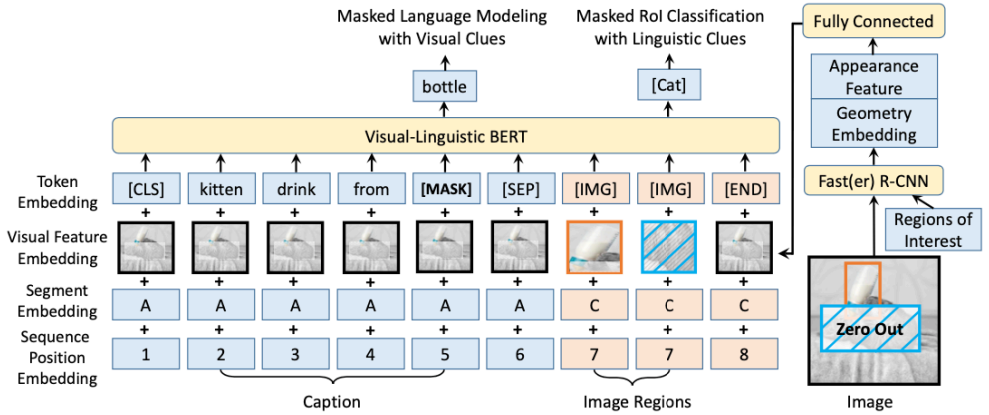


Yuxian Meng et al. NeuralPS' 19



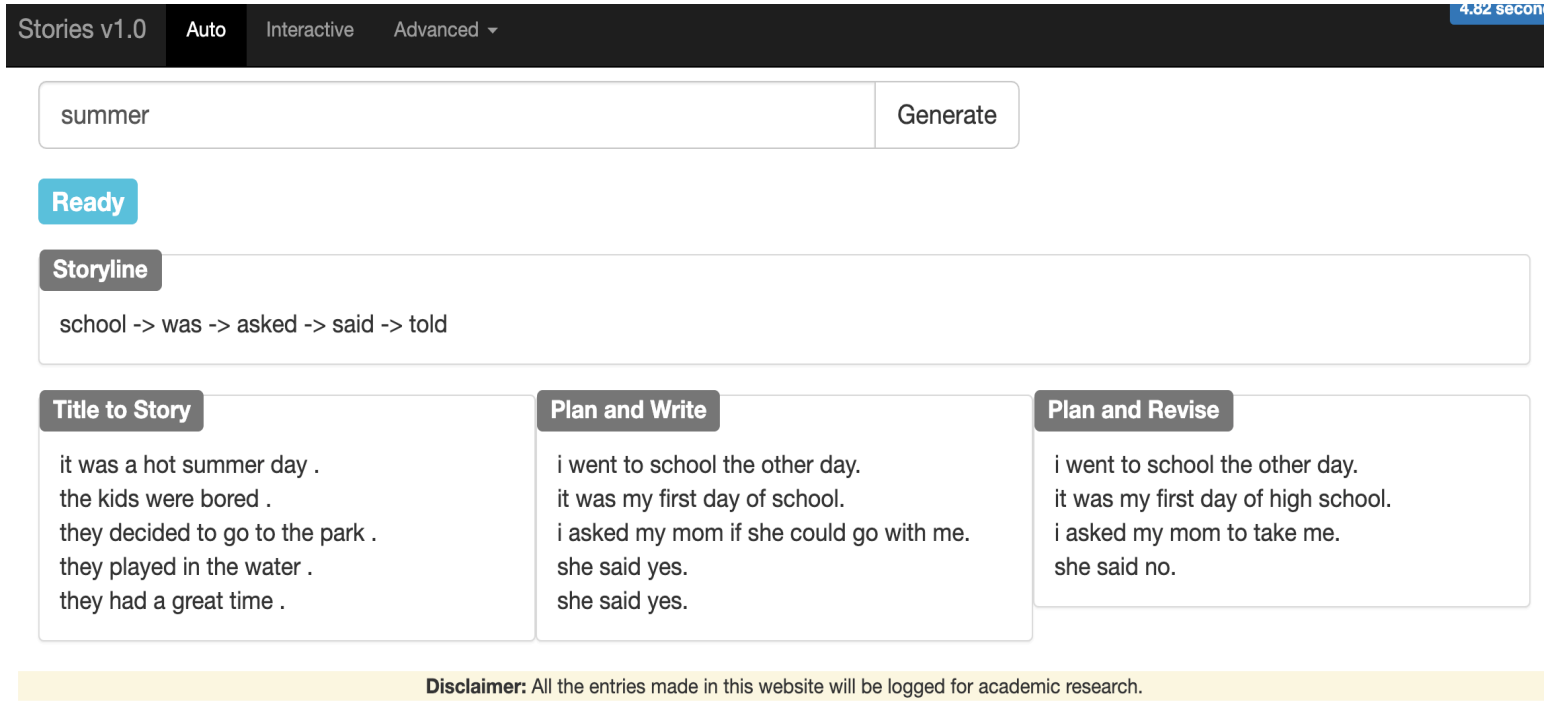


Kaitao Song et al.ICML' 19



Structured Generation Pipeline

- Parsing
- Entity detection
- Sequence labeling
- Relation extraction
- Sentiment analysis
- Action planning
- Controllable generation
- Style transfer
- Logic checking
- Grammar error correction



Evaluations

- Challenges

  For each task or released dataset, there is no standard automatic evaluation metrics.

  Automatic metric from other text generation tasks are not proper.

  Bias between evaluations of domain experts, crowd workers, and users.

  The correlations between automatic evaluation metrics and human evolutions are low.

  One reference for each generated instance cannot reflect the performance of generation models.

  Owing to the diversity of genres and task attributes in artistic text generation, evaluation metrics cannot generalize well for different scenarios.

Conclusion

- Poetry Generation
- Story Generation
- Multi-Modal Generation
  Image-Inspired Poetry Generation
  Visual Storytelling
- Other Genres

Roadmap

- Introduction
- Background Knowledge
- Existing Methods
  - Poetry Generation
  - Story Generation
  - Multi-Modal Generation
  - Other Genres
- Recent Trends and Future Direction
- Q&A

Thank you!