Creative and Artistic Text Generation

Li Juntao and Yan Rui
Peking University
Macao, China

URL: https://lijuntaopku.github.io/ijcai2019tutorial/
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 Conclusion
• Q&A
Roadmap

• Introduction
• Background Knowledge
• Existing Methods
  Poetry Generation
  Story Generation
  Multi-Modal Generation
  Other Genres
• Recent Trends and Conclusion
• Q&A
Task Description of Poetry Generation

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

Input:
- Topic: Presidential elections
- To hear the sound of communist aggression!
  I never thought about an exit poll,
  At a new Republican convention,
  On the other side of gun control.

Output:
- Missing You
  红豆生南国, (*Z P P Z)
  Red berries born in the warm southland.
- How many branches flush in the spring?
  愿君多采摘, (*P P Z Z)
  Take home an armful, for my sake,
  此物最相思. (*Z Z P P)
  As a symbol of our love.

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

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fans came together to celebrate the opening of a new studio for an artist.</td>
<td>The artist provided champagne in flutes for everyone. Friends toasted and cheered the artist as she opened her new studio.</td>
</tr>
<tr>
<td>Last week I attended a wedding for the first time.</td>
<td>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.</td>
</tr>
</tbody>
</table>

Table 1: An illustration of narrative story generation.
Demo Story Generation System

Input

Output

```plaintext
Title to Story
it was a hot summer day.
the kids were bored.
they decided to go to the park.
they played in the water.
they had a great time.

Plan and Write
i went to school the other day.
it was my first day of school.
i asked my mom if she could go with me.
she said yes.
she said yes.

Plan and Revise
i went to school the other day.
it was my first day of high school.
i asked my mom to take me.
she said no.
```

Disclaimer: All the entries made in this website will be logged for academic research.

http://cwc-story.isi.edu/
Goldfarb-Tarrant et al., NAACL-HLT ’2019
Image-Inspired Poetry Generation

**Input**

- Photograph of a serene lake with a boat.
- Photograph of a charming garden with flowers and a house.

**Output**

**Chinese Input:**

- 浮舟一曲水平堤,
- I sing a fishing song on a boat in the lake overflowing its bank,
- rowing oars with the sun setting in the west.
- 长忆西湖水中秋月,
- 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.

**Chinese Output:**

- 春风庭院养花姿,
- Breeze blows beautiful flowers in the courtyard,
- 春入帘桃叶满枝。
- Spring comes into my window, with leaves covering the branches.
- 堪笑门前青草短。
- 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.
Visual Storytelling

**Input**

- (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.

**Captions:**

- **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.

---

**Output**

- 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!

**Album Storytelling**

- 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.
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

**Couplet**

**Verse**

**Iambics**

**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**Z*PPP)
How is my home country now, in the same moonlight?
雕栏玉砌应犹在， (*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,
恰似一江春水向东流。 (**P**Z*PPP)
Flows like the river. It never ends.
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 can’t take it all happens

Ballads

Song Lyrics
References

Roadmap

• Introduction
• Background Knowledge
• Existing Methods
  Poetry Generation
  Story Generation
  Multi-Modal Generation
  Other Genres
• Recent Trends and Conclusion
• Q&A
Sequence to Sequence Model

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

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
References


Roadmap

• Introduction
• Background Knowledge
• Existing Methods
  Poetry Generation
  Story Generation
  Multi-Modal Generation
  Other Genres
• Recent Trends and Conclusion
• Q&A
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)
  \[ v_i = CSM(S_i) \]

- Recurrent Context Model (RCM)
  \[ u_i^j = RCM(v_{1:i}, j) \]

- Recurrent Generation Model (RGM)
  \[ P(w_{j+1}|w_{1:j}, S_{1:i}) = RGM(w_{1:j+1}, u_{i}^{1:j}) \]

- Training
  Cross Entropy Errors

Xingxing Zhang et al. EMNLP’14
Planning-Based Recurrent Neural Model

- **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
GAN for Poetry Generation

- GAN
  Min-Max Game

- Generator
  Reinforcement learning
  MC search

- Discriminator

![Diagram of GAN for Poetry Generation]

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Human score</th>
<th>p-value</th>
<th>BLEU-2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLE</td>
<td>0.4165</td>
<td>0.0034</td>
<td>0.6670</td>
<td>&lt;10^{-6}</td>
</tr>
<tr>
<td>SeqGAN</td>
<td><strong>0.5356</strong></td>
<td></td>
<td><strong>0.7389</strong></td>
<td></td>
</tr>
<tr>
<td>Real data</td>
<td>0.6011</td>
<td></td>
<td>0.746</td>
<td></td>
</tr>
</tbody>
</table>

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

Xiaoyuan Yi et al., IJCAI’18
Conditional Variational Autoencoder

Thematic Poem Generation

Keywords

Prior Network

Recognition Network

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
References

References

Roadmap

• Introduction
• Background Knowledge
• Existing Methods
  Poetry Generation
  Story Generation
  Multi-Modal Generation
  Other Genres
• Recent Trends and Conclusion
• Q&A
Coherent Story Generation

Task Description

Model

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

- 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

**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. [...]
Skeleton to Story Generation

- Skeleton-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

- Plan and Write
- Static Planning
- Dynamic Planning

Planning Method

Yao, Lili, et al., AAAI, 2019
CVAE and Memory Network

• CVAE
  Wording Novelty

• Cache
  Coherence

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
BERT Augmented Story Ending Prediction

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

Training Framework

Li, Zhongyang et al., IJCAI, 2019
References

Roadmap

- Introduction
- Background Knowledge
- Existing Methods
  - Poetry Generation
  - Story Generation
  - Multi-Modal Generation
  - Other Genres
- Recent Trends and Conclusion
- Q&A
Image Inspired Poetry Generation

- Image-Based Encoder
  CNN
  Bidirectional RNN

- Memory-Based Decoder
  Keyword Extractor
  Vector Representations

---

Image-based Encoder - CNN
Bidirectional RNN

Memory-based Decoder

Keyword Extractor

Topic Memory Network

VGG-19

Xu, Linli, et al., AAAI, 2018
Visual Poetry Generation of XiaoIce

Keyword Extraction

Keyword Generation

Keyword Filtering + Keyword Expansion

Automatic Evaluator

Poem Generation

Framework

Cheng, Wen-Feng, et al., arXiv:1808.03090, 2018
Multi-Modal Poetry Generation

First line: Travelling passengers came and went.

Thought of old friends brings me into melancholy

Liu, Dayiheng, et al., IJCNN, 2018
Multi-Adversarial Training

Deep Coupled Visual-Poetic Embedding Model

Generator as Agent

Discriminators as Rewards

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
References

Roadmap

• Introduction
• Background Knowledge
• Existing Methods
  Poetry Generation
  Story Generation
  Multi-Modal Generation
  Other Genres
• Recent Trends and Conclusion
• Q&A
## Overview

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Main Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rap Lyric Generation [Potash Peter et al., 15]</td>
<td>LSTM + Explicit Templates</td>
</tr>
<tr>
<td>Rap Lyric Generation [Malmi Eric et al., 16]</td>
<td>Information Retrieval Task</td>
</tr>
<tr>
<td>Chinese Song Iambics Generation [Wang et al., 16]</td>
<td>Attention-Based Seq2seq</td>
</tr>
<tr>
<td>Chinese Couplet Generation [Yan Rui et al., 16]</td>
<td>Seq2seq + Attention + Polishing</td>
</tr>
<tr>
<td>Theme-Aware Lyrics Generation [Wang Jie, 19]</td>
<td>Multi-Channel Seq2seq + LDA</td>
</tr>
</tbody>
</table>
References

Roadmap

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

• Learning Method
  Reinforcement Learning
  Inverse Reinforcement Learning
  Mutual Learning
  Imitation Learning

• Fine-Grained Controlling
  Sentiment
  Ending
  Forms

• Pre-Training Method
  GPT
  BERT
  XLNet
Recent Trends

- Better Evaluation Metrics
- Commonsense and Knowledge
- Reasoning
- New Forms of Artistic Text
- Explainability
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 Conclusion
• Q&A
Thank you!