Story generation

CS 685, Fall 2021
Advanced Natural Language Processing

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story generation

produce a narrative that follows from a given input prompt or context
Flowers have become so rare that they are the most sought after items in the world, sold at high prices in black markets, under guard in national museums etc. You just stumbled across a natural rose.
Flowers have become so rare that they are the most sought after items in the world, sold at high prices in black markets, under guard in national museums etc. You just stumbled across a natural rose.

It was the color of a sunset: red tipped petals faded to yellow. Stark contrast to the roiling forever-cloud above it. A thick green stem climbed out of a crack in the dry earth, thorns lining it like a ladder. It had been hidden between two dry logs, lying flat like hollowed bones. It must have peered out from between the dead trees only in the last few days, and I had been the first to stumble upon it.

It was worth more than my life.

Below me lay my village of rusted huts. They littered the valley sporadically, as if a train had been derailed and its carriages rolled free, far and wide. Men and women worked around the shacks, digging and raking the land, trying to grow weeds that could be eaten, as kids kicked tins into makeshift goals around them.

The rose was worth more than any of their lives too. All of them together, even. What a biodome would pay for it...

https://www.reddit.com/r/WritingPrompts/comments/dk2gdx/wp_flowers_have_become_so_rare_that_they_are_the/
prompt: Flowers have become so rare that they are the most sought after items in the world, sold at high prices in black markets, under guard in national museums etc. You just stumbled across a natural rose.

story: It was the color of a sunset: red tipped petals faded to yellow. Stark contrast to the roiling forever-cloud above it. A thick green stem climbed out of a crack in the dry earth, thorns lining it like a ladder. It had been hidden between two dry logs, lying flat like hollowed bones. It must have peered out from between the dead trees only in the last few days, and I had been the first to stumble upon it.

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GPT-2 large generates:

We have to be prepared and take care of the plants.

We can provide your flowers in all kinds of colors. The most important thing to remember when choosing flowers is the color of the petals.

Please use these links for more information.

http://www.floralkids.com/flowers/natural-flowers/flowers-for-lilies/
http://www.floralkids.com/flowers/natural-flowers/rose/
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**Prompt:**

We have to be prepared and take care of the plants. We can provide your flowers in all kinds of colors. The most important thing to remember when choosing flowers is the color of the petals. Please use these links for more information.

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... complete garbage
this task is extremely hard!

• many different plausible stories per prompt, which makes training / evaluation difficult

• do we need to model the *planning* process?

• stories can be really long

• stories have all sorts of complex linguistic phenomena
nevertheless, there’s lots of recent work on story generation!

- Fan et al., ACL 2018: *Hierarchical Neural Story Generation*

- Yao et al., AAAI 2019: *Plan-And-Write: Towards Better Automatic Storytelling*

- Tambwekar et al., IJCAI 2019: *Controllable Neural Story Plot Generation via Reward Shaping*

and many more!
<table>
<thead>
<tr>
<th>Title (Given)</th>
<th>The Bike Accident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storyline (Extracted)</td>
<td>Carrie → bike → sneak → nervous → leg</td>
</tr>
<tr>
<td>Story (Human Written)</td>
<td>Carrie had just learned how to ride a bike. She didn’t have a bike of her own. Carrie would sneak rides on her sister’s bike. She got nervous on a hill and crashed into a wall. The bike frame bent and Carrie got a deep gash on her leg.</td>
</tr>
</tbody>
</table>
You’re a Werewolf. You begin to transform, but instead of a terrifying beast, you turn into a small puppy.

Action Plan with Semantic Role Labeling

Story Prompt

Entity Anonymized Story

Full Story

I opened my eyes. Looking to my razor-sharp claws, I found that they were now neatly clipped. My ears flopped on either side of my head lazily, too soft and formless to hunt properly. Most of all, the hunger was gone. Confusion clouded my mind and I tilted my head instinctively. I approached a nearby puddle and looked in.
no standard datasets

• Fan et al., ACL 2018: *Hierarchical Neural Story Generation*: reddit r/writingprompts

• Yao et al., AAAI 2019: *Plan-And-Write: Towards Better Automatic Storytelling*: ROCStories

• Tambwekar et al., IJCAI 2019: *Controllable Neural Story Plot Generation via Reward Shaping*: CMU Movie Summaries
automatic evaluations?

- See et al., CoNLL 2019: *Do Massively Pretrained Language Models Make Better Storytellers?*
  - how related is prompt to story?
  - how coherent is the story?
  - how much does the model repeat itself?
  - how syntactically complex are the stories?
  - how surprising are the stories?
automatic evaluations?

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“human evaluation... currently the only reliable way to assess overall text quality”
how do we set up human evaluations for story quality?

- human eval of Fan et al: given a shuffled collection of three prompts and three generated stories, match them up

- human eval of Yao et al: given a prompt and two stories generated by two different models, pick which story is better
machine-in-the-loop storytelling

• How do we get evaluators to read and engage with long, complex stories?

• What if the people evaluating stories were also authors of the stories?

• **machine-in-the-loop** storytelling: a model provides *suggestions* (e.g., of scenes) to real authors, who can then use the generated text directly or as inspiration in their final story.

  Roemelle et al., ICIDS 2015, Clark et al., IUI 2018
machine-in-the-loop storytelling

- A text generation model provides *suggestions* (e.g., scenarios) to real authors, who can then use them as inspiration for their final story.

*user query:*
Flowers have become so rare that...

*Blackbox API*  
*story generation*  

*model output:*
It was the color of a sunset, red-tipped petals faded to yellow...
STORIUM: a dataset and evaluation platform for story generation

www.storium.com

Nader Akoury

Shufan Wang

Nanyun Peng
Chapter 1, Scene 1  

The storefront was empty of all decoration, but everyone around town had heard what this place was going to be: Inspectres.

The infamous company known for hunting down the supernatural around the continental United States (plus a few franchises in Canada and one right across the Mexican border) had staked a franchise claim in this city and was having open interviews for anyone who wanted to
stories are written by a group of users, each of whom write from the perspective of a different character.
each character is associated with a set of properties ("cards")
a “narrator” user creates challenges for the characters to solve. characters write scene entries addressing these challenges.

Emilia was fascinated! This wasn’t some silly hoax, but the real thing. She and her co-workers had seen videos of the cat speaking Russian, and multiple, detailed analysis by sophisticated computers proved it wasn’t faked.

What a puzzle! Emilia spent the next several hours investigating reports of animals speaking human languages. There was a lot of information to go through, and it led in so many directions that it was hard to come to any conclusion. The cat spoke in an odd accent, too, so computer translation wasn’t very reliable. She could have handled Spanish well enough, and even stumbled her way through other Romance languages, but Russian was, well, Greek to her.

“Anybody here speak Russian?”

It couldn’t hurt to ask.
Hit The Books

You have your personal libraries, the internet, and the public library. Time to research what you can about werewolves.

Heading towards an uncertain outcome, with 3 cards left.

Outcomes

Strong:
There are a few reasons a cat might start speaking Russian. Possession, inter-dimensional leakage... Either way you end up researching an exorcism, just in case this is a spirit or a demon.

Weak:
You find something out about a way to deal with Russian talking cats. It’s entirely wrong, and may make you look like an idiot.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># games</td>
<td>5,743</td>
</tr>
<tr>
<td># users</td>
<td>30,119</td>
</tr>
<tr>
<td># player cards</td>
<td>154,586</td>
</tr>
<tr>
<td># challenges</td>
<td>61,223</td>
</tr>
<tr>
<td># scene entries</td>
<td>448,264</td>
</tr>
<tr>
<td>total # of tokens</td>
<td>~126 million</td>
</tr>
<tr>
<td>ave tokens per entry</td>
<td>~247</td>
</tr>
</tbody>
</table>
mostly fantasy / sci-fi stories
(see topics below)

| mysterious, temple, cave, mythology, sacred, archeological, tomb, archaeological, mystical, ancient | creature, beast, monster, demon, undead, dragon, kill, snake, monstrous, evil |
| commander, gunship, artillery, spacecraft, squadron, infantry, warship, frigate, fleet, aircraft | wounded, ambush, troops, infantry, defeated, assault, paramilitary, melee, militia, enemy |
| telemetry, module, apparatus, calibration, device, monitoring, system, detection, diagnostics, sensor | prey, carnivorous, fanged, slain, bloodthirsty, demonic, fearsome, monster, demon, undead |
| nutjob, batshit, borderline, purely, lunatic, manipulation, stereoscopic, complex, propagandist | hijacker, stakeout, borta, firebomb, smuggle, safehouse, waggars, försöker, armados, ronja |
| accused, undercover, burglary, gunpoint, plainclothes, arrest, policeman, robbery, gunman, police | slope, trail, ravine, steep, coastline, shoreline, wooded, hillside, roads, river |
how do we evaluate?

- we put our models on the Storium platform!
- users can generate a suggestion using our model and then edit it. we collect their edits as well as some simple feedback.
  - compute recall-based metrics like ROUGE, or MT metrics like HTER (human-targeted translation edit rate)
- evaluation by domain experts for free!
also collect feedback scores

A Get a suggestion

The suggested text has been added to your draft — you are free to edit it, of course, or discard it entirely. Regardless of whether or not you use it, please tell us what you thought of it:

Bob has his eyes closed and a cup of tequila steaming in the bar. He slides to one knee, before pulling it out slowly onto an examination table with high polished wooden panels on top. "Hey! Man, you all right? I'm sure my dad won't be surprised at how skinny this kid looks."

Once he's been seated facing each student individually for several minutes Bob searches through their body fluids. With chewed tissue noisily dusting from him as blood continues piling up like coffee spills down a toilet seat drawers they're

How grammatically correct is the suggested text? (on a scale of 1–5, with 1 being the lowest) (Required)
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

How relevant is the suggested text to the current story so far? (on a scale of 1–5, with 1 being the lowest) (Required)
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

How well do the sentences in the suggested text fit together? (on a scale of 1–5, with 1 being the lowest) (Required)
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

How enjoyable do you find the suggested text? (on a scale of 1–5, with 1 being the lowest) (Required)
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5

Please provide any additional comments you have about the suggested text. (Optional)
We’ve built models that look like this:

**Challenge:** Find something valuable from these strangers…

**Character:** Edward: a rich but extremely introverted man

**Character card:** Untrusting: you are hurt and never trust people

**Scene entry completion:** Believing that these people are trying to sell him something, Edward sighed and turned away. The place seemed unfamiliar to him, old and poorly kept. “I am going to leave”, Edward said…

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**Previous challenge:** Investigate the strangers with the dogs…

**Previous entry written by this character:** Edward peered leisurely at the couple through the kitchen window. They were talking animatedly…

**Immediately previous scene entry:** Lisa kept shouting, and the dogs kept barking. Why were we arguing so near to the mark’s house? So stupid…
adding more context improves feedback scores

<table>
<thead>
<tr>
<th>Model</th>
<th>Fluency</th>
<th>Relevance</th>
<th>Coherence</th>
<th>Likability</th>
<th>Perplexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base (fine-tuned GPT-2 medium)</td>
<td>3.6</td>
<td>2.8</td>
<td>3.6</td>
<td>2.4</td>
<td>22.9</td>
</tr>
<tr>
<td>Base + history</td>
<td>3.7</td>
<td>3.2</td>
<td>4.1</td>
<td>2.7</td>
<td>21.0</td>
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A metric over user edits

• Intuitively, edits with fewer changes (additions or deletions) should receive a higher score, as this indicates that the generated text was useful to the Storium author.

• Our USER metric is a modification of ROUGE-LCS that measures the longest common subsequence between the edited text and the generated text.
top-$k$ sampling performs better than nucleus sampling

<table>
<thead>
<tr>
<th>Decoding algorithm</th>
<th>Fluency</th>
<th>Relevance</th>
<th>Coherence</th>
<th>Likability</th>
<th>USER</th>
</tr>
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<tbody>
<tr>
<td>top-$k$</td>
<td>4.0</td>
<td>2.6</td>
<td>3.4</td>
<td>3.3</td>
<td>15.6</td>
</tr>
<tr>
<td>nucleus</td>
<td>3.8</td>
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<td>2.9</td>
<td>3.2</td>
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We collected >300 edits for each decoding algorithm.
**top-\(k\) sampling performs better than nucleus sampling**

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correlations between Likert scores and **USER**

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<th>fluency</th>
<th>coherence</th>
<th>USER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>relevance</strong></td>
<td>0.51</td>
<td>0.28</td>
<td>0.55</td>
<td>0.51</td>
</tr>
<tr>
<td><strong>likability</strong></td>
<td></td>
<td>0.28</td>
<td>0.35</td>
<td>0.34</td>
</tr>
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<td></td>
<td></td>
<td>0.54</td>
<td>0.13</td>
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<td></td>
<td></td>
<td></td>
<td>0.25</td>
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correlations between feedback and **USER**

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<th>USER</th>
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<td>0.55</td>
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<td></td>
<td></td>
<td>0.25</td>
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**relevance** correlates most strongly with **USER**
correlations between feedback and **USER**

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fluency does not really correlate with **USER**
how do users modify the generated suggestions?

**Scene entry after user edited the suggestion:**
Chiang Lee hacked the shop's computer before going inside. That should keep them busy. Alarms went off, electronic locks opened, and they worried about losing all their data. He slipped in, and crossed the "security line". In this area of the shop there was an orange sticker across all windows. Chiang Lee was taking photos as he went for the record; every once in awhile someone wanted special items, so it would be good to keep a log. However, for now he knew exactly what he wanted - he found it, and pocketed it. It was a wide-spectrum signal blocker. It could interfere with electronic equipment, block signals and - allegedly - interfere with laser blasts and force fields. Whether CIA, FBI or UFO, anyone wanting to take him or slow him down had better stick to analogue and wood, because anything scientific or technological was toast. Chiang noticed other people taking pictures while running around the shop looking for some secret item...he blended in perfectly.

Common usage pattern: users keep short phrases from the suggestion but completely change the content
Annie checked her list again; she'd already read it multiple times, but she might now, finally, be ready for Christmas. Thanks to her new flight experience, she was actually going to be able to help deliver some of the many presents this year. She had also managed some private preparations of her own for afterwards. Now watching the snow fall softly just outside the window, Annie Bell felt the familiar Christmas tingle as the magic of the evening approached. She dressed warmly, and went to help Noelle with the reindeer, knowing the other elves would soon start to arrive to begin packing the sleigh. Back in her room, six brightly wrapped Christmas presents glinted on her desk, each labelled to one of her new found friends.

*Oh, wait*, Annie thought. *This is just like in the movies.* That's where she got stuck with a living ghost! She was surprised at how this part of Christmas went on so long - and by its strange behaviour that it started acting up again when things weren't exactly normal for her to be having fun. So... what did Annie do? She had a friend helping all over town. A caring friend who passed through Kringle every year-and-a half, passing out presents from their favourite tree as they went! And here they were going to make Christmas special (at least until a return trip home!), and now there seemed no end in sight before she'd need an exorcism, or possibly a demon blood sacrifice... But maybe if these last few days hadn't gone so very smoothly... she could reach back into her own deep pocket one more time and get her hands free – It would give you a real boost later. Lets hope nothing happened during the ritual, too... But enough "hurr durr" no n-gram overlap at all!
I feel like the AI gives me ideas for keeping things going. For example, I was going to just say they slay the big golem, but then the machine came up with there being 3 golems, so I had to keep going and rethink the story. I just kept the writing because I like what I was doing with the cards, and every time the AI changed the story, I just worked with it like a friend giving me ideas.
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I tried it in one story that is almost dead, just to see what the ai would come up with. It was hilarious, bad and amazing at the same time.
user feedback

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In my head, now, I’m starting to assign bios to the AIs
- sweary wild-child outsider who keeps getting piercings and tattoos and stands around at parties, glaring at the more popular kids.
- the reluctant kid who’s actually quite keen to be involved but a little shy to start with.
- the convent-educated naive kid who’s just taken LSD for the first time and whoa... gotta tell you about all the cyberpunk stuff!