Leveraging Low-resource Parallel Data for Text Style Transfer

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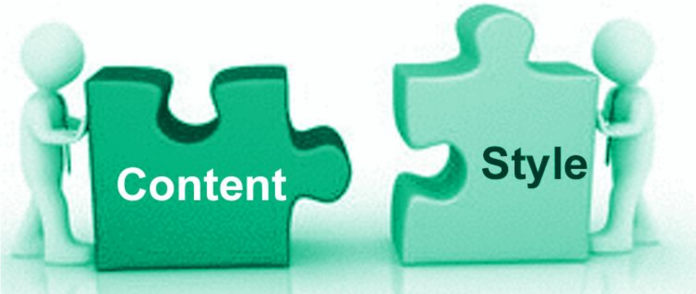
Introduction

Text Style Transfer(TST)



- Change style of given input text.
- Preserve style-independent content.
- **Style**: *demographic attrib (personality, gender), sentiment, politeness, etc.*

- No parallel data sets.
- Hard to detect styles.
- Preserving the structure and meaning of the input.
- Automatic evaluations.

Sentiment Transfer

- A sub-task of TST
- Converts positive to negative text and vice versa,
- Without changing content.
- **Uses**:
  - Marketing
  - Content Moderation
  - Communication improvement

Neg: The food is tasteless.

Pos: The food is delicious.

Parallel vs Non Parallel dataset in TST

- Parallel Data
  - Sentence pairs with aligned content and style labels
  - Limited Availability
    - Collecting & aligning can be time-consuming and expensive
- Non-Parallel Data
  - Sentence pairs that lacks aligned content and style labels.
    - Sentences where the content and style are not matched together
  - Model Complexity
    - Requires sophisticated models for effective style transfer

Our Work

Overview

- Aim: best of both parallel & non-parallel
- Building a TST system with low-resource parallel data
  - Application of multiple low-resource adaptation techniques
  - Introduction of a novel style reward approach
- Well-balanced results
  - Surpassing previous non-parallel approaches
  - In both automatic and human evaluation

Methodologies

- Hyperparameter tuning
- Prompt-guided generation
- Data augmentation
- Self-training & Filtering
- Style reward

Prompt-guided generation

POS: everything is fresh and so delicious ! ➡ *NEG*: everything was so stale

Data augmentation

Methods	Original Text	Augmented Text
Spelling	we went with a group of eight and all had a great time .	we went with a group od aight and all has and great tiem.
Insert	we went with a group of eight and all had a great time .	we all went there with such a group of eight and all had had a completely great time.
Substitute	seriously though , i have never shopped here .	seriously sara, i actually never shopped anywhere.
Synonym	great prices , great selection .	great price, great excerption.
Swap	really enjoyed the beautiful range .	enjoyed really beautiful the range.
Delete	seriously though , i have never shopped here .	seriously, i shopped here.
Split	the place was too packed, we did not enjoy it	the pla ce was too p acked, we did not e njoy it
Back_translation	the biscuits and gravy were good .	the cookies and sauce were good.

Self-training & Filtering

Original Input: everything is fresh and so delicious ! ➡ *Synthetic Output*: these donuts have the worst texture and taste.

(generated by base model)

Filtering

- Enhancing Synthetic Data Quality
- *Filtering Criteria*: style classifier accuracy, BLEU, and embedding similarity.
- *Sentence Scoring*: the geometric mean of these metrics.
- *Selecting Top Scores*: best of the generated synthetic data with the highest scores (*top k*).

Style reward

- *Aim*: improve generator focus on the target style accuracy.
- Use rewards from a style classifier in the training loss.
- *Reward* : +1 for matching the target style, -1 for not matching.
- Train with weighted combination of style rewards & cross-entropy loss

Task: *Pos to Neg*

Input: everything is fresh and so delicious ! delicious ! ➡ *Generated Output*: everything is fresh and so **R:** *-1*

Input: everything is fresh and so delicious ! ➡ *Generated Output*: everything was so stale. **R:** *+1*

Datasets

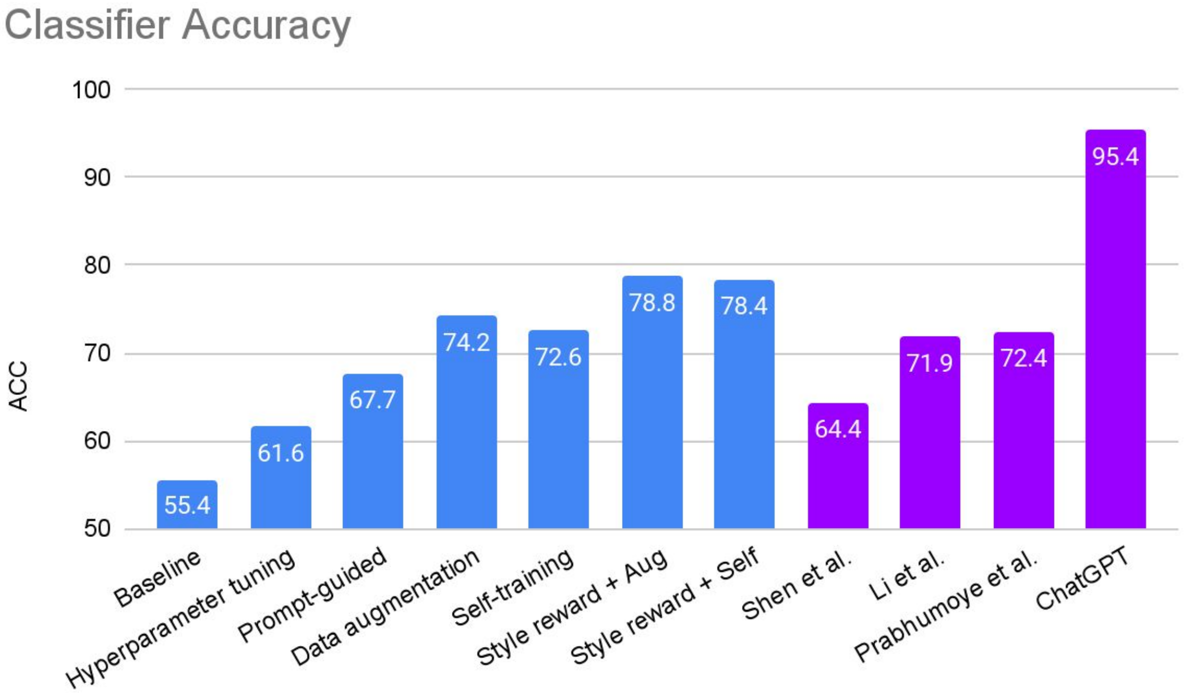
- Small parallel sentiment transfer dataset
- From Yelp reviews by Li et al. (2018)
- 500 positive-to-negative sentences
- 500 negative-to-positive sentences

Evaluation

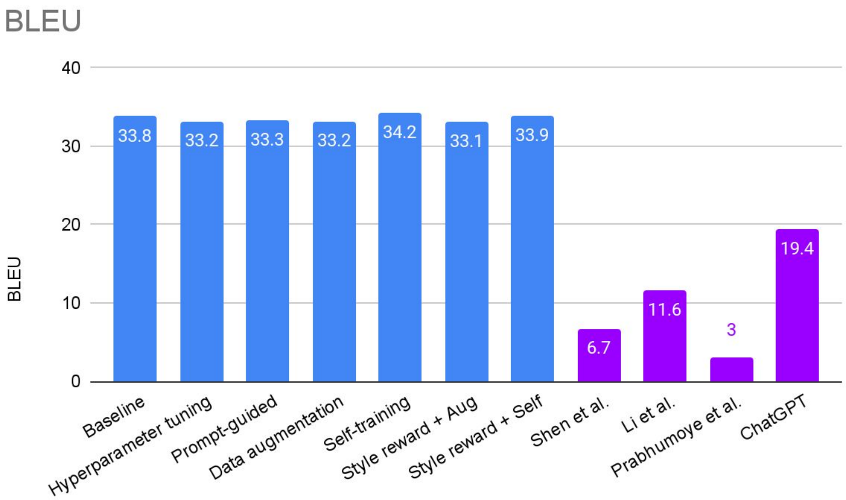
- Automatic evaluation
  - Sentiment Transfer: sentiment classifier accuracy
  - Content Preservation: BLEU, SBERT cosine similarity
  - Fluency: GPT-2 PPL
- Human evaluation
  - Style transfer, content preservation, fluency
  - 1-5 Likert scales

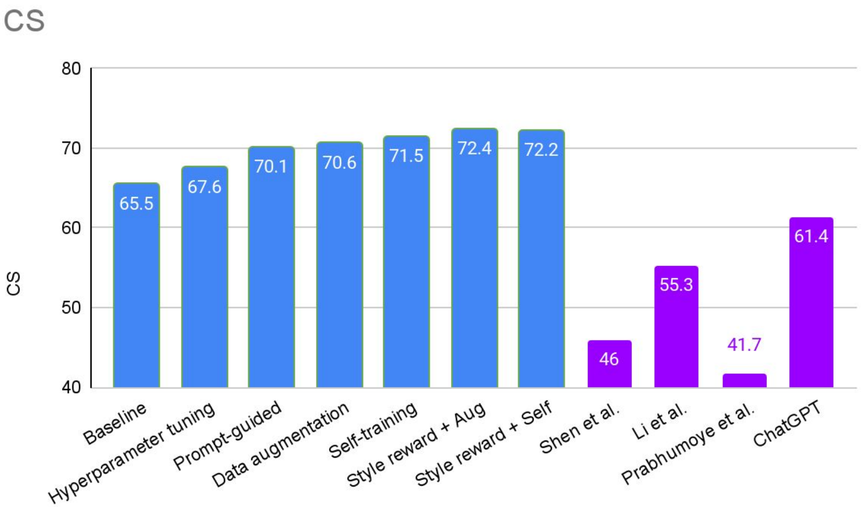
Results

Automatic: Style Transfer Accuracy

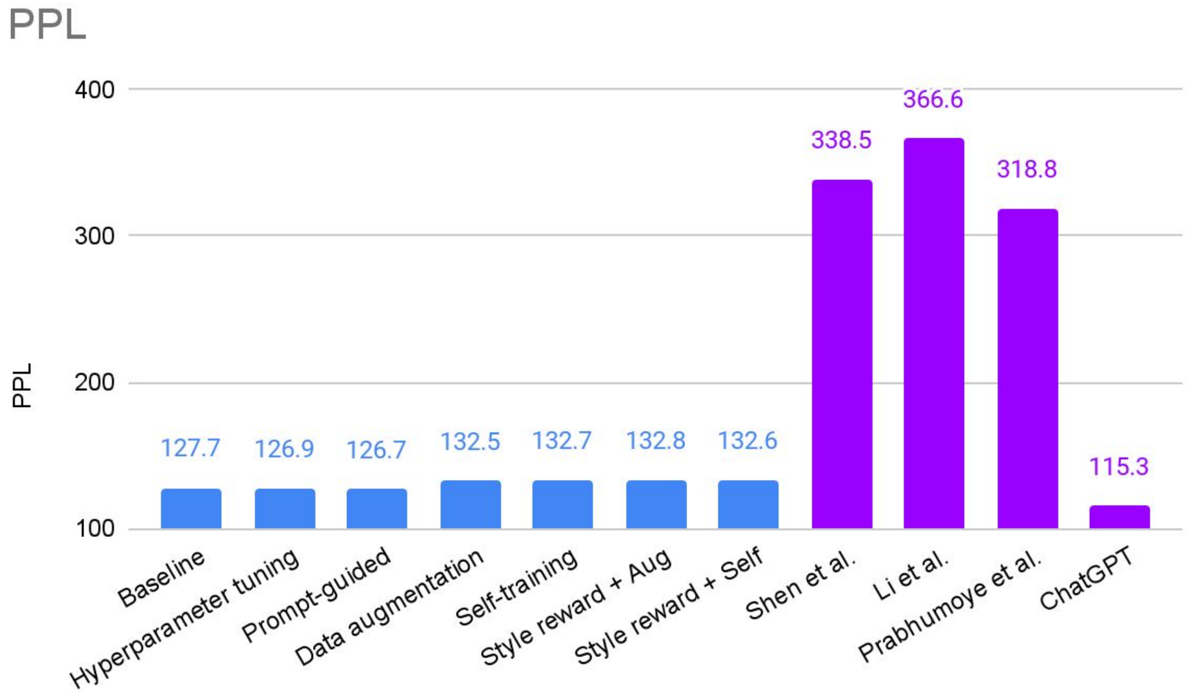


Automatic: Content Preservation

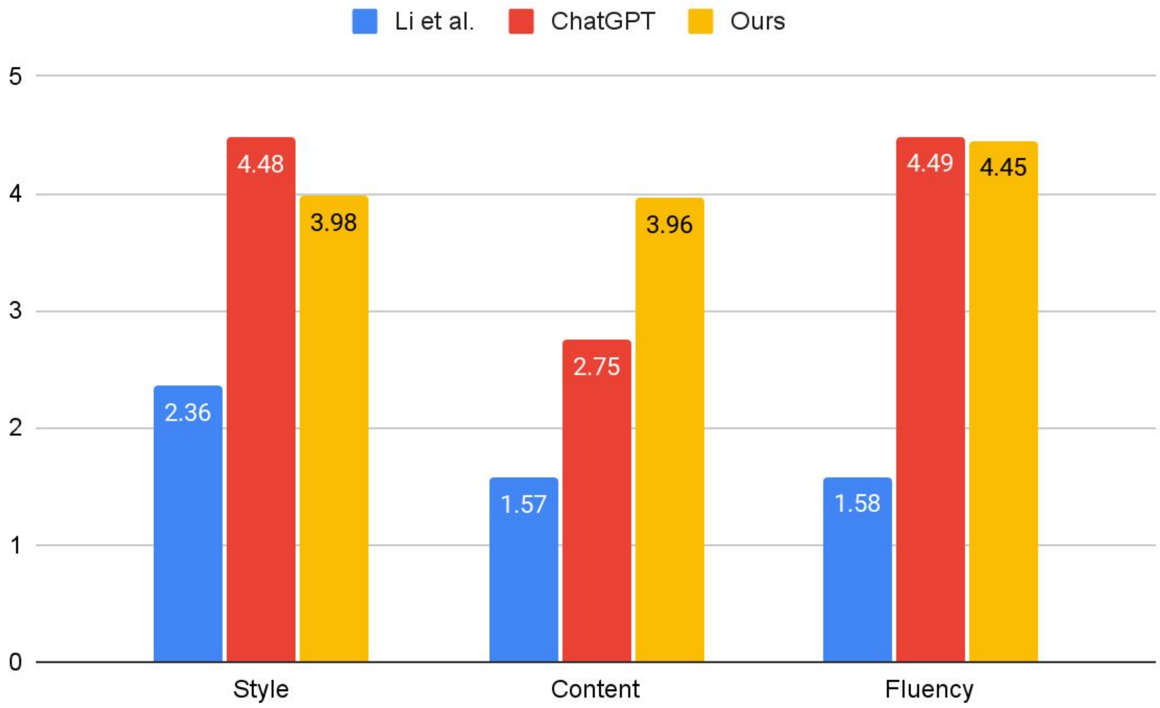




Automatic: Fluency



Human Evaluation



Conclusion

- *Text Style Transfer (TST)*: a growing research area
  - Challenges: content preservation and style transfer together, linguistic consistency, evaluation
- Our contributions:
  - Effective Use of Minimal Parallel Data
  - Style Classifier Rewards Further Improve Performance
  - Achieving Balanced Style Transfer, Content Preservation, and Fluency
    - Outperformed Non-Parallel Approaches
    - Value of Parallel Data: Highlighted its usefulness even with limited amounts.
- Future work:
  - Expanding Low-Resource Techniques
  - Exploring Different Style Transfer Tasks

Thank You

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https://github.com/souro/low_tst

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