TIGS: An Inference Algorithm for Text Infilling with Gradient Search
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Introduction

Text Infilling:
- Sequence missing value reconstruction (e.g., for damaged or historical documents)
- Lexically constrained sentence generation
- Fill in the blanks (e.g., Lyrics and poetry generation)

Challenge: given a well-trained sequential generative model, generating missing symbols conditioned on the context is challenging for existing greedy approximate inference algorithms.

Main Contribution:
- We propose an iterative inference algorithm based on gradient search, which could be the first inference algorithm that can be broadly applied to any neural sequence generative models for text infilling tasks.
- Extensive experimental comparisons show the effectiveness and efficiency of the proposed method on three different text infilling tasks, compared with five state-of-the-art methods.

Methodology

Algorithm 1 TIGS algorithm

Input: a trained seq2seq model, a pair of text infilling data ($x$, $y^*$), output length $m$.
Output: a complete output sentence $y^*$.

1. Initialize the infilled word set $\hat{y}$ and initialize $y^*$ by infilling $y^*$ with $\hat{y}$.
2. Initialize $y^{emb}$ by looking up the word embedding matrix $W_{emb}$.

for $t = 1, 2, \ldots, T$ do
   for $j = 1, 2, \ldots, |B|$ do
      O-step:
         $\hat{y}^{emb}_j$ by gradient $\nabla_{\hat{y}^{emb}} \mathcal{L}(x, y^*)$
      P-step:
         $\hat{y}_j$ = arg min $\mathcal{L}_{NLL}(x, y^*)$

end for

Update $y^*$ with $\hat{y}_j$

break if convergence then
end if

return $y^*$

Experiments

Three Datasets:
- DailyDialog
- Chinese Poetry
- Amazon product reviews

Six settings:
- Mask ratio: 25% 50% 75%
- Mask strategy: random middle

Partial Results

Seven baselines:
- UniRNN + left-to-right beam search
- UniRNN + right-to-left beam search
- UniRNN + f + b
- BiRNN-BiBS
- BiRNN-GSN
- Mask-Seq2Seq
- Mask-Transformer

Our code and data are available at https://github.com/dayihengliu/Text-Infilling-Gradient-Search