Is Everything in Order?
A simple way to Order Sentences

Somnath Basu Roy Chowdhury*, Faeze Brahman*, Snigdha Chaturvedi
Motivation

Sentence Ordering Task:

- Organizing a shuffled set of sentences into a coherent text

Shuffled Input

1. I packed my raincoat.
2. The forecast called for rainy.
3. It never rained.
4. The weather is never predictable.
5. Instead it started to snow.
Motivation

Sentence Ordering Task:

- Organizing a shuffled set of sentences into a coherent text
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Sentence Ordering Task:
- Organizing a shuffled set of sentences into a coherent text
- Requires understanding of causal and temporal relations.
- Applications in NLG, QA, etc.
Prior Works

• Pointer networks for Pairwise Ranking (Gong et al., 2016, Logeswaran et al., 2018a, Cui et al., 2018, Yin et al., 2019, 2020)

• Solving a ranking problem (Chen et. Al, 2016)

• Constraint solving + topological sorting (Prabhumoye et al., 2020)

• SOTA: Novel Pointer Decoder with Deep relational module (Cui et al., 2020)
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• SOTA: BERSON, proposed a novel Pointer Decoder with Deep relational module (Cui et al., 2020)
Re-order BART (Re-Bart)

- Solve the task as a conditional text-to-marker generation problem
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What are the advantages of text-to-marker setup over text-to-text setup?

• Less susceptible to neural degeneration.

• Text-to-text often generate tokens that are not part of the input.
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Datasets

**Paper Abstracts**
- NeurIPS
- AAN
- ACL
- NSF Research Awards
- arXiv

**Narratives**
- ROCStoris
- SIND
- Wikipedia Movie Plots
Evaluation Metrics

- **Accuracy**: The fraction of output sentence positions predicted correctly

- **Perfect Match Ratio**: The fraction of sentence orders exactly matching with the correct order

- **Kendall’s Tau**: The correlations between predicted and gold order

\[
\tau = 1 - \frac{2\ (#\text{inversions})}{\binom{n}{2}}
\]
Results
Results

Paper Abstracts

Accuracy

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Results

Paper Abstracts

Accuracy

Accuracy (%)

NeurIPS  AAN  NSF  arXiv

AON  TGCM  B-TSort  BERSON  Re-Bart
Results

Paper Abstracts

**Accuracy**

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**Perfect Match Ratio**

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Paper Abstracts

Accuracy

Perfect Match Ratio

Accuracy (%)

PMR (%)

NeurIPS  AAN  NSF  arXiv

NeurIPS  AAN  NSF  arXiv

AON  TGCM  B-TSort  BERSO  Re-Bart
Results

Paper Abstracts

Perfect Match Ration

SIND

ROCStories

PMR (%)
Results

Paper Abstracts

Perfect Match Ration

Kendall’s Tau

PMR (%)

HAN  FUDecoder  RankTxNet  BERSON  Re-Bart

SIND  ROCStories

Tau

SIND  ROCStories
Results

How does text-to-text framework perform?
Results

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![Graph showing performance comparison between BART (finetuned) and ReBART across different datasets: NeurIPS, AAN, SIND, NSF, arXiv, and Movie Plots. The graph indicates varying PMR percentages for each dataset.](image)
Results

How does text-to-text framework perform?
Results - BART vs T5

BART

T5

Accuracy  PMR  Kendall's Tau

Accuracy  PMR  Kendall's Tau

text-to-text  text-to-marker
Results - BART vs T5

BART embeddings

T5 embeddings
Ablations

- shuffled output
- w/o markers
- random markers
- ReBART

Best PMR

PMR
Analysis - Effect of Shuffling
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Degree of shuffling $d(S^*, S')$: Minimum number of swaps required to reconstruct ordered sequence $S^*$ from shuffled input $S'$

$$\hat{d}(S^*, S') = \frac{d(S^*, S')}{|S^*|}$$
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Investigate the effect on Re-BART’s performance varies with change in number of input sentences in the sequence
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Investigate if Re-BART predict sentences at certain positions better than others

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For incorrect predictions $Y$, investigate how far it was from the correct prediction $Y^*$. Computed as the minimum number of swaps $d(Y, Y^*)$. 
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![Graph showing the relationship between $d(Y, Y^*)$ and the number of instances.](image-url)
Analysis - Sentence Displacement
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![Graph showing accuracy against relative displacement]
Cross-Attention Visualization
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Attention is concentrated near the sentence markers.
Takeaways

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