

# Improving Performance of PRIDE Algorithm through Advanced Methods

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# 1. Introduction

## Relationship Extracting Tasks

- Identification & **Classification** of relationships between entities from sentences
  - recognizing the entities involved
  - understanding the interactions between them
- Utilizes NLP techniques
  - to analyze text
  - to infer meaningful relationships
- Applications: social network analysis, product recommendation systems, etc.

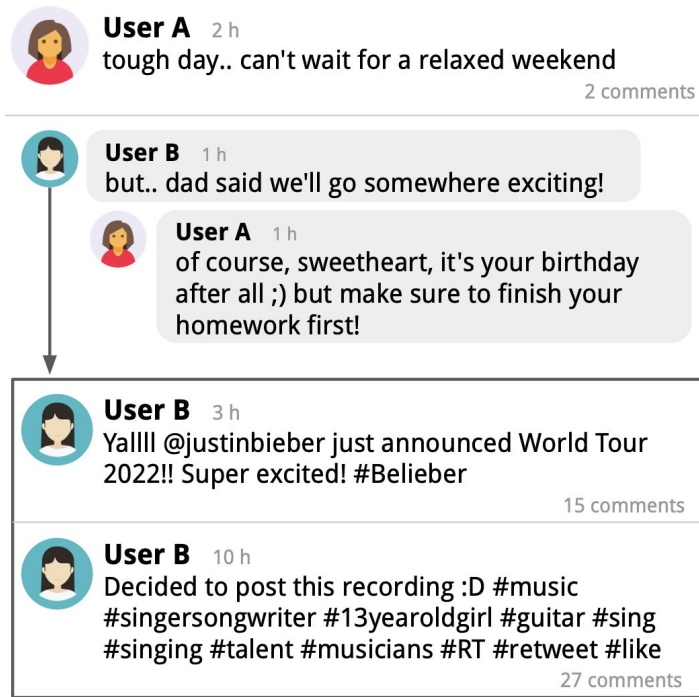


Figure 1: Example of conversation in social media.

## 2. Related Work

### PRIDE (ACL 2021)

- neural multi-label classifier for Predicting Relationships In DialogueE
- Makes inference among 12 fine-grained directed speaker's relationships from dialogue

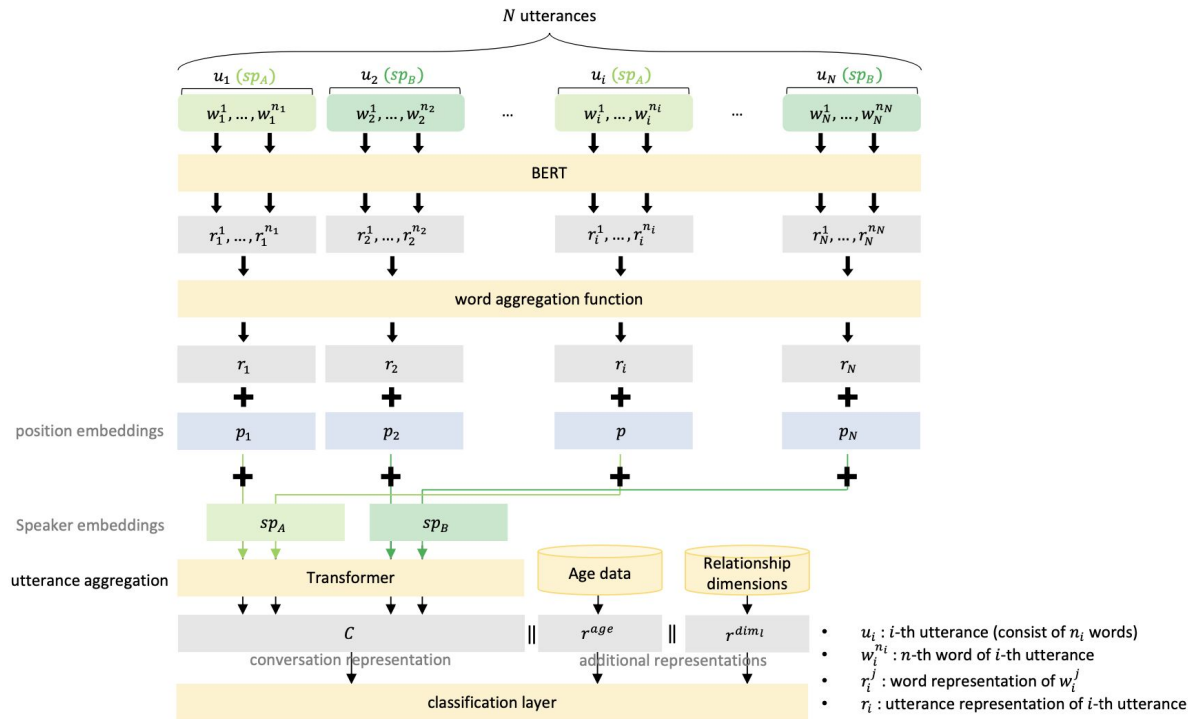


Figure 1: PRIDE model

## 2. Related Work

### Limitations

1. splits input sequence of utterances into chunks, and runs BERT for each chunk
2. do not make good use of BERT in identifying relationship between chunks
3. assumption that each chunk has maximal possible length

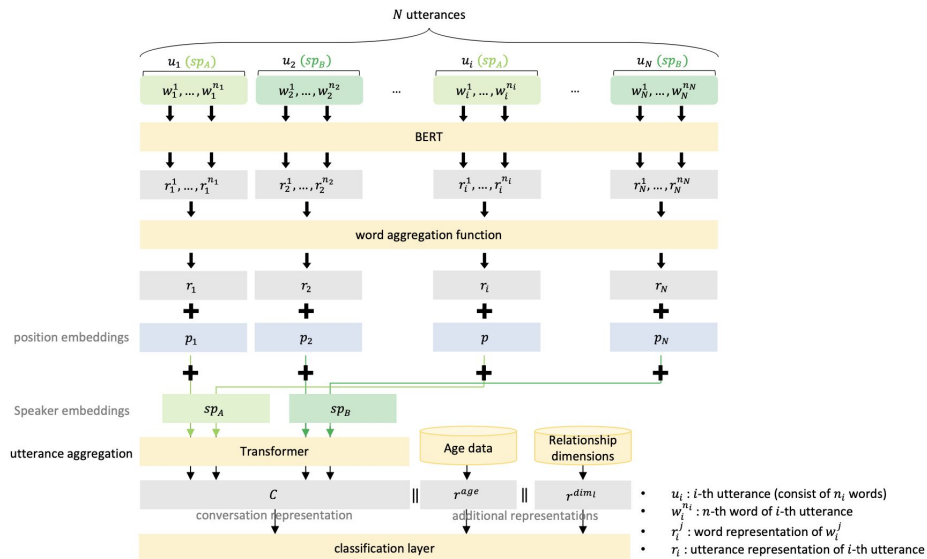


Figure 1: PRIDE model

# 3. Approach

## 3.1. Random shuffling utterances in utterance chunks

- PRIDE vs Ours
  - PRIDE : Create utterance chunks and Run BERT for each chunk  
→ making word representation by fragment of a conversation
  - **Ours** : randomly shuffle the order of utterances  
→ run BERT for each random combination of utterances  
→ **exchange information between words without considering order of utterances**

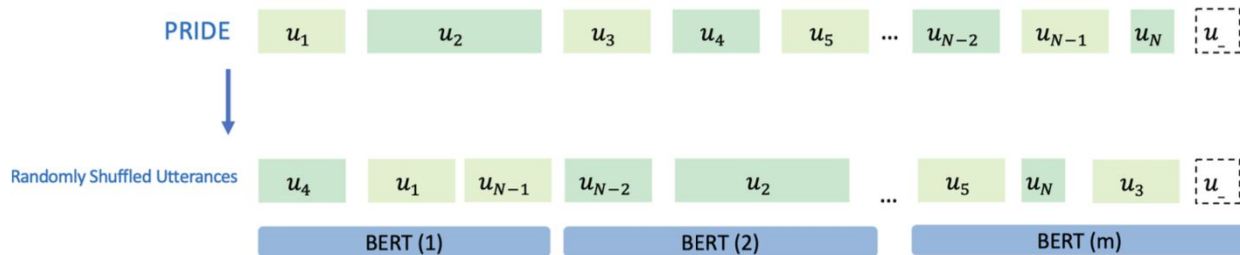


Figure 2: Randomly shuffled utterances before constructing utterance chunks.

# 3. Approach

## 3.2. Enhancing conversational context of PRIDE by overlapping chunks

- PRIDE vs. Ours
  - PRIDE : creates chunks and runs BERT several times  
→ no connection between chunks at word level
  - **Ours** : creates overlapped chunks  
→ **takes full advantage of BERT & understand “smooth” context between chunks**

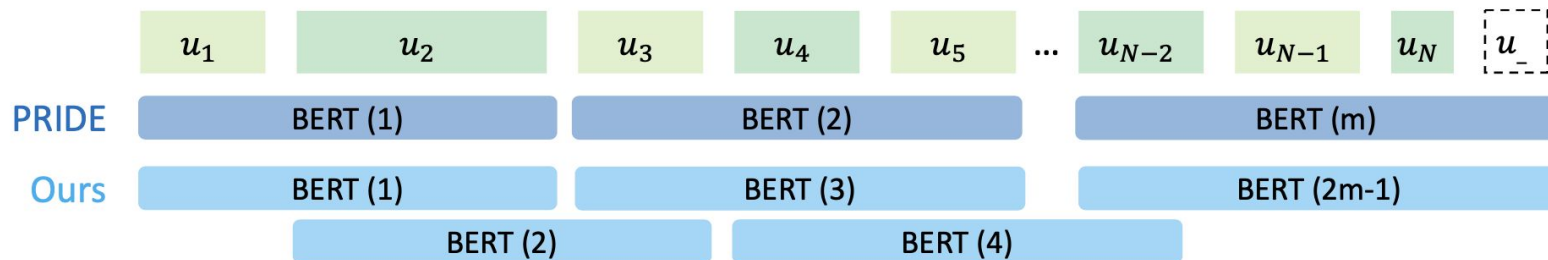


Figure 3: Comparison between original PRIDE and our method over running BERT on each chunk.

## 4. Experiments

**FiRe** - a **F**ilm **R**elationship dataset presented by Tigunova et al. [2019]

model	cross-val on FiRe		
	F1	P	R
RNN	0.11	0.11	0.15
BERT <sub>ddrel</sub>	0.2	0.25	0.2
HAM	0.23	0.25	0.22
BERT <sub>conv</sub>	0.27	0.25	0.33
PRIDE (ours)	<b>0.36</b>	<b>0.37</b>	0.38
PRIDE-shuffle	0.35	0.34	<b>0.39</b>
PRIDE-overlap	0.34	0.35	0.38
PRIDE-shuffle-overlap	0.32	0.35	0.34

Table 3: Performance of our algorithms compared to previous algorithms.

## 4. Experiments

class	PRIDE (ours)	PRIDE -shuffle	PRIDE -overlap	PRIDE -shuffle-overlap
friend	0.466	<b>0.517</b>	0.505	0.505
lover	<b>0.622</b>	0.611	0.621	0.588
spouse	0.354	0.391	<b>0.403</b>	0.316
colleague	0.222	<b>0.263</b>	0.142	0.125
child	<b>0.606</b>	0.5	0.517	0.529
parent	0.621	0.566	0.588	<b>0.622</b>
sibling	0.3	<b>0.419</b>	0.346	0.333
employee	0.267	<b>0.296</b>	0.262	0.185
boss	0.136	0.179	<b>0.2</b>	0.172
enemy	0.122	0.086	0.034	<b>0.167</b>
medical	0.467	0.276	<b>0.483</b>	0.25
commercial	0.077	<b>0.08</b>	0.065	0.071

Table 4: Class F1 scores of our algorithms compare to PRIDE.



## 5. Analysis

**Purpose** : make BERT identifying conversation context at word level → Improve Performance

**Expectation** : Conversational understanding would help model create contextual word embedding

PRIDE - shuffle

→ **decrease in Precision & increase in F1 score**

- Disrupted accuracy balance
- for specific relationships, it outperformed PRIDE

PRIDE - overlap

→ **no improvement in performance**

- provided too much information
- hindered in inferring the relationship
- Just Transformer encoder is enough for information exchange between utterance representations

PRIDE  
-shuffle -overlap

→ **no improvement in performance**

- leads to loss of meaningful information in word representations

# 5. Analysis

class	PRIDE (ours)	PRIDE -shuffle	PRIDE -overlap	PRIDE -shuffle-overlap
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Table 4: Class F1 scores of our algorithms compare to PRIDE.

- 1. Friend, Colleague, Sibling, Commercial and Employee**
  - PRIDE-shuffle shows improvement
  - **Selected words in each script are crucial**
  - **Good for catching specific words in conversation**
- 2. Lover, Spouse, Boss and Medical**
  - PRIDE-overlap shows similar or higher performance
  - **Sequence of utterances works more importantly**
  - **Good for relationship extraction in specific situation**
- 3. Child and Parent**
  - PRIDE performs better or similarly with others
  - **Hierarchically understanding is more important**
  - **Good for fundamental relationship**
- 4. Enemy**
  - PRIDE-shuffle-overlap shows highest performance
  - **Just mere coincidence**

## 6. Conclusion

**Contrary to our expectation... the overall Performance Comparison was**

Random Shuffling & Overlapping  $\prec$  Hierarchically representation [Word  $\rightarrow$  Utterance  $\rightarrow$  Conversation]

**BUT...**

According to each relationship label, It may differ which method performs better

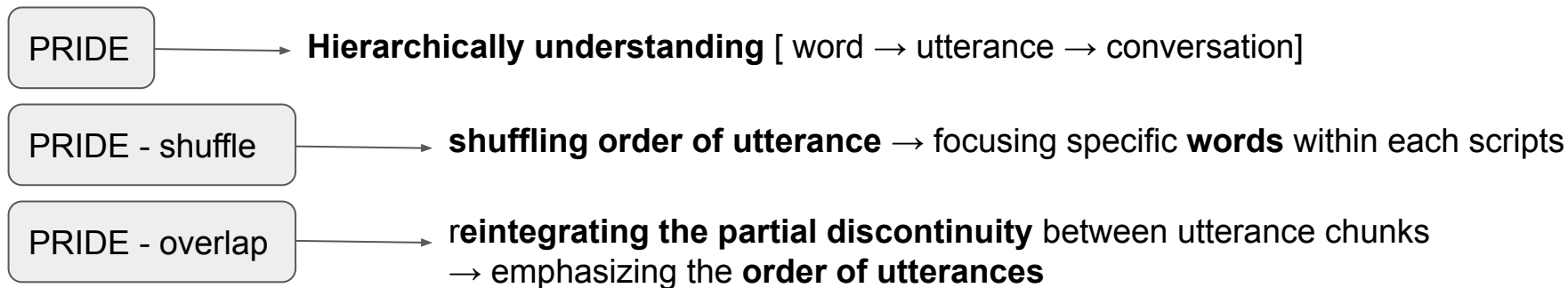
### **Our Contribution**

1. Experiments for Two methods : Shuffling & Overlapping to add additional context
2. Comparing each method's performance for each relationship label
3. Observing which method helps to classify specific relationship
4. Examining the effectiveness of PRIDE's hierarchical representation of conversation

**Thank you**

## 5. Analysis

### Effect of each Method



**Multi Class Binary Classification** → **“Methods’ performances differ according to each label”**