

Siamese network-based GRU and BERT

For Authorship Verification (AV)

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Introduction

In the realm of Natural Language Processing, the problem of Authorship Verification (AV) presents significant challenges with practical implications in literary analysis. This task requires discerning whether disparate texts are composed by the same individual. In pursuit of this, our project explores two distinct deep learning models:

- GRU-based model analyzes text sequences to detect stylistic nuances.
- BERT-based model delves into the depths of context and semantics with its attention-driven approach.

Our fine-tuned models obtain improvement in performance compared to a baseline method in author verification task.

Methods

Trained on a robust corpus of 30,000 text pairs, our models are fine-tuned for precision in Authorship Verification (AV).

GRU

- Text Merging: By concatenating Text 1 and Text 2, the GRU model is poised to directly contrast and discern the writing styles, capturing the distinctive hallmarks of authorship.
- Embedding with GloVe: This step transforms the unified text into an embedded form, setting the stage for stylistic and syntactic analysis.
- GRU Layer: Specialized in tracking patterns across text sequences, the GRU layer is central to identifying author-specific characteristics.
- Pooling: It then distills the extensive sequence data, extracting pivotal features.
- Output Prediction: The model culminates in a dense layer, culminating in a sigmoid output that probabilistically determines authorship.

BERT:

- Siamese Architecture: The BERT model's Siamese architecture processes texts in tandem, preserving their individual contexts, which is essential for a nuanced comparison of authorial styles.
- Independent Encoding: Each text is independently encoded through BERT, providing a rich contextual analysis.
- Mean Pooling: This step averages the embeddings, with a deliberate focus on contextually significant tokens.
- Probability Calculation: Lastly, the model computes authorship probabilities using a distance metric and a sigmoid function for the final output.

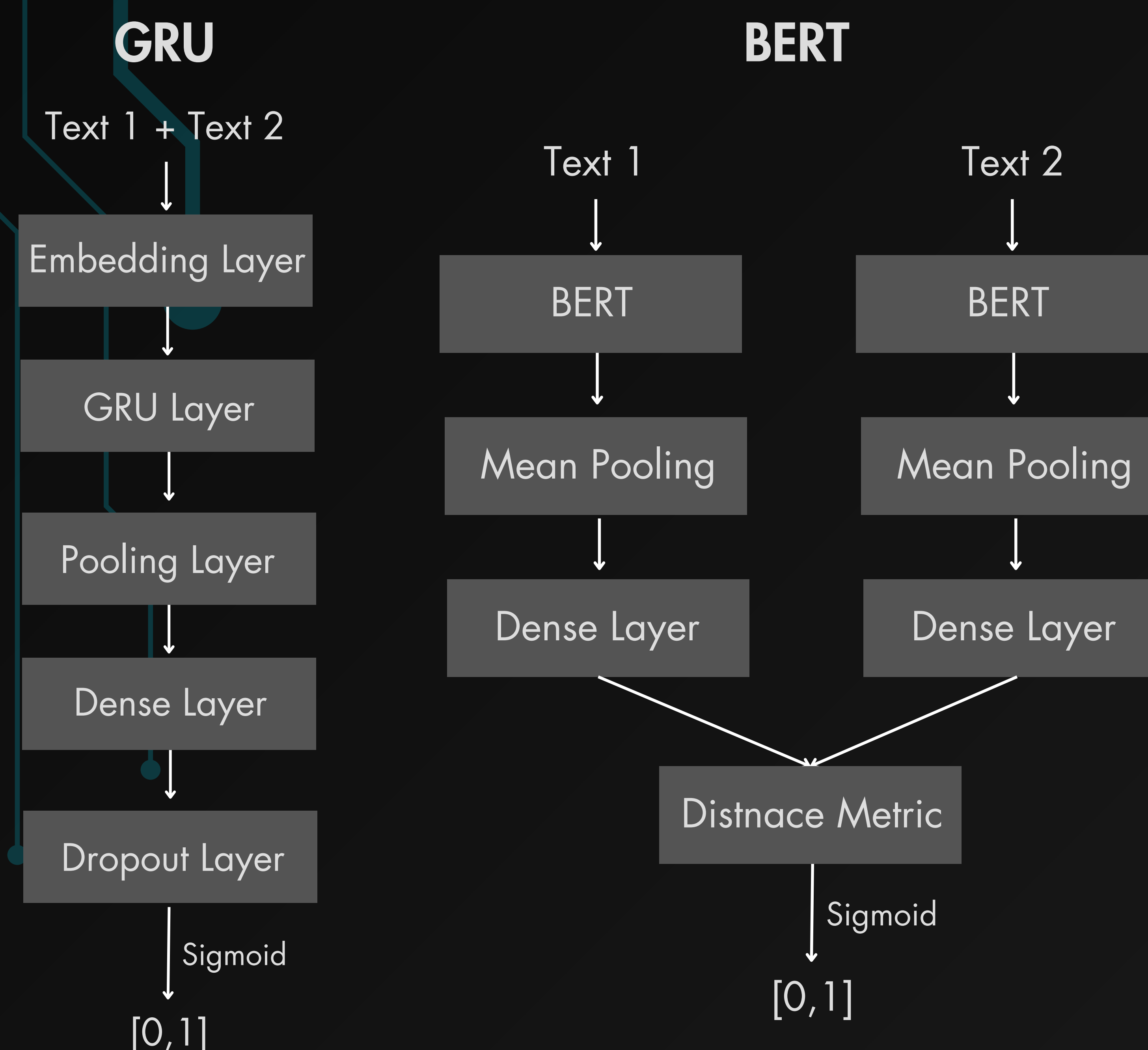


Figure 1: Model architecture for Siamese network-based GRU and BERT model

Result



Figure 2: Model performance of GRU and BERT models on development set

Conclusion

- Findings: BERT's advanced contextual understanding leads to superior performance in AV, as indicated by the metrics.
- Significance: These results underscore the potential of transformer models to revolutionize tasks that require deep linguistic analysis.
- Implications: Suggests a broader application for BERT in forensic linguistics and literary studies for author identification.
- Future Directions: Investigating hybrid models that combine the sequential focus of GRU with BERT's contextual acuity could further enhance AV capabilities.

Reference

Qian, Chen, Tianchang He, and Rao Zhang. "Deep learning based authorship identification." Report, Stanford University (2017): 1-9

Tyo, Jacob, Bhuwan Dhingra, and Zachary C. Lipton. "Siamese Bert for Authorship Verification." CLEF (Working Notes). 2021