Enhancing Writing Style Change Detection using Transformer-based Models and Data Augmentation

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What are the task goals?

Identifying alterations in writing style at the paragraph level within a multi-author document

Providing solutions for different levels of difficulty

What are the subtasks?

Subtask 1 (Easy): Variety of topics

Subtask 2 (Medium): Topic variety is small

Subtask 3 (Hard): Same topic

Our Methodology

Data Preparation

Data Augmentation

Fine-tuning Models

Ensemble Modeling

Convert the task to a binary classification task and prepare the data for fine-tuning pre-trained transformer models

Generate more data samples for feeding the models

Try fine-tuning different pre-trained transformer-based models based on the prepared data samples

Try ensembling different approaches to improve the results

Data Preparation

- We concatenate each two consecutive paragraphs within each document using a separator token

- We assign the associated binary label

- We employ the corresponding tokenizer associated with each model

- According to maximum input sequence size for our utilized pre-trained models we applied a truncation strategy

  - We removed tokens from both ends of each sequence to ensure equal attention is given to each paragraph

Datasets statistics

Dataset	documents	Avg. paragraphs per document	samples	positive	negetive
Training 1	4200	4.07	12,904	11,347	1,557
Training 2	4200	7.71	28,216	13,215	15,001
Training 3	4200	5.55	19,113	9,021	10,092
Validation 1	900	4.14	2,828	2,451	377
Validation 2	900	8.82	7,042	3,029	4,013
Validation 3	900	5.56	4,112	1,953	2,159

Data Augmentation

- To generate more data, we disregard the consecutiveness and order of the paragraphs

- The task will be transformed to the following task:

    "Determining whether the same author wrote two concatenated paragraphs"

Data Augmentation

- **First Method:** Simply swapping the paragraphs in each sample and create a new sample with the same label

- **Second Method:** Identify paragraph pairs that are not consecutive but are written by the same author.

- **Third Method:** Identify paragraph pairs that are not consecutive and are not written by the same author.

  - In the documents where the count of authors is one less than the number of style changes, we deduce that paragraphs not authored by the same author are indeed composed by distinct authors.

Pre-trained Transformer Models

Based on the prepared data, we fine-tuned three popular transformer models by adding a binary classification layer on top of each.

- **BERT**

- **RoBERTa**

- **ELECTRA**

Generalization

- Task 2 and Task 3 share similarities as they both involve style changes occurring while the topic remains consistent

- Task 2 and Task 1 exhibit similarities as they both encompass style changes alongside topic transitions

- We explore the potential benefits of leveraging datasets from other subtasks to enhance the model performance for a specific subtask.

Ensemble Modeling

- For each subtask, we develop three models, all based on fine-tuning the RoBERTa pre-trained model.

  - The **basic** model fine-tuned on the official datasets

  - The **augmented** model fine-tuned on the augmented datasets

  - The **generalized** model fine-tuned on all the three subtask datasets

Experimental Settings

- GPU: NVIDIA A100 GPU

- Maximum sequence length: 512

- Learning rate: 0.00001

- Batch size: 16

- Number of epochs: 10

Results

- Performance comparison of pre-trained models fine-tuned by the basic datasets.

- The results are based on the evaluation sets.

Pre-trained Model	Subtask 1	Subtask 2	Subtask 3
BERT	0.9823	0.7451	0.7048
ELECTRA	0.9882	0.8024	0.7797
RoBERTa	**0.9957**	**0.8106**	**0.8140**

Results

- Performance results of different approaches.

- The results are based on the evaluation sets.

Approach	Subtask 1	Subtask 2	Subtask 3
Basic	**0.9957**	0.8106	**0.8140**
Augmented data	0.9832	0.8053	0.7266
Generalized (all datasets)	0.9661	0.8042	0.7449
Ensemble	0.9907	**0.8221**	0.7906

- We select the best performing approach for each subtask to perform on the final test sets.

Results

- Performance results of final approaches in respective subtasks.

- The results are based on the unseen test sets.

Task	Reported F1 Score	Ranking position
Subtask 1	0.984	**First**
Subtask 2	0.843	**First**
Subtask 3	0.812	Second

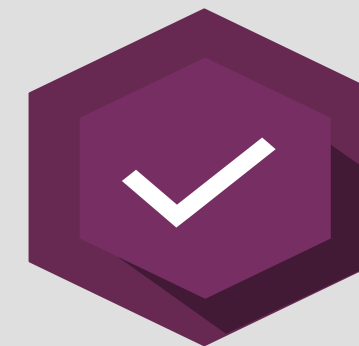# Contact

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