Semantics-Preserved Data Augmentation for Aspect-Based Sentiment Analysis

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Original review:	But the staff was so horrible to us.
BT	But the staff were so awful for us.
EDA	But so staff was the ugly to uranium.
C-BERT	But the situation was being good to me.
AS-SPM & AE	But the staff was always horrible to me.
Senti-SPM & AE	But the situation was so horrible to me.

Semantics-Preserved Data Augmentation
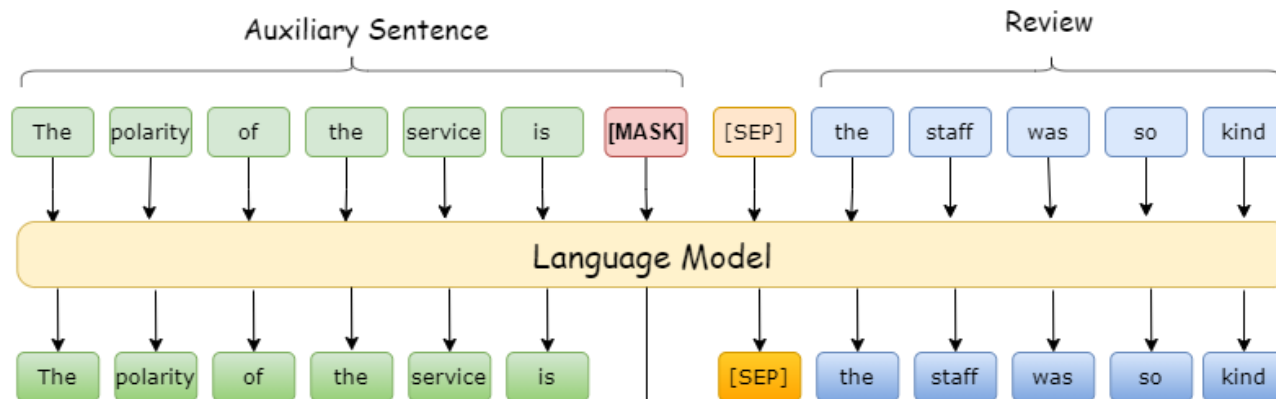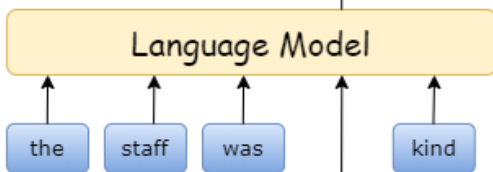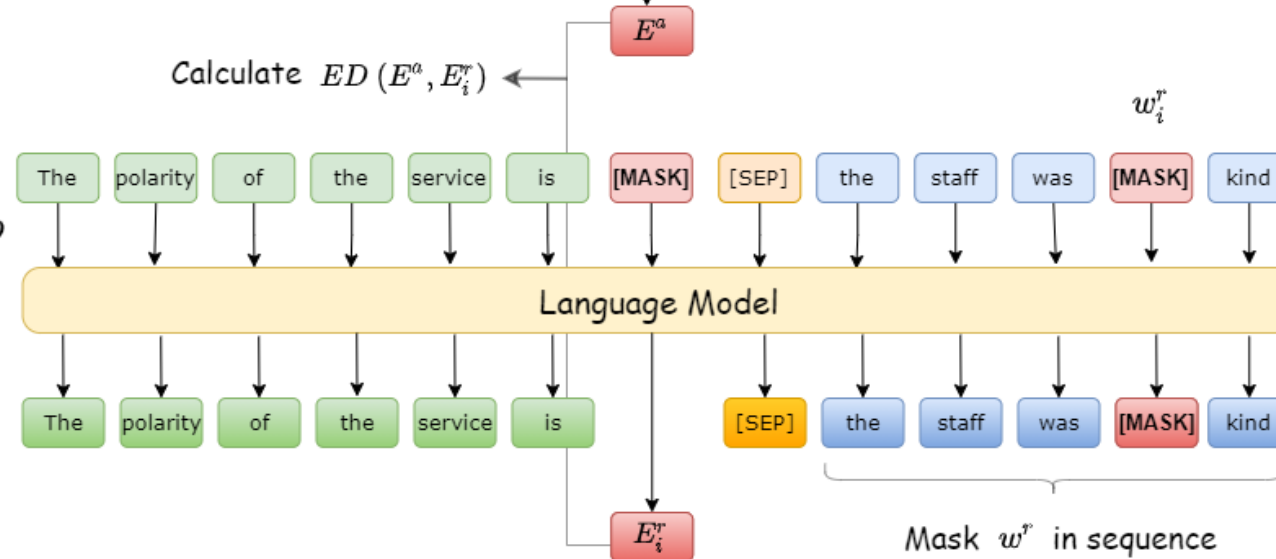
Experimental Settings

- Tasks
  - Aspect category sentiment classification (ACSC)
  - Aspect term sentiment classification (ATSC)
  - Aspect term extraction (ATE)
  - Multilingual Scenarios
  - Multi-Aspect Multi-Sentiment Scenarios
  - Stock Price/Risk Movement Prediction

- Baselines
  - Back Translation (BT)
  - Easy Data Augmentation (EDA)
  - C-BERT (Random Masking Strategy)

Aspect-Based Sentiment Analysis (English)
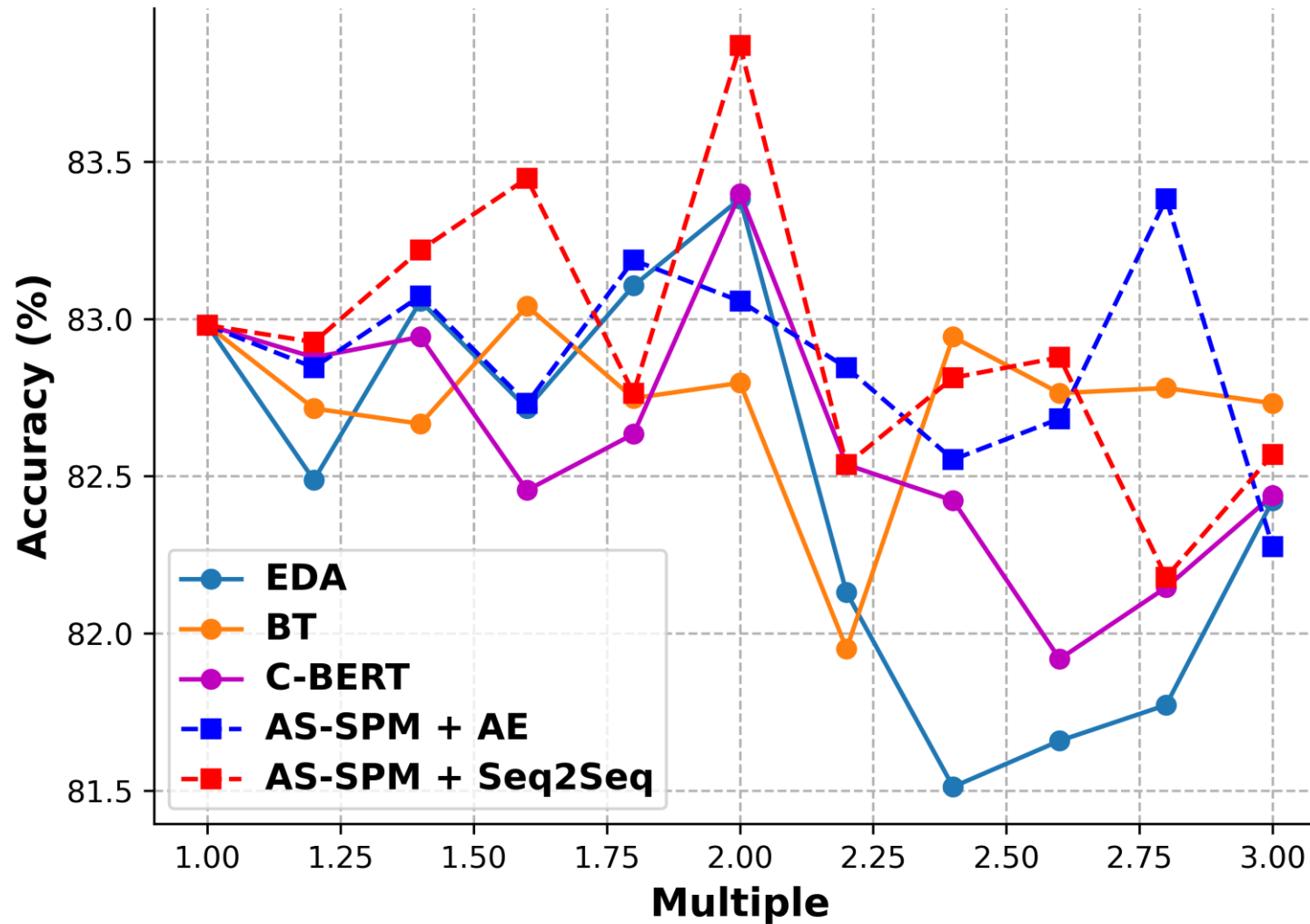
Model	ACSC	ATSC				ATE			
	Rest14	Rest14	Lap14	Rest15	Rest16	Rest14	Lap14	Rest15	Rest16
Bert_{base}	$82.98_{0.78}$	$79.48_{0.64}$	$75.32_{1.08}$	$81.62_{1.07}$	$86.58_{0.56}$	$86.44_{0.49}$	$78.49_{1.38}$	$66.10_{4.61}$	$72.42_{2.38}$
+ BT	$82.45_{0.62}$	$79.98_{0.51}$	$75.76_{1.19}$	$82.61_{0.60}$	$86.22_{0.58}$	$86.57_{0.48}$	$80.66_{2.27}$	$70.34_{1.65}$	$74.23_{0.64}$
+ EDA	$82.82_{0.15}$	$79.82_{0.58}$	$76.11_{0.58}$	$81.77_{1.43}$	$85.65_{0.53}$	-	-	-	-
+ C-BERT	$83.45_{1.14}$	$79.67_{0.80}$	$76.45_{0.90}$	$80.37_{2.56}$	$85.57_{1.69}$	$86.73_{0.15}$	$81.00_{1.68}$	$69.21_{1.14}$	$75.19_{0.57}$
+ AS-SPM & AE	$83.14_{0.98}$	$80.55_{0.42}$	$76.33_{1.19}$	$83.91_{0.98}$	$\mathbf{87.85}_{0.38}$	$\mathbf{87.18}_{0.63}$	$\mathbf{82.86}_{1.50}$	$\mathbf{70.68}_{1.15}$	$\mathbf{75.62}_{0.64}$
+ Senti-SPM & AE	$84.07_{0.36}$	$80.50_{0.80}$	$77.21_{0.61}$	$84.28_{0.64}$	$87.61_{0.40}$	-	-	-	-
+ AS-SPM & Seq2Seq	$\mathbf{84.17}_{0.94}$	$81.19_{0.65}$	$\mathbf{77.93}_{0.43}$	$\mathbf{84.46}_{0.22}$	$87.55_{0.45}$	$87.04_{0.54}$	$81.51_{1.07}$	$69.27_{0.87}$	$75.24_{0.58}$
+ Senti-SPM & Seq2Seq	$83.39_{1.03}$	$\mathbf{81.50}_{0.47}$	$77.55_{1.31}$	$83.74_{1.25}$	$87.81_{0.54}$	-	-	-	-

Influence of Augmentation Size

Multilingual Scenario

Model	Language						
	AR	CH	DU	FR	RU	ES	TU
Bert$_{base}$	$88.48_{0.78}$	$93.79_{0.87}$	$85.37_{3.36}$	$85.98_{2.47}$	$90.78_{1.86}$	$81.66_{1.17}$	$66.81_{1.73}$
+ BT	$88.24_{0.87}$	$94.58_{1.40}$	$\mathbf{88.20}_{1.66}$	$87.66_{3.93}$	$93.90_{1.50}$	$84.00_{1.70}$	$72.89_{3.92}$
+ C-BERT	$87.88_{2.24}$	$94.20_{1.58}$	$84.74_{2.82}$	$88.41_{1.69}$	$92.96_{1.46}$	$80.16_{2.72}$	$71.59_{6.34}$
+ AS-SPM & AE	$89.20_{1.01}$	$95.48_{1.17}$	$86.32_{1.30}$	$88.41_{1.56}$	$\mathbf{94.21}_{0.42}$	$\mathbf{84.66}_{1.51}$	$72.31_{2.13}$
+ Senti-SPM & AE	$87.41_{0.88}$	$94.31_{0.32}$	$86.16_{1.54}$	$88.97_{1.02}$	$92.81_{1.28}$	$83.00_{2.32}$	$71.73_{4.06}$
+ AS-SPM & Seq2Seq	$\mathbf{90.28}_{1.34}$	$95.31_{0.74}$	$86.63_{1.25}$	$\mathbf{89.15}_{1.41}$	$93.75_{1.23}$	$82.83_{1.51}$	$71.44_{2.74}$
+ Senti-SPM & Seq2Seq	$88.48_{1.76}$	$\mathbf{95.58}_{0.71}$	$87.26_{1.95}$	$88.78_{2.19}$	$91.40_{0.95}$	$83.66_{2.80}$	$\mathbf{73.62}_{3.01}$

Sentiment Analysis & Multi-Aspect Multi-Sentiment

Model	MR	SST-2
Bert_{base}	$85.64_{0.77}$	$90.39_{0.81}$
+ BT	$85.90_{0.37}$	$90.82_{0.54}$
+ EDA	$85.54_{0.41}$	$90.53_{0.88}$
+ C-BERT	$85.02_{1.38}$	$90.16_{0.46}$
+ Senti-SPM & AE	$85.75_{0.50}$	$90.91_{0.34}$
+ Senti-SPM & Seq2Seq	$\mathbf{86.52}_{0.59}$	$\mathbf{91.51}_{0.42}$

Model	MAMS	
	ATSC	ACSC
Bert_{base}	$82.23_{0.41}$	$73.45_{1.38}$
+ BT	$82.73_{0.37}$	$73.60_{1.02}$
+ EDA	$82.78_{0.20}$	$74.53_{1.40}$
+ C-BERT	$82.34_{0.48}$	$74.22_{0.92}$
+ AS-SPM & AE	$82.09_{0.41}$	$75.29_{0.93}$
+ Senti-SPM & Seq2Seq	$82.33_{0.72}$	$73.89_{1.08}$
+ AS-SPM & AE	$83.00_{0.80}$	$\mathbf{76.15}_{0.79}$
+ Senti-SPM & Seq2Seq	$\mathbf{83.17}_{0.51}$	$75.27_{0.69}$

Stock Price/Risk Movement Prediction

Model	Aspect	
	Return	Risk
Bert_{base}	$50.57_{2.99}$	$50.74_{3.36}$
+ BT	$51.24_{0.95}$	$51.55_{3.42}$
+ EDA	$51.84_{1.83}$	$51.45_{1.77}$
+ C-BERT	$52.13_{1.25}$	$51.68_{2.66}$
+ Return-SPM & AE	$52.87_{0.78}$	$53.91_{1.46}$
+ Return-SPM & Seq2Seq	$\mathbf{54.04}_{0.77}$	$53.17_{2.60}$
+ Risk-SPM & AE	$51.98_{0.68}$	$55.07_{2.47}$
+ Risk-SPM & Seq2Seq	$52.02_{0.54}$	$\mathbf{55.32}_{2.96}$

Auxiliary Sentence	ACC.
[MASK]	$50.57_{2.68}$
Risk [MASK]	$51.51_{2.56}$
Risk will [MASK]	$52.12_{2.82}$
Market risk will [MASK]	$\mathbf{55.32}_{2.96}$

Conclusion

- We present a controllable augmentation for ABSA, which is controllable to generate reasonable reviews without converting aspect-level polarity.

- We propose SPM to measure the impact of the related words on deciding specific aspect and sentiment, and adopt two replacement strategies to ABSA tasks.

- The exploration in the financial application scenario also supports the usefulness of the proposed method

Code & Datasets: https://github.com/Quant-NLP/SPDAug-ABSA

Related Works and Events

- **Related Works**
  - **From Opinion Mining to Financial Argument Mining**. (Springer Nature – Open Access)
    - http://springer.nlpfin.com/

- **Related Events**
  - **Call for Paper:** Financial Technology on the Web @ ACM TWEB
    - https://acmfinweb.nlpfin.com/
  - FinNum-3 **Shared Task** @ NTCIR-2022 – Investor's and Manager's **Fine-grained Claim Detection**

  - **EMNLP-2021 Tutorial**: Financial Opinion Mining

  - The **Workshop** of **Financial Technology** and Natural Language Processing (FinNLP @ **IJCAI**)
  - The Workshop on Financial Technology on the Web (FinWeb @ **WWW**)

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Thank you for your attention!

Feel free to contact us if you have any questions.

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