NLP Homework – A.Y. 2020-2021

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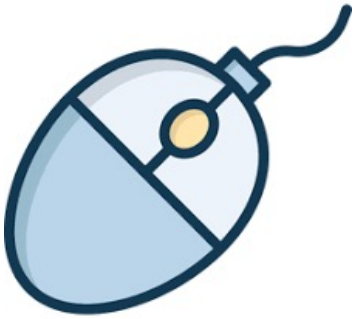
Word-in-Context (WiC) disambiguation

Homework 1

Word-in-Context as a binary classification task:

The cat chases after the ***mouse***.

Click the right ***mouse*** button.



Word-in-Context (WiC) disambiguation

Data preprocessing

- Tokenization and lemmatization to prepare our data
- Derive a frequency-based vocabulary from the training set
- Filter out rare words (i.e. *Hapax Legomea*)
- Pre-trained static word embeddings from *Word2Vec* and *GloVe*

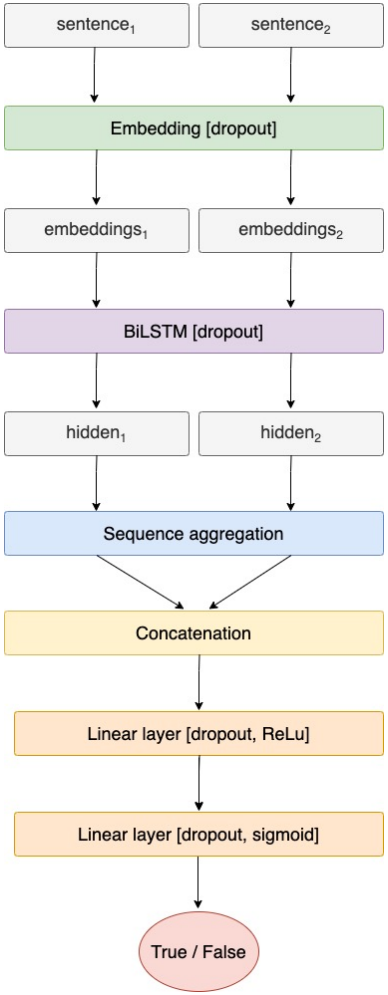
Word-in-Context (WiC) disambiguation

Our approach

- Bidirectional LSTM to encode input sentences
- (shallow) Context-aware representation of the input tokens
- Multi-Layer Perceptron (MLP) architecture as baseline
- Experiment with different settings

Word-in-Context (WiC) disambiguation

Architecture

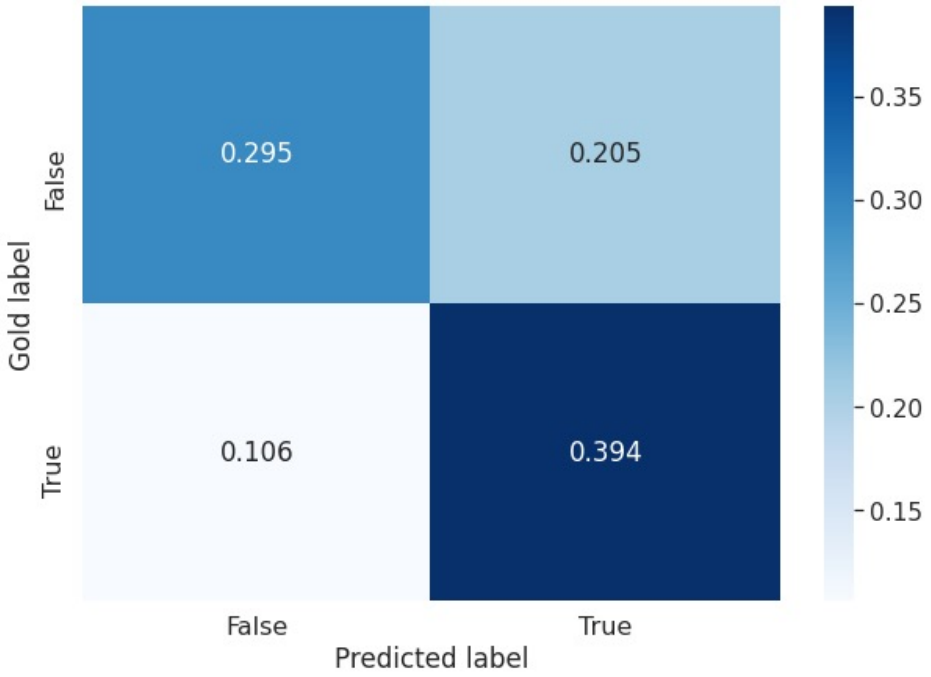


Word-in-Context (WiC) disambiguation

Experiments

Model	F1 (%)
MLP	62.85
+ lemmatization	**63.57**
+ rare words removal	61.17
+ lowercase	61.28
BiLSTM	67.6
+ lemmatization	68.3
+ rare words removal	**69.14**
+ lowercase	67.73

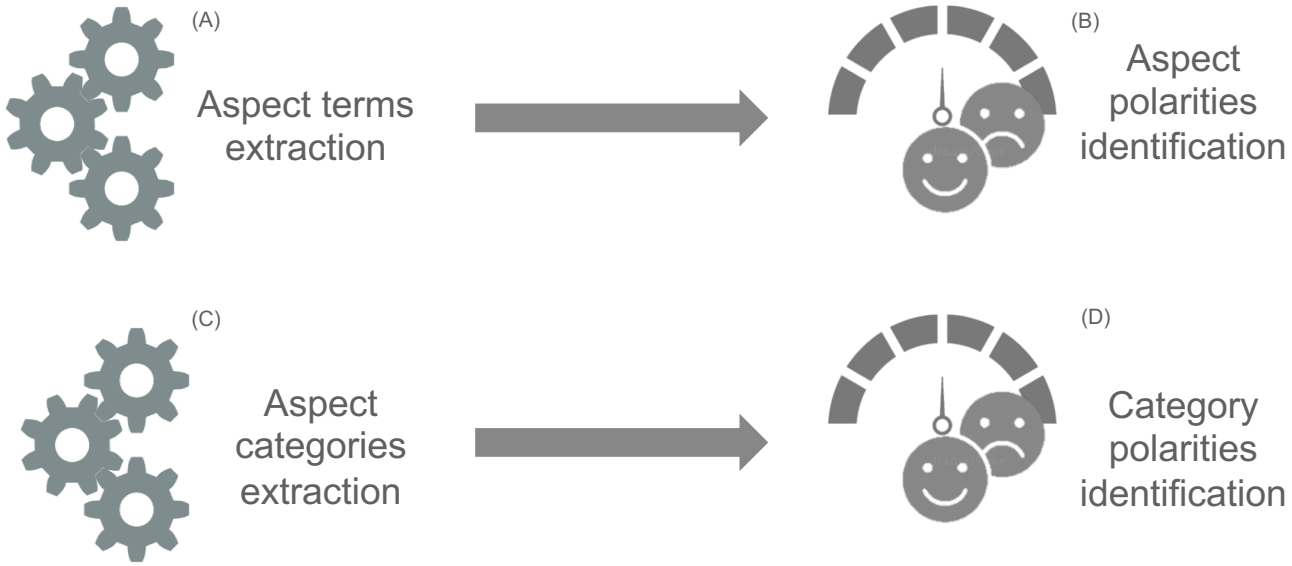
Embedding	F1 (%)
Word2Vec	**69.14**
300d GloVe	64.77
Word2Vec $\oplus$ 300d GloVe (*)	66.05
Word2Vec $\oplus$ 300d GloVe (**)	66.18



Aspect-Based Sentiment Analysis (ABSA)

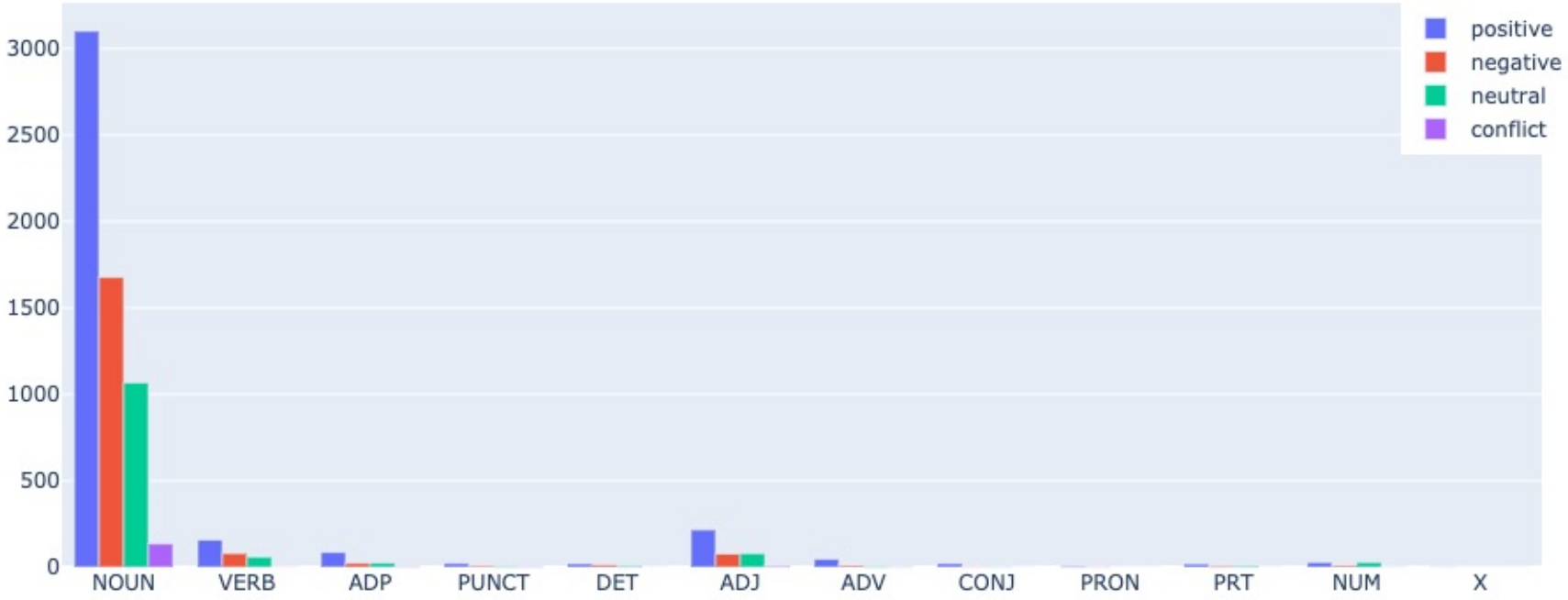
Homework 2

ABSA identification pipeline:



Aspect-Based Sentiment Analysis (ABSA)

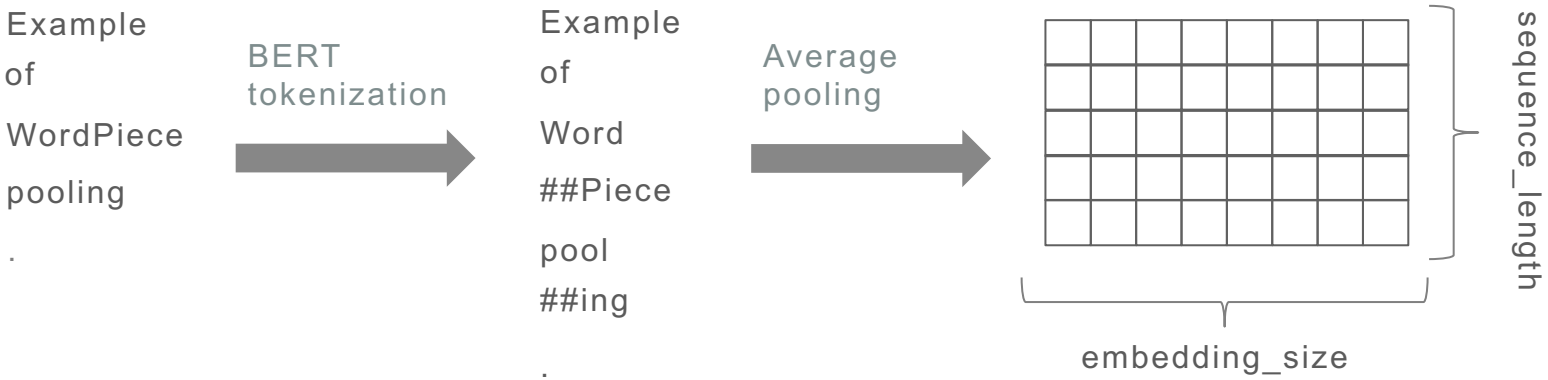
Data statistics



Aspect-Based Sentiment Analysis (ABSA)

Data preprocessing

- Extract POS tags from our data
- Apply data augmentation with masking (+160% dataset size)
- Average BERT WordPiece embeddings



Aspect-Based Sentiment Analysis (ABSA)

Our approach – Individual learners

- Solve the aspect terms extraction task using NER
- Jointly extract aspect terms and identify polarities (i.e. A+B)
- Jointly extract category terms and identify polarities (i.e. C+D)

The food is tasty and portion sizes are appropriate.

Task A+B: O B_{POS} O O O B_{POS} I_{POS} O O O

Task C+D: [$FOOD_{POS}$]

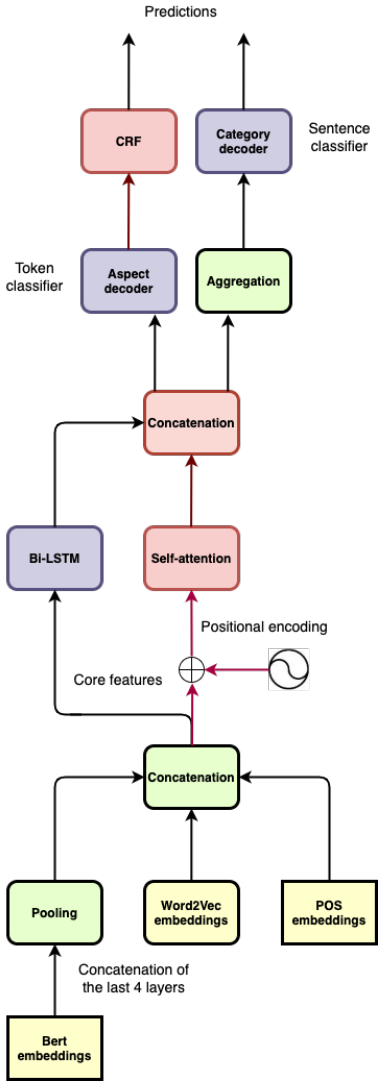
Aspect-Based Sentiment Analysis (ABSA)

Our approach – Multitask learning

- Learn multiple tasks in parallel *(Caruana, 1996)*
- Aspect terms can be useful to predict categories *(Xue et al., 2017)*
- Benchmark against individual learners approaches

Aspect-Based Sentiment Analysis (ABSA)

Unified architecture



Aspect-Based Sentiment Analysis (ABSA)

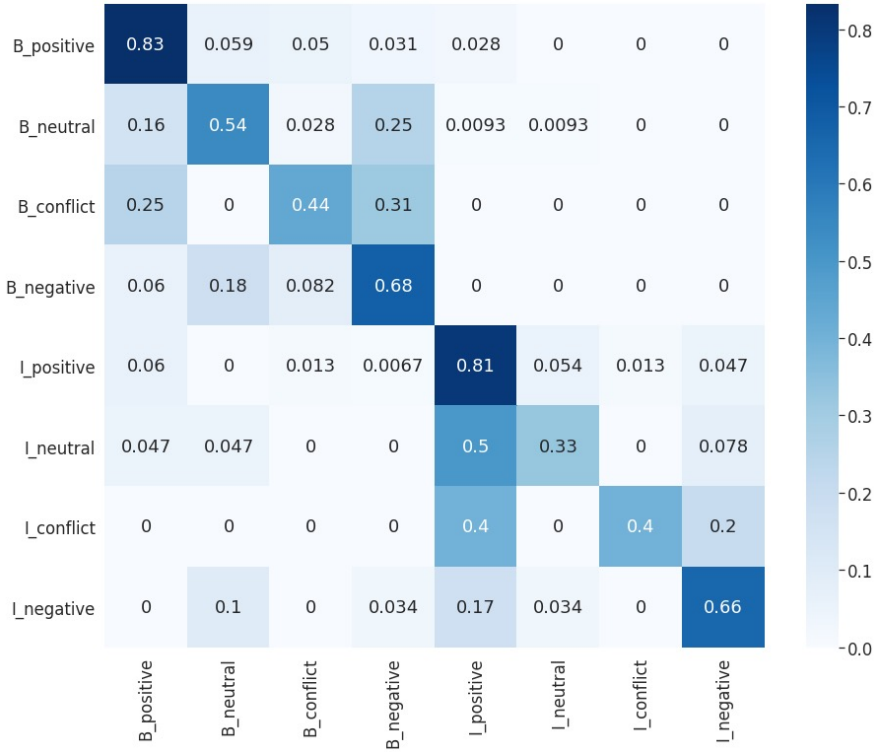
Experiments – Tables

Architecture	Core features	Aspects		Categories $(\Phi_{restaurant})$	
		F_1^{macro}	F_1^{micro}	F_1^{macro}	F_1^{micro}
MLP	BERT	35.82	47.73	34.59	41.97
	+ Word2Vec	36.95	50.09	33.76	42.51
	+ POS	38.10	48.58	36.42	42.86
BiLSTM	BERT	49.54	59.91	50.69	62.34
	+ Word2Vec	49.20	61.50	51.63	64.50
	+ POS	**50.04**	**65.02**	**55.00**	**66.47**
BiLSTM (attention)	BERT	47.79	58.47	49.05	60.18
	+ Word2Vec	47.98	59.22	49.34	60.79
	+ POS	49.46	60.18	53.88	64.05
CRF-BiLSTM	BERT	47.57	57.17	48.95	59.48
	+ Word2Vec	48.11	60.10	48.03	59.22
	+ POS	49.85	62.93	51.13	62.88
Transformer (encoder)	BERT	35.92	48.19	49.44	61.07
	+ Word2Vec	36.79	50.10	49.93	61.86
	+ POS	37.33	50.53	51.09	63.01

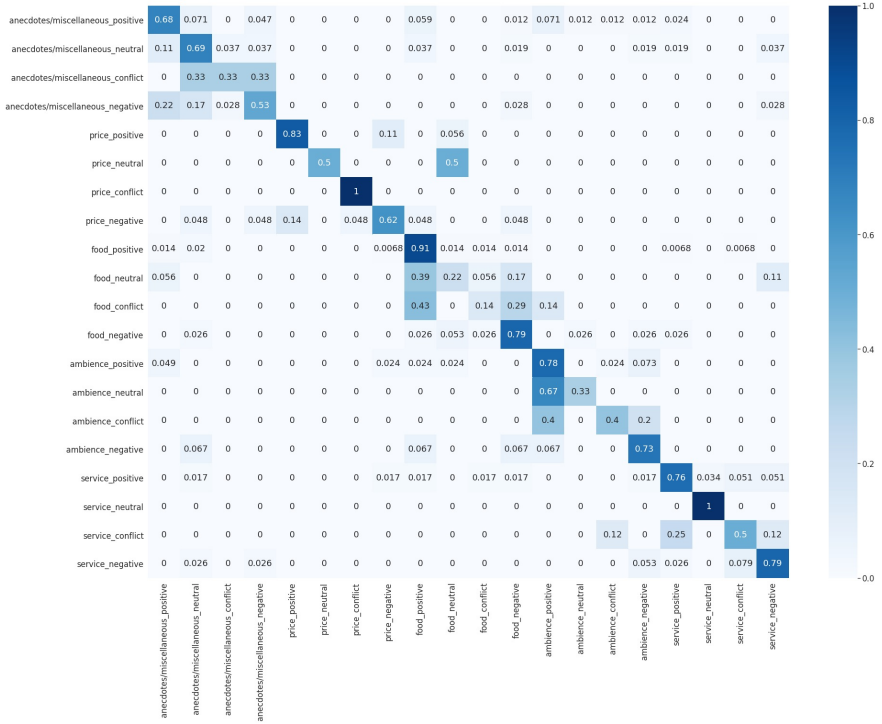
Model	Aspects		Categories $(\Phi_{restaurant})$	
	F_1^{macro}	F_1^{micro}	F_1^{macro}	F_1^{micro}
Aspect classifier	41.25	60.16	-	-
Category classifier	-	-	38.23	49.12
Multistep classifier	**50.04**	**65.02**	**55.00**	**66.47**

Aspect-Based Sentiment Analysis (ABSA)

Experiments – Confusion matrices



Task A+B



Task C+D

References

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- Rich Caruana. 1996. Algorithms and applications for multitask learning. In Proceedings of the Thirteenth International Conference on Machine Learning, pages 87–95. Morgan Kaufmann.
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- *Jeffrey Pennington, Richard Socher, and Christopher D Manning. 2014. Glove: Global vectors for word representation. In EMNLP, volume 14, pages 1532– 1543.*

Thanks for the attention!