Universität Bielefeld

Cluster of Excellence
Cognitive Interaction Technology

CITEC

Aspect-Based Sentiment Analysis Using a Two-Step Neural Network Architecture

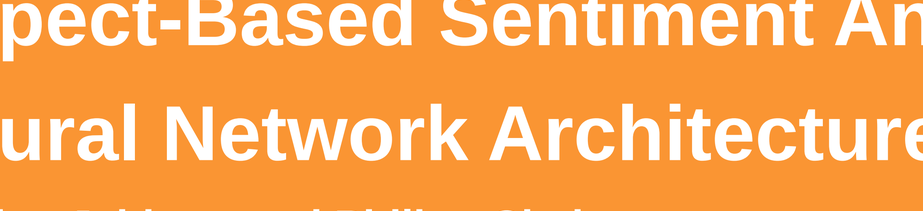
Soufian Jebbara and Philipp Cimiano

Motivation

- Millions of customer reviews available in the World Wide Web
- Valuable insights for customers and businesses
- Overall polarity of a sentence too coarse-grained

More fine-grained

- Sentiment analysis as a relation extraction problem
- the sentiment of some opinion holder towards a certain aspect of a product needs to be extracted:



Features

Word Embeddings

- Skip Gram Model [1]
- Trained on Amazon Reviews [2]
  → Domain-Specific Embeddings

Part-of-Speech Tags

- Stanford POS Tagger [3] with 45 tags
- Encode as 1-of-K vector

Sentics

- SenticNet 3 [4] concepts
- 5 sentics per word:
  pleasantness, attention, sensitivity, aptitude, polarity

Word	Nearest Neighbors
speed	spped
	speeds
	speeed
	25mbs
	speedwise
keyboard	keyboard's
	typing
	keyboad
	zaggmate
	keypad
service	customer
	serivce
	servce
	company
	courtious

Aspect Term Extraction

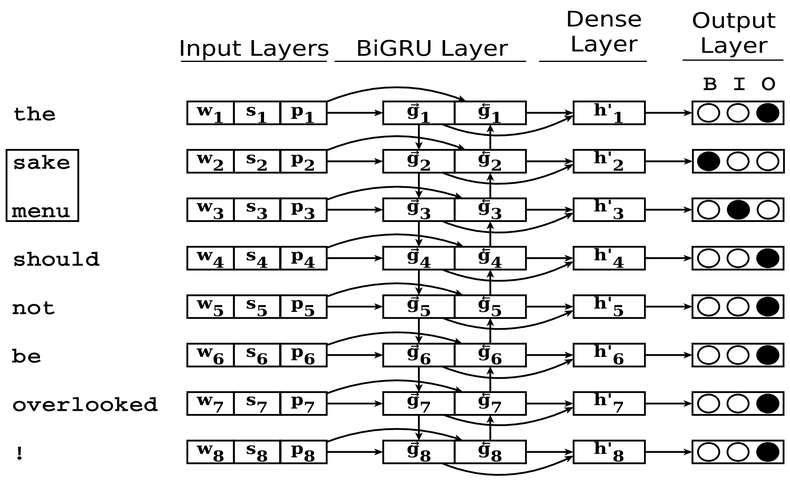
Aspect Term extraction as sequence labeling:

- Encode aspect terms using IOB2 tags [5]:

"The sake menu should not be overlooked !"

O B I O O O O O

Predict tag sequence using recurrent neural network:



Aspect-Specific Sentiment Extraction

Predict polarity label of each extracted aspect term separately:

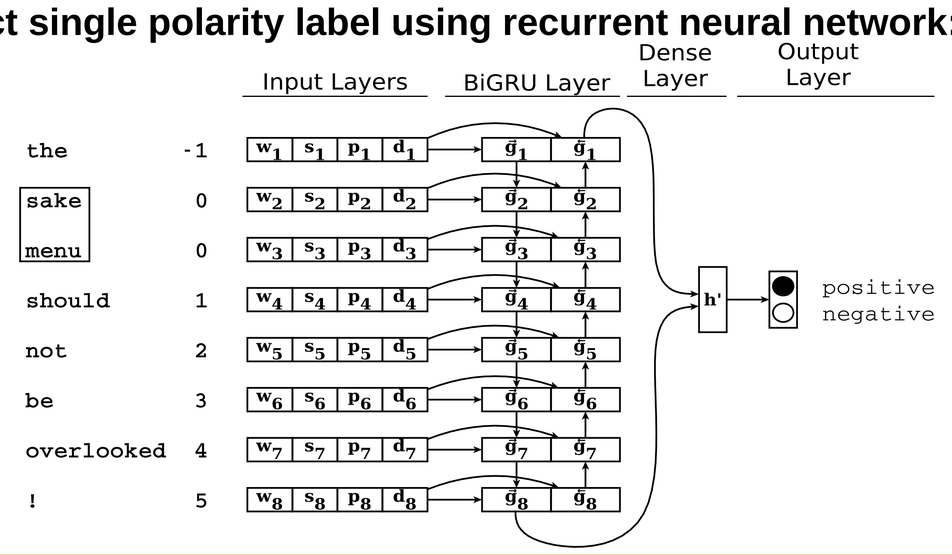
- Mark aspect term in sentence using relative word distances:

"The sake menu pos should not be overlooked !"

-1 0 0 1 2 3 4 5

- Learn embedding vectors for (discrete) distance values on-the-fly

Predict single polarity label using recurrent neural network:



Evaluation

- 5-fold cross validation on provided training data
- Evaluate only Positive/Negative aspect terms

Aspect Term extraction

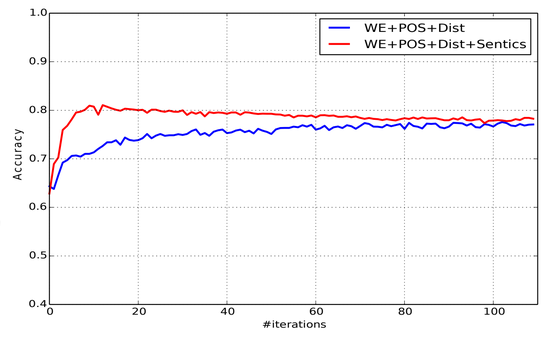
Features	F_1	Precision	Recall
WE+POS	**0.684**	0.659	**0.710**
WE+POS+Sentics	0.679	**0.663**	0.697

Aspect-Specific Sentiment extration

- Predict polarity labels for ground truth aspect terms

Features	Accuracy
WE+POS+Dist	0.776
WE+POS+Dist+Sentics	**0.811**

- Sentics improve accuracy and allov
  for less training iterations:



Conclusion

- Two-Step approach with recurrent neural networks seems promising
- Sentics beneficial for aspect-specific sentiment extraction:
  - Higher accuracy
  - Shorter training needed

Acknowledgements

This work was supported by the Cluster of Excellence Cognitive Interaction Technology 'CITEC' (EXC 277) at Bielefeld University, which is funded by the German Research Foundation (DFG).

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