Aspect Based Sentiment Analysis with Gated Convolutional Networks

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Problem Statement - Aspect Based Sentiment Analysis

Two subtasks:

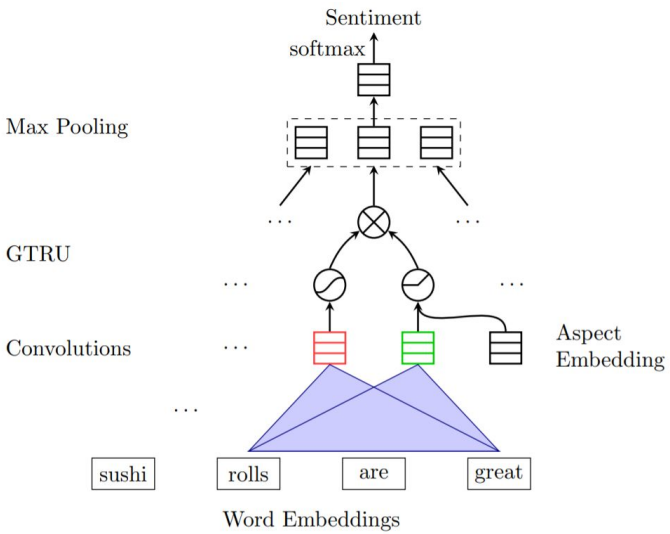
- Aspect-Category Sentiment Analysis (ACSA)
- Aspect-Term Sentiment Analysis (ATSA)

Sentence
Average to good Thai food, but terrible delivery.
Average to good Thai food, but terrible delivery.

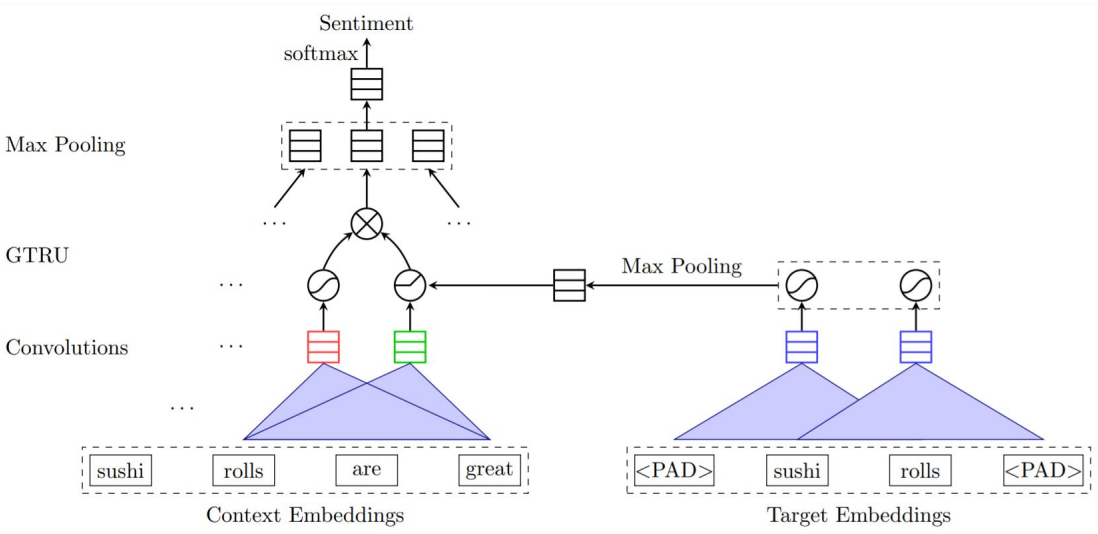
Proposed Approach

- CNN Model with Gating Mechanism
- Gated Tanh-ReLU selectively outputs sentiment features according to a given aspect or entity.
- Simpler than existing models (compared to models with attention)
- Can be trained in parallel - not time dependent unlike previous attention based and LSTM models

Gated Convolutional Network with Aspect Embedding (GCAE)



ACSA



ATSA

Datasets

- SemEval Workshops - customer reviews: Restaurant & Laptop
- **Hard Datasets:** Sentences having multiple aspect labels associated with multiple sentiments

Sentence	aspect category/term	sentiment label
Average to good Thai food, but terrible delivery.	food	positive
Average to good Thai food, but terrible delivery.	delivery	negative

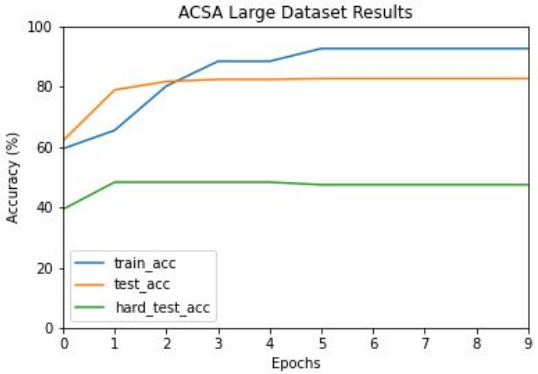
Table 1: Two example sentences in one hard test set of restaurant review dataset of SemEval 2014.

Implementation Details

- 300-dimension GloVe vectors pre-trained on unlabeled data of 840 billion tokens
- Random initialization - uniform distribution $U(-0.25, 0.25)$
- Adagrad
- Batch size: 32 instances
- Learning Rate: $1e-2$
- Maximal epochs: 30
- 5-fold cross validation

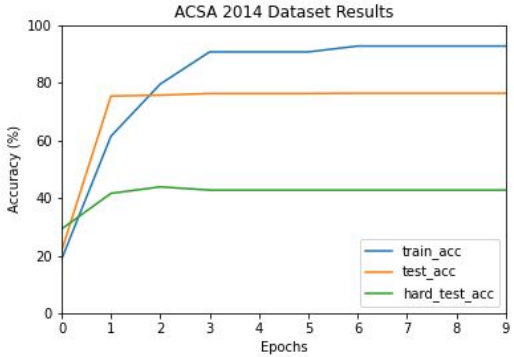
Results - ACSA

Models	Restaurant-Large		Restaurant 2014	
	Test	Hard Test	Test	Hard Test
SVM*	-	-	75.32	-
SVM + lexicons*	-	-	**82.93**	-
ATAE-LSTM	83.91±0.49	66.32±2.28	78.29±0.68	45.62±0.90
CNN	84.28±0.15	50.43±0.38	79.47±0.32	44.94±0.01
GCN	84.48±0.06	50.08±0.31	**79.67±0.35**	44.49±1.52
GCAE	**85.92±0.27**	**70.75±1.19**	79.35±0.34	**50.55±1.83**



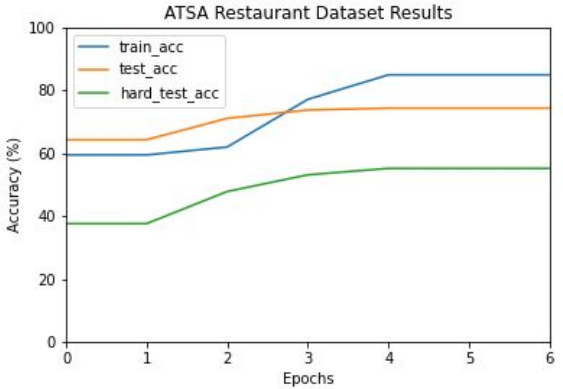
Reproduced Results

GCAE	Restaurant-Large		Restaurant 2014	
	Test	Hard-Test	Test	Hard-Test
	82.60	47.43	76.29	42.69



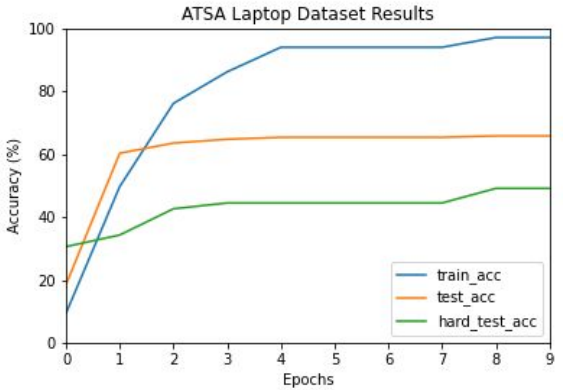
Results - ATSA

Models	Restaurant		Laptop	
	Test	Hard Test	Test	Hard Test
SVM*	77.13	-	63.61	-
SVM + lexicons*	**80.16**	-	**70.49**	-
TD-LSTM	73.44±1.17	56.48±2.46	62.23±0.92	46.11±1.89
ATAE-LSTM	73.74±3.01	50.98±2.27	64.38±4.52	40.39±1.30
IAN	76.34±0.27	55.16±1.97	68.49±0.57	44.51±0.48
RAM	76.97±0.64	55.85±1.60	68.48±0.85	45.37±2.03
GCAE	**77.28±0.32**	**56.73±0.56**	**69.14±0.32**	**47.06±2.45**



Reproduced Results

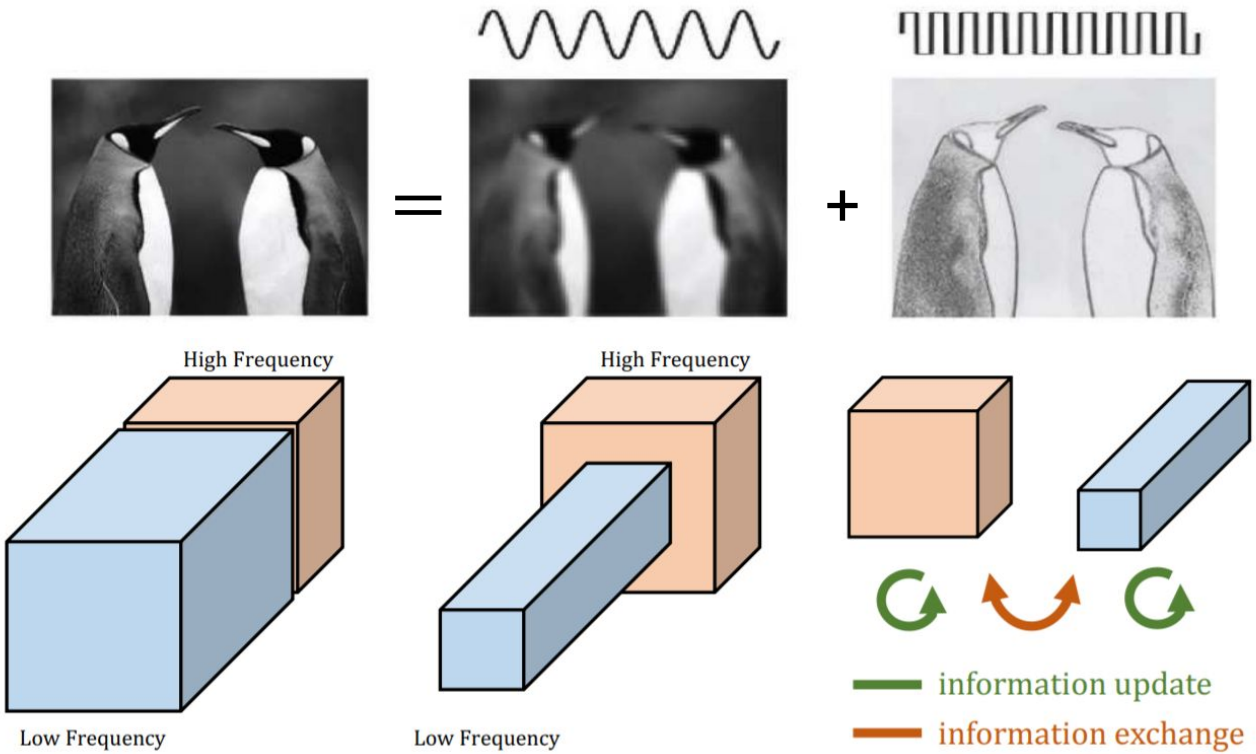
GCAE	Restaurant		Laptop	
	Test	Hard-Test	Test	Hard-Test
	74.25	55.10	65.74	49.07



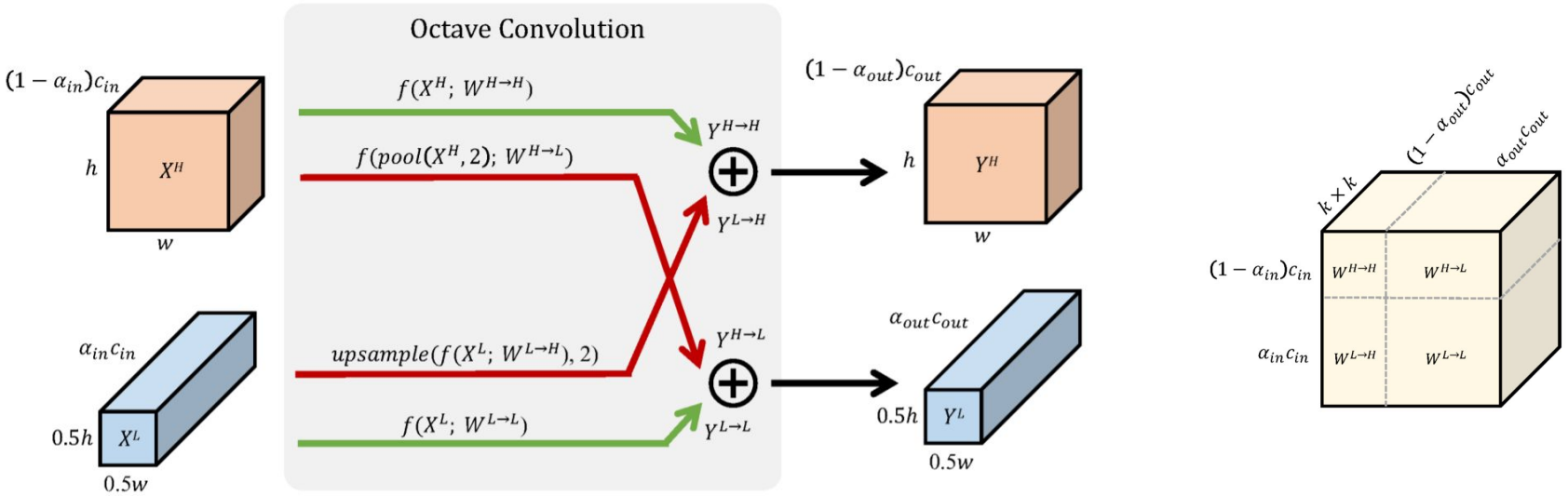
Novel Ideas that can be implemented

- Octave Convolutions
- Squeeze & Excitation Block

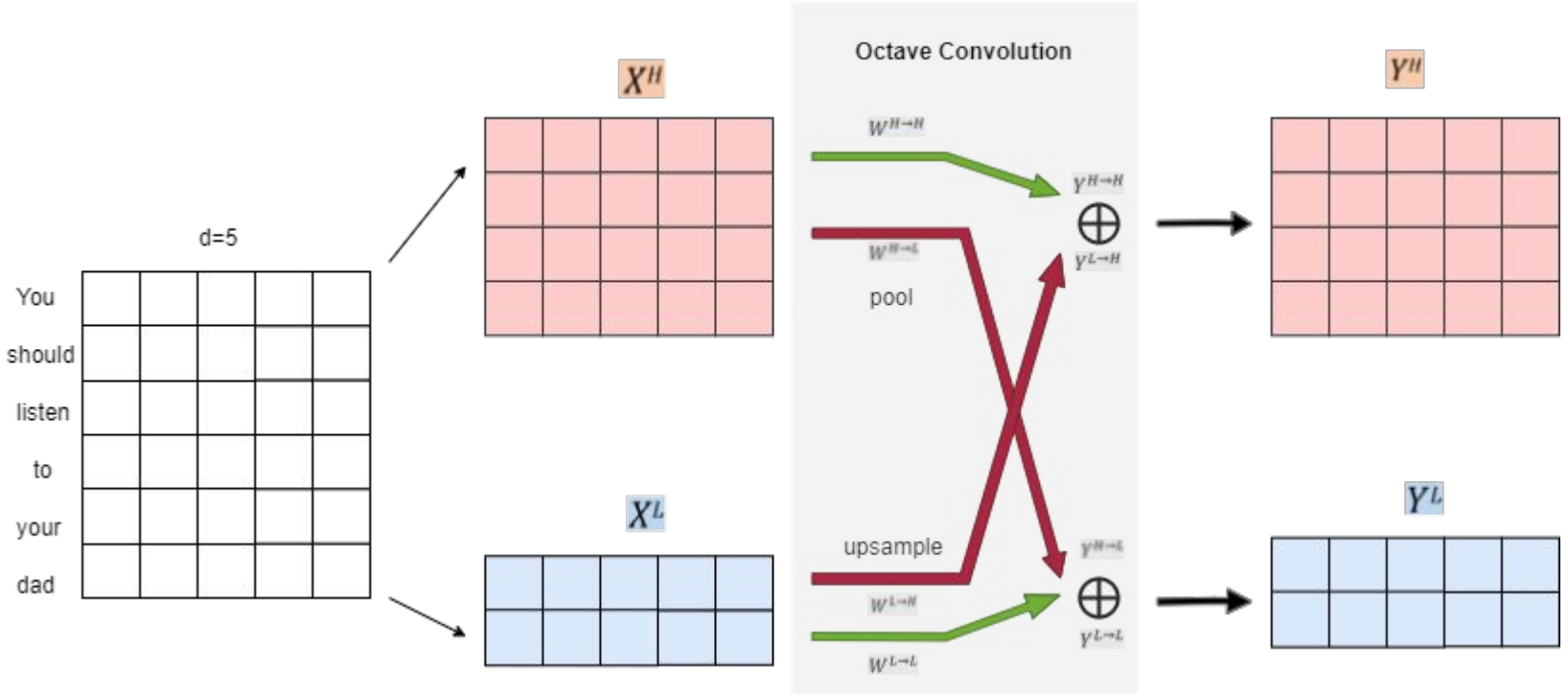
Octave Convolutions



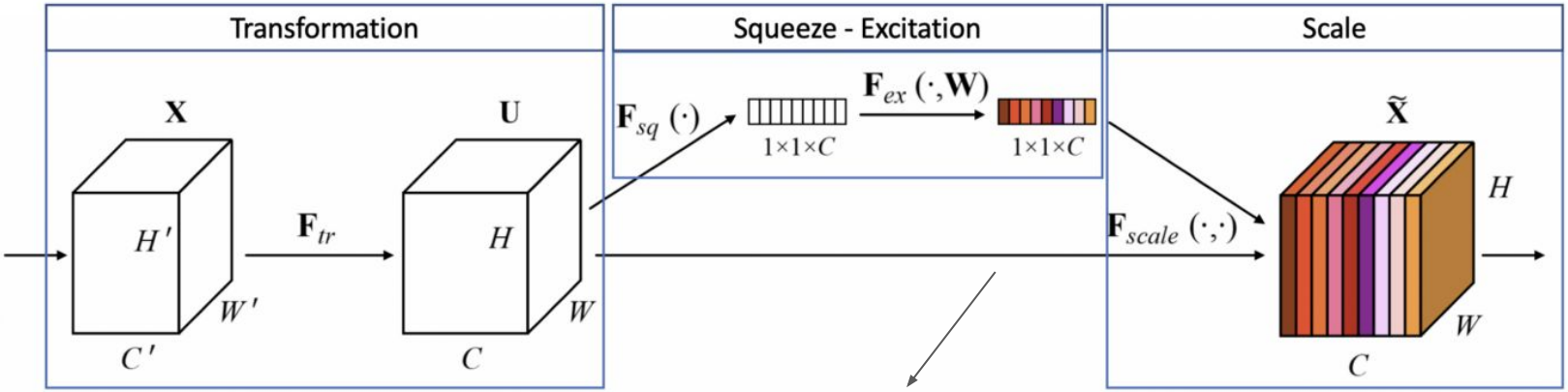
Detailed Design

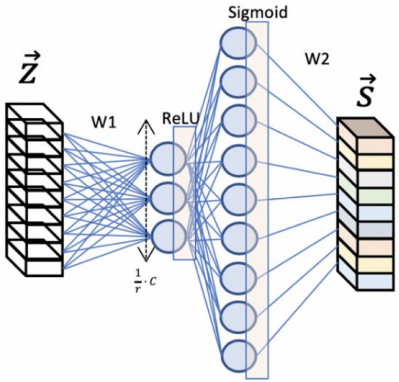


Octave convolutions on word embeddings



Squeeze & Excitation Block





Conclusion

- An efficient CNN with gating mechanisms for ACSA and ATSA tasks.
- Reproduced results similar to paper findings.
- Octave convolutions and SE Block to improve accuracy and enhance performance or original architecture

References

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- https://github.com/wxue004cs/GCAE

Thank You