

Aspect based sentiment Analysis and Summarization of Reviews

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Motivation

Standard sentiment analysis or star rating does not convey a lot of useful/actionable information about product or business entity. Aspect based sentiment analysis and review summarization help customers make informed decisions, and businesses take corrective actions.

Problem Definition

1 Aspect based Sentiment Analysis

Input

The **price** is reasonable, **service** is poor
Great **service** but **food** is okay.

Output

Sentiment (**Positive**, **Negative**, **Neutral**) of the review for each of 5 aspects (**Ambience**, **Food**, **Price**, **Service**, **Miscellaneous**)

Challenges

- 1 Lack of large labelled data set (no scope for validation set).
- 2 Detecting miscellaneous aspect and neutral sentiment more accurately
- 3 Non trivial reviews, like -
P Definitely not a restaurant to skip
N Never been disappointed here
N Never been disappointed like this
- 4 Understanding which neural network architecture works and why

Links

Data: Semeval-2014, [kaggle.com/yelp-dataset](https://www.kaggle.com/yelp-dataset)

Code: github.com/ankitdwivedi23/cs221-project

Video:

<https://drive.google.com/file/d/1QTsl1WpLiVta1TKVEEZE08uMKQMkvXQi/view?usp=sharing>

Approaches

- 1 **Aspect Detection** Trained 5 Logistic Regression Classifiers, one for each aspect, using hinge loss function as the optimization objective, and Stochastic Gradient Descent for training. Experimented with following word ngram features:

- Term Frequency-Inverse Document Frequency

TF-IDF

N-gram \longleftrightarrow Review importance

- Pointwise Mutual Information [1],

PMI

N-gram \longleftrightarrow Aspect importance

Approaches

2 Sentiment Analysis per Aspect

- **Linear Classifier**: In addition to using **tf-idf** and **PMI** (for positive and negative reviews), added a preprocessing step to modify words present in a negated context

Negated Context [1]

Not even the pizza was good \Rightarrow Not even the **pizza_NEG** was **good_NEG**

- **RNN**: Trained a bidirectional GRU network, using GloVe word embeddings to represent review tokens

Analysis

- Reviews like - "**The atmosphere is unheralded the service impedible and the food magnificent.**" contain a lot of unseen words which make both **TF-IDF** and **PMI** scores not so helpful.
- Reviews like - "**Not only was the food not bad but the price was also reasonable.**" makes it difficult to capture negated context.

Going Forward

1 Aspect based Sentiment Analysis

- In-depth error analysis
- Experiment with attentional encoder networks to capture positive/negative contexts over long ranges [2]
- Add more training and test data from SemEval 2015 and 2016 tasks

2 Summarization

We have not explored summarization beyond a basic baseline of using **TextRank** [3] on sentence vectors to rank the N most important sentences for the summary. Going forward, we would like to explore deep learning models for text summarization.

References

- [1] Svetlana Kiritchenko, Xiaodan Zhu, Colin Cherry, and Saif Mohammad.
NRC-canada-2014: Detecting aspects and sentiment in customer reviews.
In *Proceedings of the 8th International Workshop on Semantic Evaluation (SemEval 2014)*, pages 437-442, Dublin, Ireland, August 2014. Association for Computational Linguistics.
- [2] Youwei Song, Jiahai Wang, Tao Jiang, Zhiyue Liu, and Yanghui Rao.
Attentional encoder network for targeted sentiment classification.
CoRR, abs/1902.09314, 2019.
- [3] Rada Mihalcea and Paul Tarau.
TextRank: Bringing order into texts.

Classification Results

Aspect Detection

Metrics	Train	Test
Total	3348	363
Predicted	3323	330
Correct	3320	285
Precision	0.999%	0.864%
Recall	0.992%	0.785%
F1-score	0.995%	0.825%

Sentiment Analysis

Approach	Train	Test
Classifier: TF-IDF	99.64%	85.31%
Classifier: PMI	89.34%	84.91%
Classifier: Log Count Ratio	90.17%	84.19%
Classifier: TF-IDF + Negated Context	99.70%	85.44%
Bidirectional GRU	99.20%	86.82%

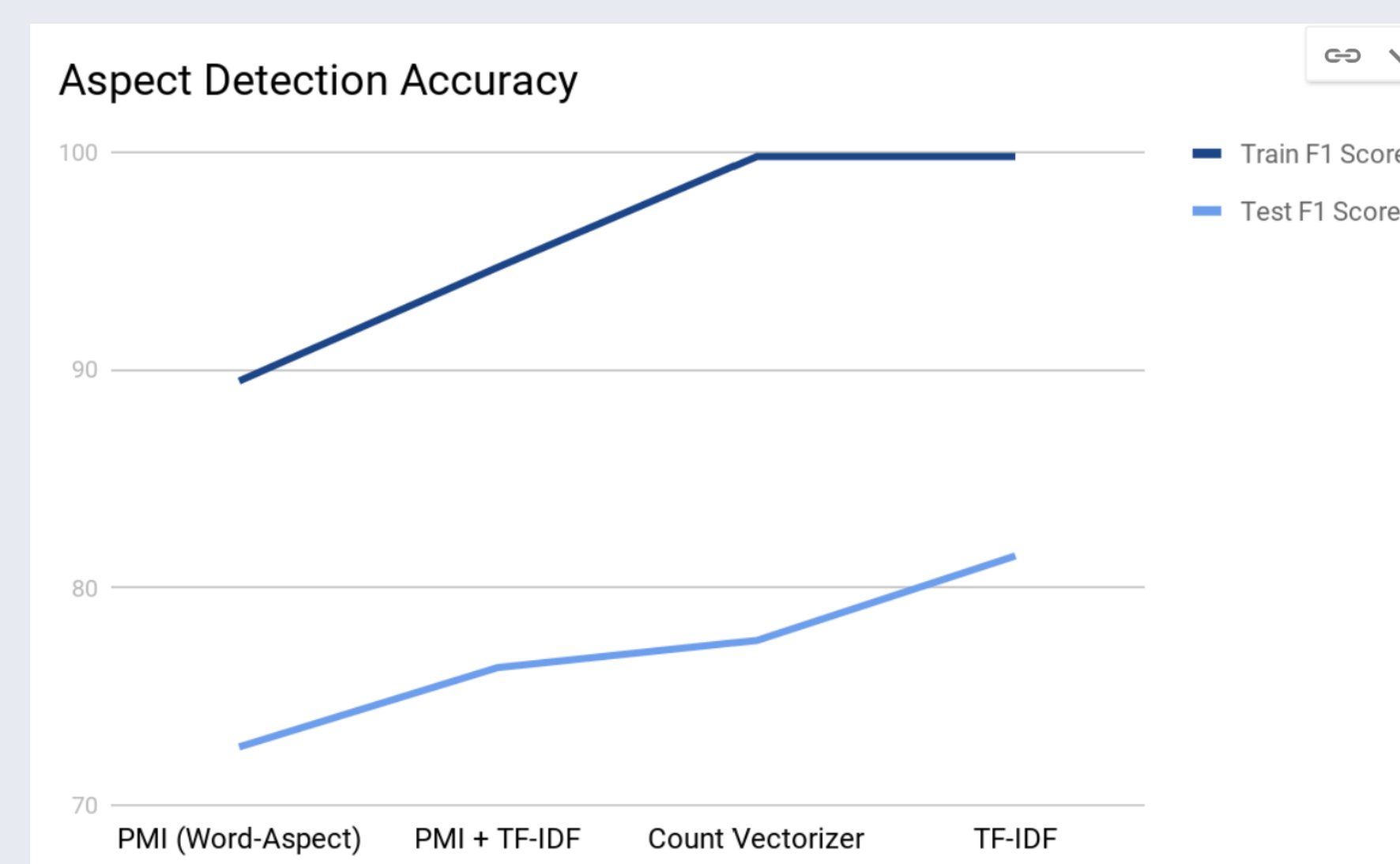


Fig.: Aspect Detection

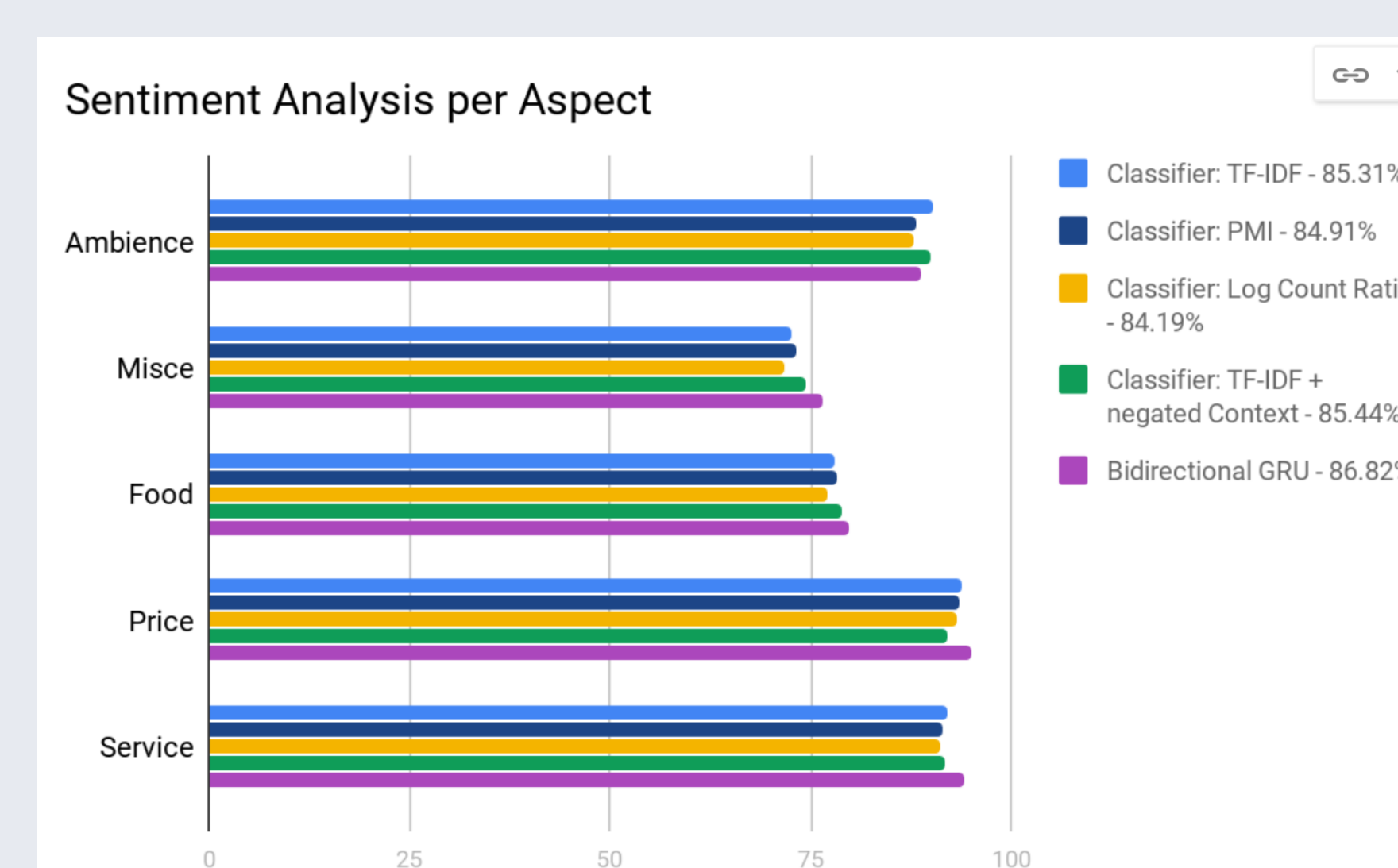


Fig.: Sentiment Analysis