INDRAPRASTHA INSTITUTE of INFORMATION TECHNOLOGY DELHI

# SARCASM DETECTION IN ENGLISH LANGUAGE

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## INTRODUCTION


- Sarcasm is a prevalent form of communication across various cultures.
- Sarcasm is a way of expression in a humorous or mocking way.
- However, detecting sarcasm in textual means is challenging.
- Sarcasm can lead to misunderstandings and conflicts if not interpreted correctly.
- Studies suggest that misinterpretations of sarcasm can occur in up to 20% of cases.
- Further, sarcasm in conversation may affect various sentiment analysis tasks and lead to biased analysis.

## LITERATURE REVIEW

- Rathod et al. investigated sarcasm detection in news headlines. Neural networks were used to create sarcasm detectors and study how computers pick up sarcasm's idiomatic patterns.

- Ghosh et al. redefined sarcasm detection as a word sense disambiguation problem. They termed it as Literal/Sarcastic Sense Disambiguation (LSSD).

- Ghosh et al. also investigated various Long Short-Term Memory (LSTM) network architectures, emphasizing attention mechanisms. The significance of contextual information and attention mechanisms in enhancing sarcasm detection performance

## DATASET

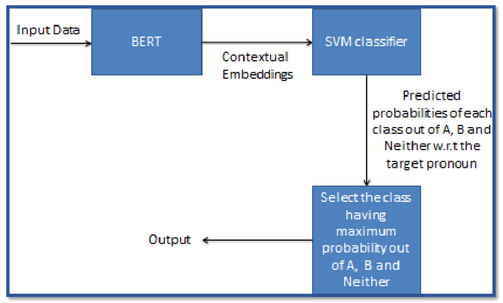
- Collection of tweets accompanied by a label and a non-sarcastic rephrase.
- Labels were provided directly by the authors of the tweets themselves.
- Mitigates any potential biases or interpretation issues that may arise from using predefined tags or third-party annotators.

| | tweet | rephrase | sarcastic |
|---|---|---|---|
| 0 | The only thing I got from college is a caffein... | College is really difficult, expensive, tiring... | 1 |
| 1 | I love it when professors draw a big question ... | I do not like when professors don't write out ... | 1 |
| 2 | Remember the hundred emails from companies whe... | I, at the bare minimum, wish companies actuall... | 1 |
| 3 | Today my pop-pop told me I was not "forced" to... | Today my pop-pop told me I was not "forced" to... | 1 |
| 4 | @VolphanCarol @littlewhitty @mysticalmanatee I... | I would say Ted Cruz is an asshole and doesn't... | 1 |

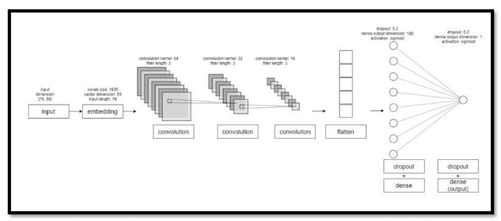
Data Snippet

## METHDOLOGY

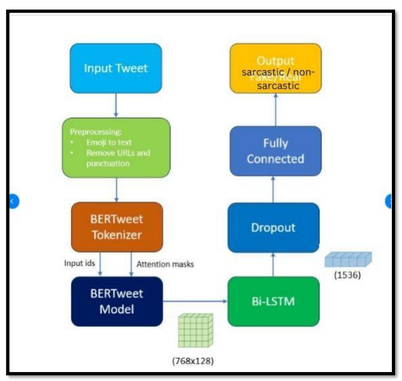
- **Preprocessing:-**
  - **a) Tweet Normalisation**
  - **b) Token Normalisation**
- **Model Selection**
- **Sarcasm Detection**
  - **a) SVM**
  - **b) Pre-trained Helnivan**
  - **c) BertTweet with BiLSTM**
  - **d) Bert-Based-Uncased with KIM-CNN**
  - **e) RoBERTa Base with Dense layers**
- **Sarcastic Rephrase**
  - **a) RoBERTa**




SVM classifier with BERT embeddings




KIM CNN with BERTtweets & BERT embeddings

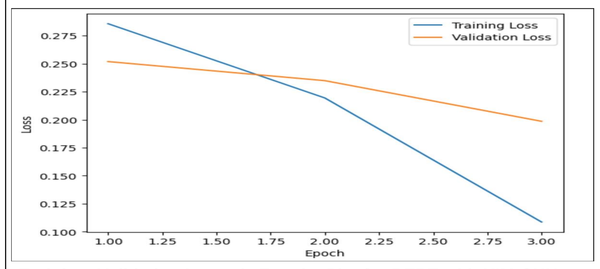



BERTtweets with BiLSTM

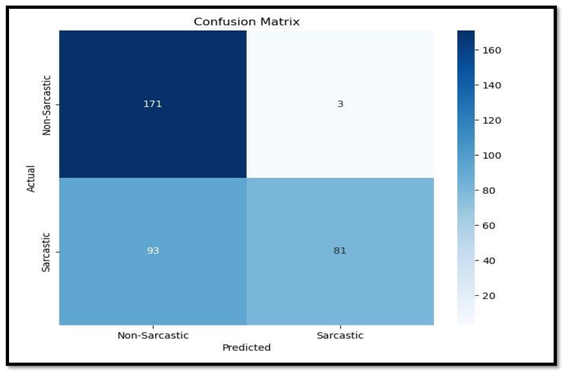
## RESULTS

| MODEL | ACCURACY | MACRO-F1 |
|---|---|---|
| SVM | 0.619 | 0.53 |
| Pre-trained Helnivan (English Sarcasm Detector) | 0.793 | 0.46 |
| BertTweet with BiLSTM | 0.766 | 0.43 |
| Bert-Based-Uncased with KIM-CNN | 0.723 | 0.63 |
| Roberta Base with Dense layers | 0.793 | 0.46 |

**Summary of Evaluation Metrics**




Training, Validation Loss v/s Epochs Plot for BERT with KIM-CNN




Confusion Matrix of Sarcasm Rephrase Detection using RoBERTa

```
Accuracy: 0.857
Precision: 0.735
Recall: 0.857
F_score: 0.791

              precision    recall  f1-score   support

           0       0.86      1.00      0.92      1200
           1       0.00      0.00      0.00       200

    accuracy                           0.86      1400
   macro avg       0.43      0.50      0.46      1400
weighted avg       0.73      0.86      0.79      1400

(0.8571428571428571, 0.7346938775510203, 0.8571428571428571,
```

Classification Report of RoBERTa with BiLSTM and Dense layers

## ANALYSES

- SVM gives an accuracy of 0.619 amongst the models used. It forms a baseline for performance of ML-based models in sarcasm detection.
- BertTweet with BiLSTM and Bert-Based-Uncased with KIM-CNN models show moderate performance, and the Roberta Base with Dense layers achieves the highest accuracy.
- Helnivan, a pre-trained sarcasm detection model is used as a baseline for transformer based models in sarcasm detection.
- Transformer based are effective in capturing contextual information and subtle linguistic cues associated with sarcasm. Models like Bert-Based-Uncased with KIM-CNN, which leverage transformer-based architectures like BERT demonstrate competitive performance with a macro-F1 score of 0.63.

## CONCLUSION

- Overall, the use of transformer-based models for sarcasm detection showcases promising results.
- This highlights the importance of leveraging advanced neural network architectures and pre-training strategies for understanding complex linguistic phenomena in natural language processing tasks.
- Text-only sarcasm detection has limitations; understanding requires context like tone and situation. Multimodal approaches, considering text, audio, and visual cues, are essential for accurate detection.

## References

Rathod, S., & Kataria, A. Sarcasm Detection Using Natural Language Processing. *Available at SSRN 4451909*.

Ghosh, D., Guo, W., & Muresan, S. (2015, September). Sarcastic or not: Word embeddings to predict the literal or sarcastic meaning of words. In *proceedings of the 2015 conference on empirical methods in natural language processing* (pp. 1003-1012).

Ghosh, D., Fabbri, A. R., & Muresan, S. (2017). The role of conversation context for sarcasm detection in online interactions. *arXiv preprint arXiv:1707.06226*.

Chen, Y. (2015). *Convolutional neural network for sentence classification* (Master's thesis, University of Waterloo).