# A Deeper Look into Sarcastic Tweets Using Deep Convolutional Neural Networks
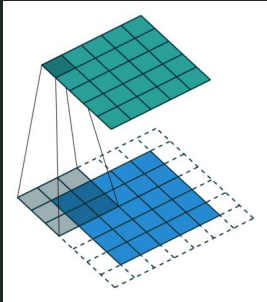
**Data Mining - Presentation2**





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# PROBLEM DESCRIPTION

- The Merriam-Webster dictionary defines sarcasm as a sharp and often satirical or ironic utterance; a bitter taunt.
- It is an important feature in **Natural Language Processing** tasks and is used in opinion mining, marketing research, information categorization, etc.
- It is key in Sentiment Analysis as it can completely flip the Polarity of opinions.
- Hence it cannot be treated just as a simple problem of Text Classification

- Example:

> "If Hillary wins, she will surely be pleased to recall Monica each time she enters the Oval Office"

# DATA MINING TASKS USED

1) **Data Selection**: Taken from Kaggle where reddits tweets have been classified.

| | Sarcastic (1) | Not sarcastic (0) |
|---|---|---|
| Train | 400000 | 400000 |
| CV | 50000 | 50000 |
| Test | 50000 | 50000 |
| Total | 500000 | 500000 |

We prepared a balanced dataset for our task

2) **Data Pre-processing**: The raw data source was used to create usable data CSVs. Plus text cleaning and exploratory data analysis was also performed.

| | label | comment | author | subreddit | score | ups | downs | date | created_utc | parent_comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | But they'll have all those reviews! | RoguishPoppet | ProductTesting | 0 | -1 | -1 | 2016-11 | 2016-11-01 02:04:59 | The dumb thing is, they are risking their sell... |
| 1 | 1 | wow it is totally unreasonable to assume that ... | pb2crazy | politics | 2 | -1 | -1 | 2016-11 | 2016-11-01 02:42:11 | Clinton campaign accuses FBI of 'blatant doubl... |
| 2 | 1 | Ho ho ho... But Melania said that there is no ... | pb2crazy | politics | 8 | -1 | -1 | 2016-10 | 2016-10-18 16:20:53 | Anyone else think that it was interesting the ... |
| 3 | 1 | I can't wait until @potus starts a twitter war... | kitduncan | politics | 3 | -1 | -1 | 2016-11 | 2016-11-01 03:22:33 | Here's what happens when Obama gives up his Tw... |
| 4 | 1 | gotta love the teachers who give exams on the ... | DEP61 | CFBOffTopic | 3 | -1 | -1 | 2016-11 | 2016-11-01 03:30:11 | Monday night Drinking thread Brought to You by... |

3) **Data Mining**: Used CNN model for text classification task.

4) **Interpretation/Evaluation**: We used F1-score and confusion matrix to evaluate the model.

```
+--------+-----------+-------------------------------------------+
| Model  | F1-Score  | % of sarcastic comments correcly classified |
+--------+-----------+-------------------------------------------+
|   1    |  0.7234   |                  73.58                    |
|   2    |  0.7179   |                  71.78                    |
|   3    |  0.7242   |                  71.75                    |
|   4    |  0.7235   |                  72.07                    |
|   5    |  0.7222   |                  70.71                    |
|   6    |  0.7215   |                  72.10                    |
+--------+-----------+-------------------------------------------+
```

# LIST OF ISSUES AND CHOSEN ISSUE OF WORK

- Good Understanding of the context of the situation
- Culture and Gender in the Question
- People Involved in the sarcastic statement
- Prone to Novelty in Vocabulary use
- Unstructured Data
- Borders of Sarcasm aren't that well defined
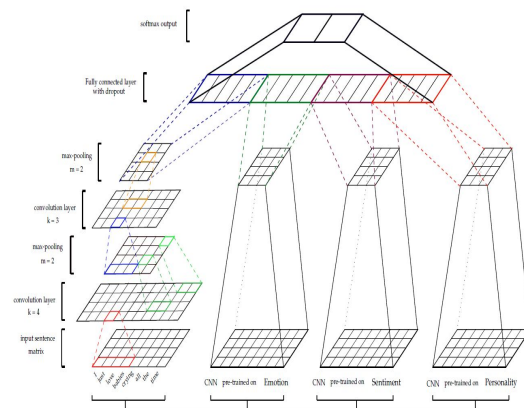


To solve each of the above issue we created different models for each of the variables, namely: **sentiment, emotion and personality**.

# APPROACH AND IDEA

We've used 1D CNN models to extract features from raw texts and make classifications. We've used combinations of three different kinds of features:

1. Content features from raw texts.
2. Sentiment features using Transfer Learning. Model trained on twitter dataset.
3. Emotion features using Transfer Learning. Two models trained on two different datasets.

In total we made 6 models with combination of above 3 models to check which of the model performs the best.

# Model 1: Using only content features

Predictions made using only content features extracted from 1D CNN.

F1-Score = 0.7234

% of correctly classified comments = 73.58%
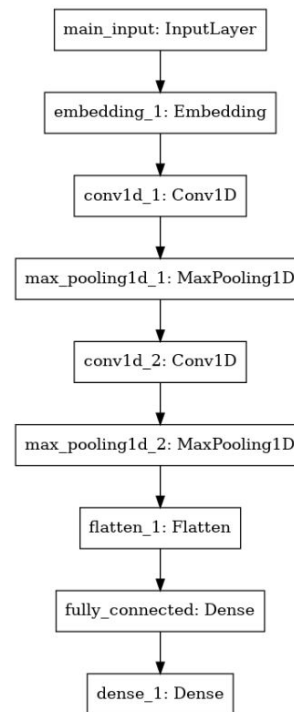
# Model 2: Using content features + sentiment features

Predictions made using content features extracted from 1D CNN and sentiment features from pre-trained model.

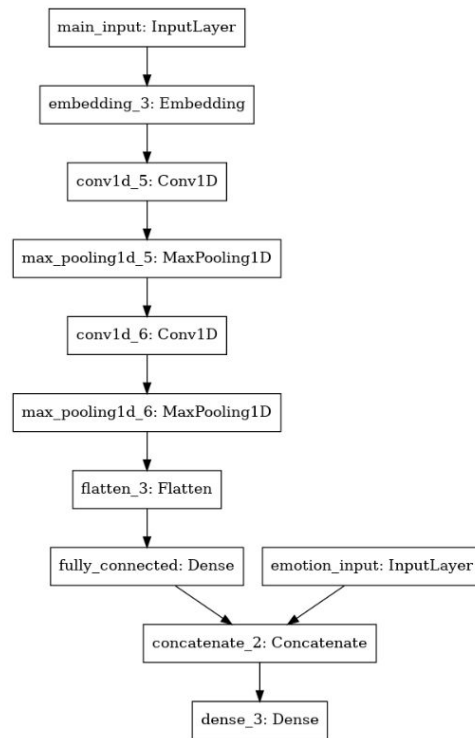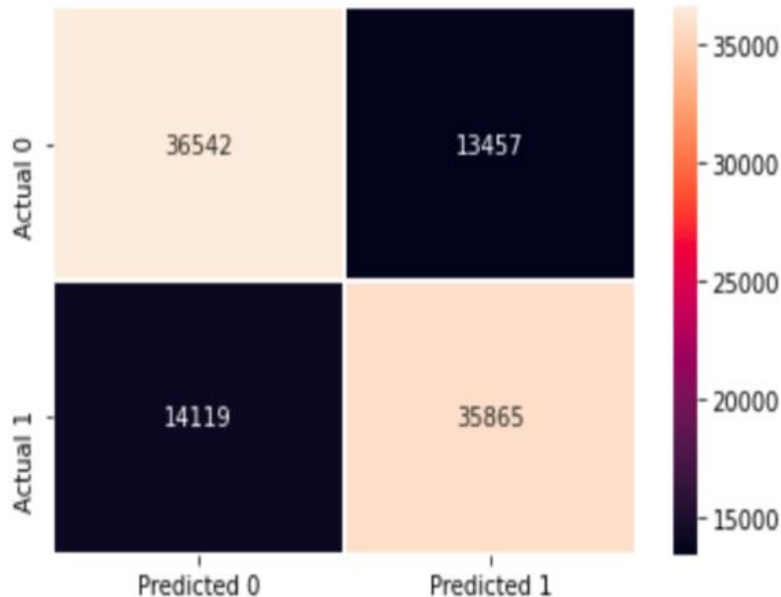F1-Score = 0.7179
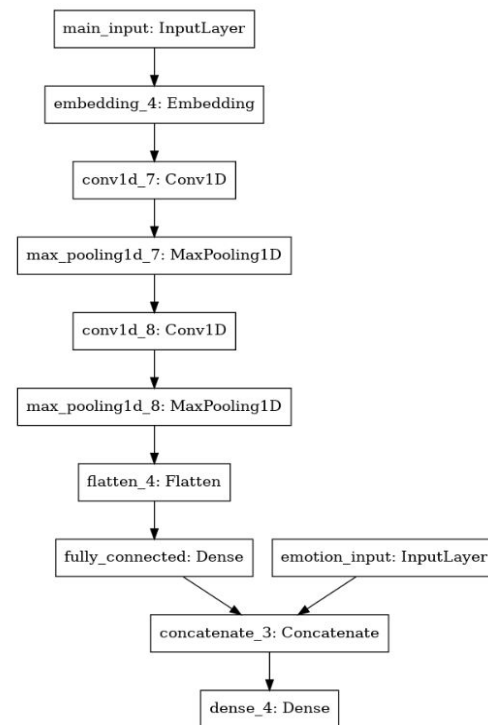
% of correctly classified comments = 71.78%
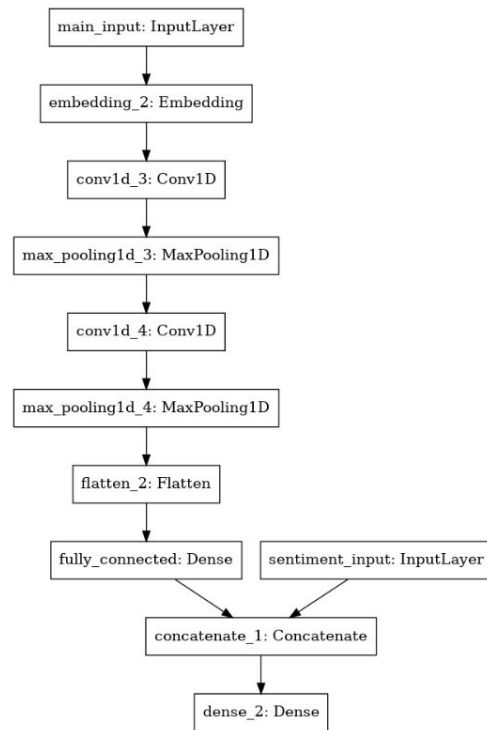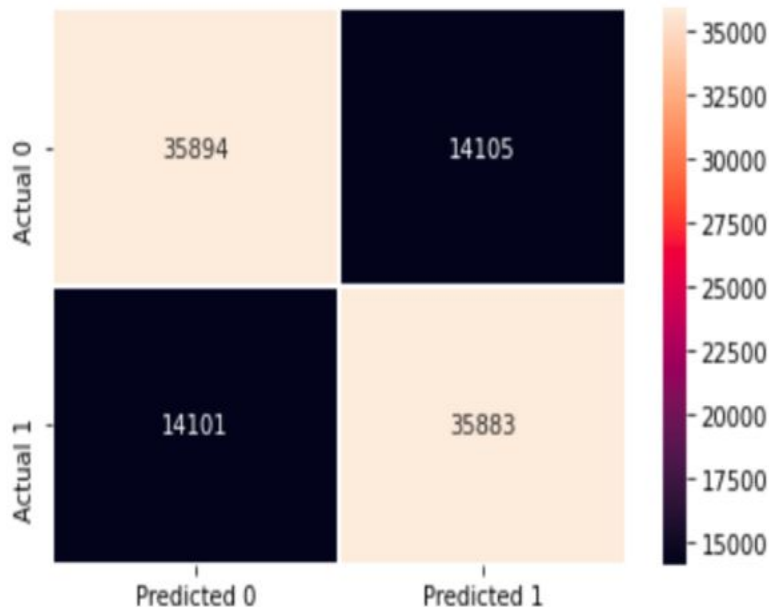
# Model 3: Using content features + emotion features

Predictions made using content features extracted from 1D CNN and emotion features from pre-trained model.

F1-Score = 0.7242

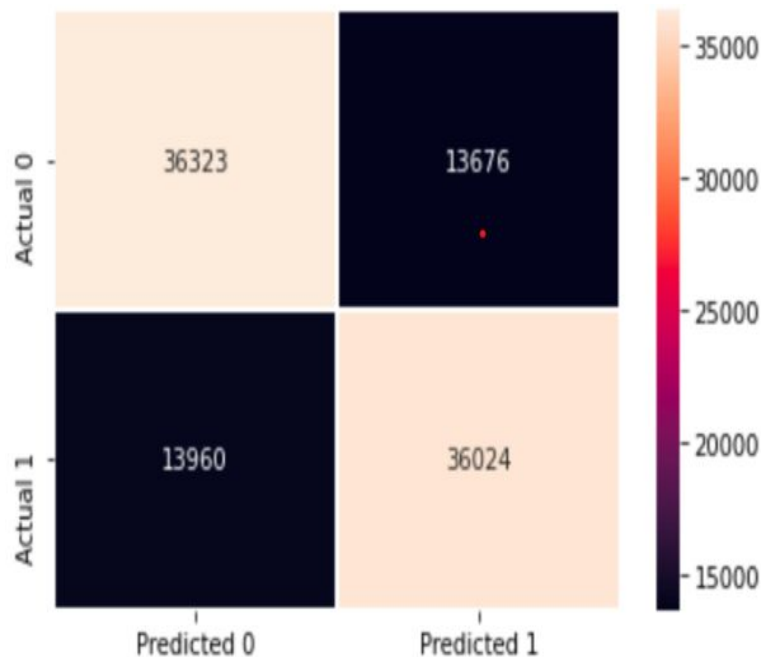% of correctly classified comments = 71.75%

# Model 4: Using content features + emotion features

This time we have used a different model trained for emotion features.

F1-Score = 0.7235

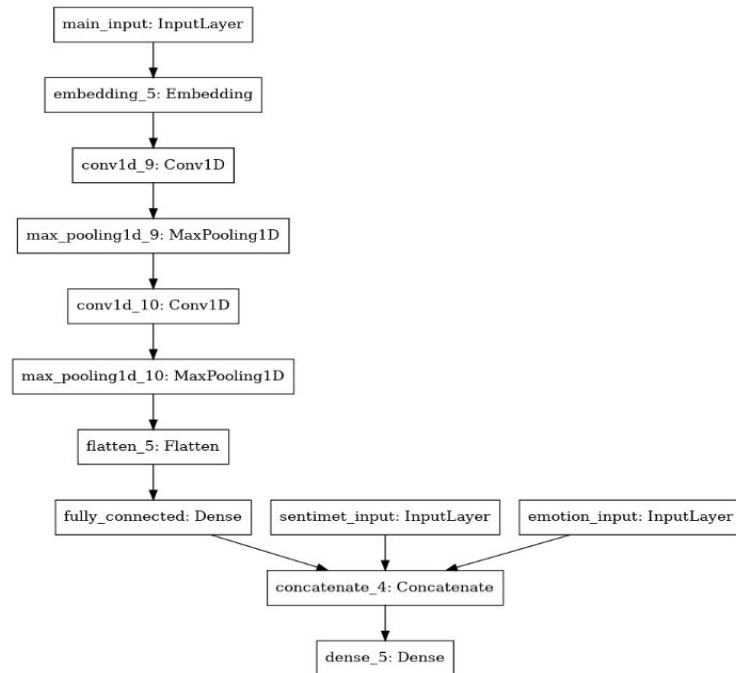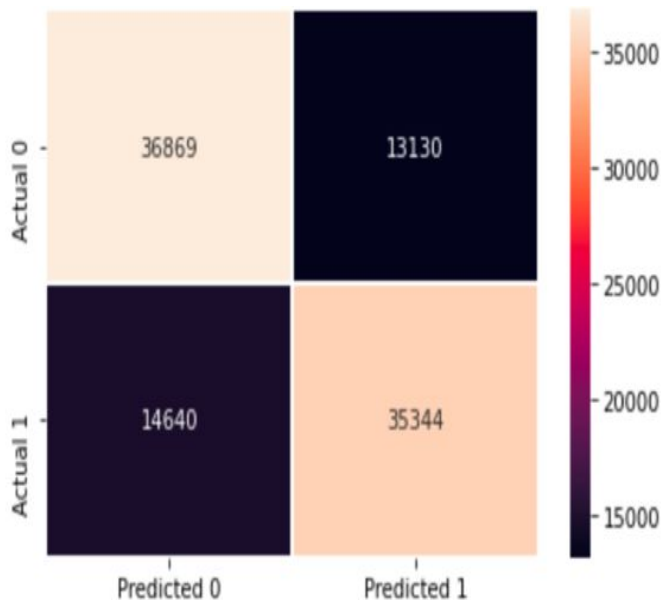% of correctly classified comments = 72.07%

# Model 5: Using content features + sentiment features + emotion features

Predictions made using content features extracted from 1D CNN, sentiment features and emotion features extracted from pre-trained models.

F1-Score = 0.7222
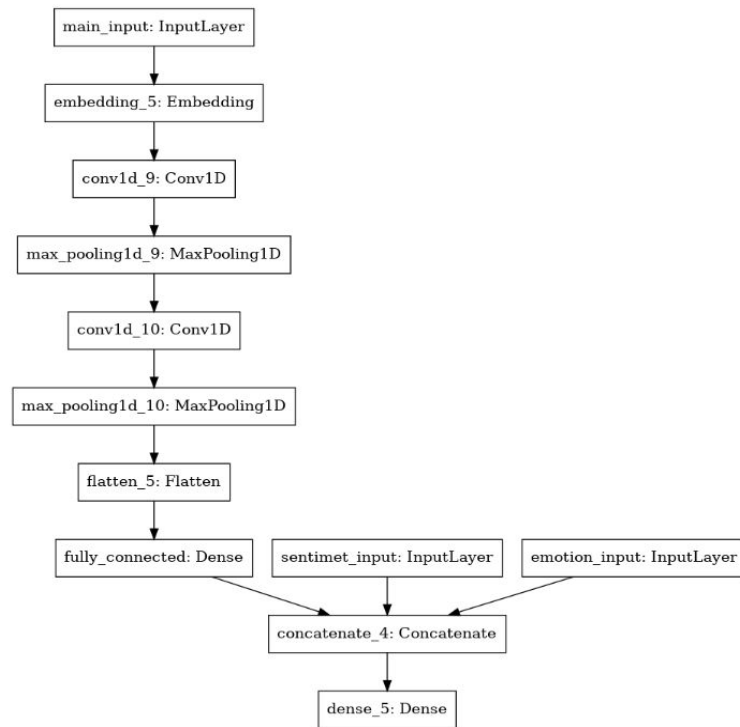
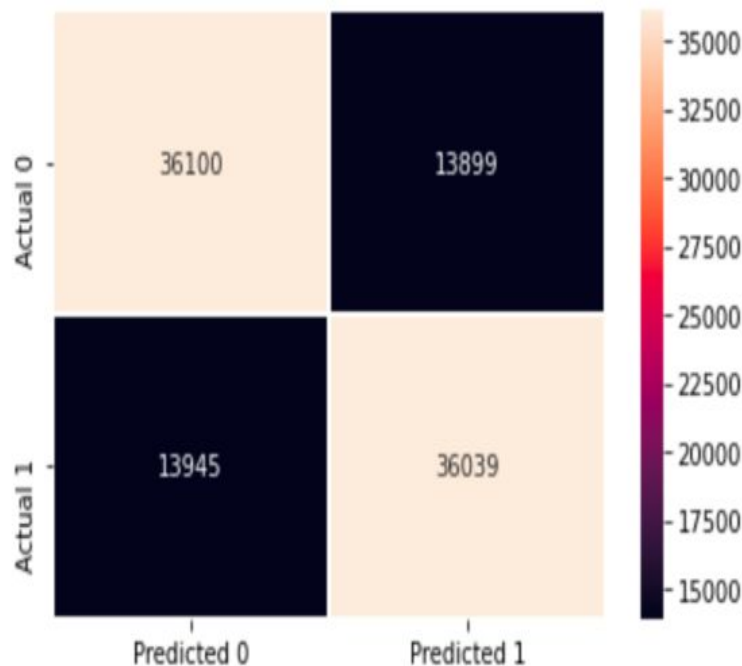% of correctly classified comments = 70.71%

# Model 6: Using content features + sentiment features + emotion features

This time we have used a different model trained for emotion features.

F1-Score = 0.7215

% of correctly classified comments = 72.1%

# CONCLUSIONS

We've seen that adding emotion and sentiment features from pretrained models have degraded our results.

Possible reason: Models were trained on much smaller datasets as compared to our SARC dataset

**Better Approaches**: Transformer Based Approach for Sarcasm Detection

# REFERRED RESEARCH PAPERS

Below are some of the research papers we referred to understand previous approaches of Sarcastic Tweets classification:

1) [Tsur et al.2010] Oren Tsur, Dmitry Davidov, and Ari Rappoport. 2010. ICWSM-a great catchy name: Semi-supervised recognition of sarcastic sentences in online product reviews. In ICWSM, pages 162–169.
2) [Gonz´alez-Ib´anez et al.2011] Roberto Gonz´alez-Ib´anez, Smaranda Muresan, and Nina Wacholder. 2011. Identifying sarcasm in Twitter: A closer look. In Annual Meeting of the Association for Computational Linguistics: Human Language Technologies: short papers-Volume 2, pages 581–586. Association for Computational Linguistics.
3) [Riloff et al.2013] Ellen Riloff, Ashequl Qadir, Prafulla Surve, Lalindra De Silva, Nathan Gilbert, and Ruihong Huang. 2013. Sarcasm as contrast between a positive sentiment and negative situation. In EMNLP, volume 13, pages 704–714.
4) [Khatri et al.2020] Akshay Khatri, Pranav P, Dr. Anand Kumar M, 2020. Sarcasm Detection in Tweets with BERT and GloVe Embeddings