

Sarcasm and Sentiment Analysis Literature Review

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Abstract - This paper does a brief literature review regarding the topic of using sentiment analysis to deduce sarcasm, specifically using advancements in transformer architecture models like a broad multitask transformer network, to allow for human-like sentiment understanding. Then expanding upon those ideas to use context clues specifically in social networks data like hashtags to understand if something is truly sarcasm, as we do not have the benefit of social cues like tone, and posture to deduce if someone is being ironic or sarcastic. So when looking at these social media context clues we would need to tokenize them in different aspects so the 2nd journal goes into the math and understanding of how we can tokenize and gather different context clues from social media platforms like twitter. The final article that we reviewed look at how to do sentiment analysis using the hugging face library, and how it could be expanded upon to incorporate more data and features. After reviewing these pieces of literature we looked into how we can combine all this to begin creating or expanding on a sentiment analysis model to better detect sarcasm.

Index Terms – Literature Review, Sarcasm, Sentiment Analysis, Transformers, Twitter.

INTRODUCTION

Social media platforms have transformed the way we communicate and express our opinions, being able to share our opinions with the world in a matter of seconds with Twitter being a prominent platform for users to share these thoughts and ideas. In most cases you can understand and distinguish the feelings behind these tweets. However, sarcasm and irony in conversation can be hard to distinguish, so adding in not being able to see the emotions through these social media platforms like twitter can make it increasingly difficult to accurately understand the true sentiment behind tweets. In recent years, sentiment analysis has emerged as a powerful tool taking advantage of recurrent neural networks and transformer models to identify the emotional tone of a message.

However we ask the question, if sentiment analysis can be used to identify sarcasm? This literature review explains what sentiment analysis is and looks at the possibility of using sentiment analysis to discover sarcasm. Our goal is to explore what models currently exist to identify sarcasm in tweets, and how they could be improved upon to create a better understanding of sarcasm within tweets.

WHAT IS SENTIMENT ANALYSIS

Sentiment analysis has become a significant part of natural language processing (NLP) which falls under the broader category of text classification, which is used to categorize text into different classes based on their content. The goal of sentiment analysis is to analyze and identify the underlying emotion of the text. The process involves analyzing the words, phrasing, and syntax used in the text to identify the specific emotions and opinions expressed. This is done using various machine learning algorithms and techniques that identify patterns and features in the text.

One of the key structures used in sentiment analysis recently is the transformer architecture, which is a deep learning technique that has shown significant improvements in natural language processing tasks. Transformer models are used to process the text input and analyze the relationships between words in a sentence expanding on recurrent neural networks, allowing for a faster and more accurate analysis of the sentiment expressed. With the increasing amount of data available on social media platforms, sentiment analysis using transformer models has become an important tool for businesses, researchers, and policymakers to understand public sentiment and make informed decisions. Sentiment analysis can be used for a range of applications, including social media monitoring, customer feedback analysis, and political analysis.

LITERATURE REVIEW

Sentiment Analysis like described earlier to determine the author's or speaker's attitudes toward an expressed object or text's overall emotional tendencies. However, this process is not ideal for pretrained existing models because they use one of feature-based or fine-tuning methods, along with many of these existing models use single task-specific contextual representation [1] which does not work well for sentiment analysis. To address these problems a group of software engineers have proposed a broad multitask transformer network (BMT-Net).

The BMT-Net is an extract-then-classify structure that explores the high-level contextual information of unstructured data using both feature and fine-tuning based techniques. The structure takes advantage of the powerful extraction capabilities of the transformer encoder to obtain high-level contextual information [1]. BMT-Net can also learn the robust contextual representation of text due to its powerful capacity of searching in both depth and width feature spaces. The BMT-Net model was tested on two popular datasets of binary Stanford Sentiment Treebank (SST-2) and SemEval Sentiment Analysis in Twitter (Twitter), and in comparison, to other models outperformed them with an accuracy of 94.0% which is the closest any

model has come to in comparison to humans (97.8%) regarding sentiment analysis [1].

Sarcasm occurs frequently within peoples day to day content, especially in English, and is inherently difficult to analyze, for a human. Thus sarcasm has become a common phenomenon within sentiment analysis, and because it is not entirely about the vocabulary it could be hard to train a machine learning model to analyze sarcasm. So an initial instinct would be to look beyond vocabulary, but how so? One way could be to look at the specific context and with platforms such as twitter, we could look to different aspects like threads, hashtags, and followers to generate some context.

To do this, a couple members of the computer science department from the University of Sheffield investigated this idea of context by analyzing these clues from a twitter dataset, specifically they looked at the hashtags and developed a hashtag tokenizer for GATE, so that sentiment and sarcasm found within hashtags can be detected more easily [2]. In simple terms, the tokenization works using a Viterbi-like algorithm to look for the best possible match that combines a set of known words that make up the hashtag, which would normally be characterized as a single token [2]. In their research they were concerned with not just identifying whether tweets are sarcastic or not, but also considering the range of the sarcastic modifier on the meaning of the tweet and on the polarity of the sentiment expressed. This was done to some success as according to their experiments, the hashtag tokenization achieves 98% Precision, while the sarcasm detection achieved 91% Precision and polarity detection 80% [2].

One of the first articles we reviewed was a blog by hugging face which went into detail about how one should analyze sentiment on tweets. They went through a brief overview about sentiment analysis explaining at its core that sentiment analysis uses machine learning to automatically identify how people are talking about a given topic [3]. Then goes into detail regarding how they can use a python API connected to the twitter API known as Tweepy to gather tweets, and other API's to help visualize the information. You install dependencies like transformers, tweepy, matplotlib, and wordcloud to help both with the model and the visualization aspects.

After installing the dependencies, we use tweepy to authenticate our API credentials and gather the tweets needed to train and perform the sentiment analysis on. Then we can use one of the many sentiment analysis models in the hugging face library to analyze our selected group of tweets [3]. Hugging Face has more than 400 models for sentiment analysis in multiple languages, including various models specifically fine-tuned for sentiment analysis of tweets [3]. We analyze the tweets we collected from tweepy using the hugging face model and output our results using

the pandas library, which will group the tweets into the categories of sentiment provided by the model [3].

SARCASM

Sarcasm is a form of language that involves saying the opposite of what one intends to convey, often with the use of irony or satire. It is a common phenomenon in social media, and is inherently difficult to analyze, not just automatically but often for humans too. It has an important effect on sentiment, but is usually ignored in social media analysis, because it is considered too tricky to handle [2]. Thus, it is an intriguing concept not only because of its toughness for a computer but also because of how hard it is to tell for humans especially through written communication. In written communication we lack the non-verbal cues, such as tone of voice or facial expressions, that are present in face-to-face communication to tell if sarcasm is being conveyed. So seeing if not only a computer can pick up specific elements of what sarcasm is but see if there are any patterns to pick up sarcasm especially through that written text as stated above because of how hard it is. There have been some attempts and as stated above on how to do it using context clues, and expanding on some previous models made through hugging face we believe it will be a fun and interesting task.

TWITTER

Twitter is a popular social media platform that allows users to post and interact with short messages, known as tweets, that are limited to 280 characters. It has become a powerful tool for communication, news dissemination, and marketing, with millions of users worldwide. With Twitter's mass popularity one of the more intriguing things about twitter is because of its simplicity and mass use it is a breeding ground for data. From people tweeting about politics, sports or tech, users sharing their feedback about a new shiny app, or passengers complaining to an airline about a canceled flight there are billions of thoughts being communicated daily [3]. Though with all the data provided from twitter it can be hard to make sense, understand how people are thinking and feeling about certain topics. So when we combine sentiment analysis with the mass amount of data on twitter it will allow us to make sense of all that data in real-time to uncover insights that could drive business decisions, and give us a broader understanding of people's thoughts.

CONCLUSION

Overall through the current expertise and advancements within sentiment analysis, the papers shown using transformer architecture models like a broad multitask transformer network have shown to work very well in sentiment analysis cases with an accuracy of 94.0% which is the closest any model has come to in comparison to humans (97.8%) [1]. Using these models with the large dataset of

social media at our disposal to train and analyze there could be various possibilities for advancement.

One of the interesting sectors we would like to look into is sarcasm detection. With this BMT-Net model we can look into sarcasm sentiment analysis using specific techniques to look within the context of the information beyond the vocabulary. This is especially useful when looking at a dataset like twitter where we could use context clues like hashtags and threads. Specifically in the cases of hashtags incorporating them into our sentiment analysis and tokenizing them properly could really transform the way we detect sarcasm within a setting like twitter. Using Hugging Face makes this sentiment analysis easy with its large model network and through API's like tweepy will allow us to easily analyze twitter sentiment.

With all this understanding coming from the literature review it makes the project of looking at sarcasm in sentiment analysis through a medium like twitter very plausible as a project, and will allow us to take a current sarcasm model in hugging face then expand on the model for better sarcasm detection.

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