Natural Language Processing Group project

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Abstract

This research paper analyses the last words of the inmates on death row in Texas since 1984 to analyse the emotions of these inmates and whether these emotions reflected their religious beliefs. To conduct this research, we used natural language processing methods, to be more specific; sentiment analysis on a dataset obtained from Texas Department of Criminal Justice. The word cloud generated from the dataset highlighted frequently used words such as 'love', 'God', 'sorry' and 'family'. Through sentiment analysis we obtained quantitative results. Our results showed that 37% of the collected statements showed remorse and 39% involved religion.

1 Introduction

Analyzing the language used in the last words of every inmate executed in Texas since 1984 can provide valuable insights into the emotional and psychological states of these individuals facing their imminent deaths. By examining the sentiment expressed in their final statements, we may uncover patterns that shed light on their mental and emotional states at the time of execution. Through sentiment analysis we can analyse the type of words being used. Additionally, analyzing the language may offer glimpses into their personal beliefs, religious or spiritual inclinations. Such analysis can contribute to a deeper understanding of the human psychology under extreme circumstances and provide important insights into the complexities of the death penalty system.

2 Related work

Previous work dealing with sentiment analysis and classification mostly focuses on analysing emotions in domains such as social media, customer reviews, legal contexts and political speeches. The application of natural language processing methodologies in the analysis of emotions and stance of regret and religion in the last words of inmates on death row is very specific and therefore not thoroughly investigated. A lot of papers focused on this domain deal with the psychological backgrounds and mental effects of inmates not merely targeting the use of language such as [4]. The article [3] deals with a similar data set analysing positive emotion words by using using a computerized quantitative text analysis approach. Finally the paper [2] presents an emotional classification assigning a set of emotions to inmates based on their final statement. Based on previous work there is a lack of emphasis on the religious use of words which we will further investigate.

3 Data

The data we used comes from a Kaggle dataset. It contains the last statement of 583 convicts, along with other data such as age and race [5]. In turn, the dataset comes from the publicly accessible website of the Texas Department of Criminal Justice [1].

4 Methodology

The methodology employed in this project involved conducting a word cloud of the dataset as well as a sentiment analysis on the last statements of death row inmates in Texas. It provides a quantitative measure to specifically evaluate the sentiment associated with the religious aspect of the last words of the death row inmates and the overall emotions experienced.

4.1 Word Cloud

The first thing we did once we had collected the data was to get the wordcloud associated with the dataset:

Figure 1: Word Cloud associated with the dataset

As we can see, some of the most repeated words are 'love', 'thank', 'religion' and 'family'.

4.2 Part-of-speech tagging

We also wanted to observe and evaluate the most repeated words in the statements, but due to the fact that there was no data pre-processing we got uninteresting results [1], because the most repeated words are determinants, pronouns or punctuation signs. Therefore we applied Part-of-speech (POS) tagging method to filter the most repeated nouns[2].

4.3 Sentiment analysis

Firstly, we performed sentiment analysis as it can help identify the prevalence of words associated with remorse, regret, acceptance, or even hope. It enables us to understand the spectrum of emotions experienced by these individuals as they confront their sentence.

The dataset was loaded using the Pandas library, and the NLTK library was used for sentiment analysis, specifically using the VADER (Valence Aware Dictionary and sEntiment Reasoner) lexicon. The first step was to preprocess the data by removing any rows where the last statement was labeled as "decline", meaning that no statement was provided. Next, a SentimentIntensityAnalyzer object was instantiated to actually perform the sentiment analysis. A custom function was defined to apply the sentiment analysis on each last statement, retrieving the compound sentiment score. This compound score represents the overall sentiment polarity of the statement. To further analyze the presence of remorse in the last statements, specific keywords related to remorse such as ("sorry," "regret," "apologize," "repent," and "remorse") were defined. A second function was created to perform sentiment analysis based on the presence of these remorse keywords in the text. If any of the keywords were found in the text, the statement was classified as "Remorseful"; otherwise, it was classified as "Not Remorseful." This function also returned the compound sentiment score.

The results, including the last statement, sentiment score, and remorse classification, were stored in a new DataFrame, which was printed to display the last statements, sentiment scores, and remorse classifications.

4.4 Religion in the statements

Another interesting point to consider is religion. A classification task to divide statements into *religion-involved* or *not-religion-involved* was first conducted. As we had no labeled data to train and build a classifier, we went for a straightforward approach of labeling each statement based on the words they contained. We created the regex pattern containing the words 'religion', 'faith', 'god', 'worship', 'lord', 'jesus', 'heaven', 'spirit', 'allah', 'almighty', 'christ', 'holy' and labeled a sentence as religious if it contained any of the above tokens.

The second task consisted in retrieving the most frequent sequences of words in the dataset. Constructing bi-grams for each of the above-mentioned categories to roughly see if there were any differences between both types of statements. This is done by applying the function get_most_repeated_ngrams to the filtered version of the dataset, generating separate results for each category.

4.4.1 Sentiment analysis of religious statements

Next, we conducted a sentiment analysis on statements labeled as *religion-involved*. This analysis aims to determine the polarity of these statements, indicating whether the sentenced conveyed a positive or negative sentiment. To compare the sentiment of the religious-related statements with the overall sentiment of all the last statements, the mean polarity score of the religious statements was calculated. By comparing this mean polarity score to the polarity score of all the last statements, we can assess whether the religious-related statements tended to be more positive or less positive in nature.

5 Experiments and results

As mentioned in the methodology, we decided to classify statements as remorseful if they involved any words that suggest regret for their actions e.g. sorry, regret, repent etc. From this style of classification, we classified 172 of the 461 non-declined statements to be remorseful, meaning 37% of the statements express remorse. We also calculated the polarity score of all of the non-declined statements which led to a mean score of 0.663726, with a max polarity score of 0.9987 and a minimum score of -0.9951.

The POS tagging results are showed below

Table 1: Most Repeated Words with No Data Preprocessing

Word	Count
.	4404
I	3849
,	2718
to	1672
you	1663
and	1413
the	1315
my	909
for	859
that	829

Table 2: Most Repeated Nouns using POS tagging

Word	Count
family	356
God	235
Lord	157
life	155
people	132
Jesus	115
love	114
peace	108
Thank	103
Warden	102
pain	94

Religion results:
We classified 228 statements to be *religion-involved* and 341 as *not-religion-involved*.
The most repeated bigrams are shown in the following tables:

Table 3: Most repeated bigrams and their frequencies

Overall		
Bigram	**Count**	**Relative Frequency**
I love	588	0.012071
I am	535	0.010983
I have	229	0.004701
love you	217	0.0044547
that I	204	0.0041878
I would	197	0.0040441
and I	191	0.0039209
like to	169	0.0034693
want to	167	0.0034282
all of	167	0.0034282

Table 4: Most repeated bigrams in statements involving religion and their frequencies

Religion involved		
Bigram	Count	Relative Frequency
I am	369	0.011699
I love	342	0.010843
I have	150	0.0047557
I would	129	0.0040899
and I	127	0.0040265
that I	123	0.0038997
love you	123	0.0038997
all of	121	0.0038363
like to	114	0.0036143
want to	111	0.0035192

Table 5: Most repeated bigrams in non religious statements and their frequencies

Not Religion involved		
Bigram	**Count**	**Relative Frequency**
I love	246	0.014326
I am	166	0.0096675
love you	94	0.0054743
that I	81	0.0047173
I have	79	0.0046008
I would	68	0.0039602
I hope	67	0.0039019
and I	64	0.0037272
I want	63	0.003669
want to	56	0.0032613

We then found the polarity scores of the religious related statements to compare with the polarity scores of all of the statements to see if the statements with a religious aspect were more or less positive. The average polarity score of the statements with a religious aspect was 0.786153, with a max polarity score of 0.9988 and a minimum polarity score of -0.9866. Below you can see a bar chart comparing the mean of the polarity scores of the religious related statements against all of the statements, both religious and non-religious along the possible scale of polarity scores with -1 being entirely negative and 1 being entirely positive:
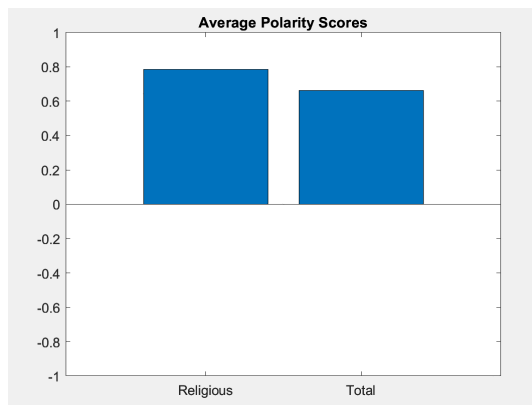
Figure 2: Bar Chart of mean polarity scores

6 Conclusion and discussion

The results showed that approximately 37% of the non-declined statements expressed remorse. This fact suggests that many inmates, exhibited last minute feelings of regret, sorrow, or repentance for their actions. Additionally, while remorse was present in a notable portion of the statements, it is important to note that not all statements conveyed it. This suggests that the variety of emotions of individuals facing execution is complex and diverse.

The mean polarity score for all non-declined statements was 0.663726, indicating a generally positive sentiment. This indicates that despite the gravity of their situations, some inmates expressed positive emotions or sentiments. This could imply a range of factors such as finding peace or forgiveness, or expressing love and gratitude towards their loved ones. Regarding the limitations of this approach, it's important to note that sentiment analysis provides a quantitative measure of sentiment polarity, but it might not capture the full complexity and nuances of the emotional states expressed in the statements.

Among the statements, 228 (approximately 39%) were classified as religion-involved, indicating that religion played a significant role in the final words of these individuals. On the other hand, 341 (approximately 59%) were labeled as not-religion-involved, suggesting that religion was not explicitly mentioned or emphasized in those statements. From this information we can conclude that, although most statements were not religious-oriented, religion still holds significance for a considerable number of individuals on death row, potentially providing them with solace, spiritual guidance, or a means to express their faith.

As you can see from the bar chart, statements involving religion had a slightly higher average polarity score of 0.786153 compared to the rest of the statements. This means that such statements tend to carry a slightly more positive sentiment. The use of religious language or beliefs may have

contributed to a greater sense of hope, comfort, or acceptance among the individuals making them. It suggests that religion may play a role in shaping the emotional tone and outlook of the inmates. However, it's important to note that the difference in sentiment is relatively small, indicating that emotions expressed in both categories of statements generally leaned towards the positive side.

Lastly, the prevalence of words related to love, God, sorry, and family indicates that these individuals often express emotions and attachments to loved ones in their final moments. The presence of remorse-related words suggests that some inmates experience regret or a sense of accountability for their actions.

The study contributes to a deeper understanding of human psychology under extreme circumstances and offers important insights into the complexities of the death penalty system. However, it is important to note the limitations of this study. The analysis is based solely on the last statements of inmates executed in Texas, which may not be an accurate representation of all death row inmates or execution practices in other jurisdictions. Additionally, the sentiment analysis approach relies on lexical analysis and may not fully capture the complexities of emotions expressed in the statements. Future research could expand the analysis to include a broader range of death row inmates from different jurisdictions and cultural backgrounds. Additionally, incorporating qualitative analysis techniques, such as interviews or surveys, could provide deeper insights into the emotional and psychological states of these individuals.

7 References

References

[1] Executed offenders - texas department of criminal justice. https://www.tdcj.texas.gov/death_row/dr_executed_offenders.html.

[2] Jamilu Awwalu, Saleh El-Yakub Abdullahi, and Ogwueleka Francisca Nonyelum. Naïve bayes emotion classification of final statements from death row youths before execution. *Malaysian Journal of Computing and Applied Mathematics*, 3(2):60–72, 2020.

[3] Sarah Hirschmüller and Boris Egloff. Positive emotional language in the final words spoken directly before execution. *Frontiers in Psychology*, 6:1985, 2016.

[4] Brendan D Kelly and Sharon R Foley. Love, spirituality, and regret: Thematic analysis of last statements from death row, texas (2006–2011). *Journal of the American Academy of Psychiatry and the Law Online*, 41(4):540–550, 2013.

[5] mykhe1097. Last words of death row inmates.
https://www.kaggle.com/datasets/mykhe1097/
last-words-of-death-row-inmates.