Finding patterns between religions and emotions

A quantitative analysis based on Twitter data

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Abstract   The emotions someone associates with his or her religion and how this person talks about his or her faith have always been considered a personal topic. In this paper, the question of whether specific religions and emotions are connected is discussed. Based on Twitter data, individual networks, or so called "tribes", are created for four religions: Buddhism, Christianity, Islam and Judaism and four emotions: anger, fear, joy and sadness. Similarities and differences between tribes are analyzed using the content of the tweets. A network analysis is done for all tribes and the resulting data is used to create a machine learning model for each category. Using these, general patterns between emotions and religions are outlined and discussed. An analysis with further data was conducted on our model.

1 Introduction

Religion has always played an important role in people's life. At the beginning of mankind, everything unexplainable was usually attributed to one or more Gods. [5] In the Middle Ages, when the church was one of the two great powers, people had to have a faith. People without any religion or with beliefs that were different were often punished and killed. However, faith was never a pure coercion. Most people believed in their respective God out of conviction. [7] Today, though freedom of religion exits in most places of the world, it is not surprising that there are still many people who believe in God [11].

   Unfortunately, despite this freedom, discrimination and hatred towards certain religions have risen considerably. In the western world, the popularity of conservative and anti-immigration ideologies has been growing steadily, which has resulted in discrimination against certain religions. Despite the rise in religious discrimination, people have held onto their faith. Possible reasons for this may include beliefs that faith gives them strength and guidance through their lives, fear of death and consequences of non-eternal life and adherence to family traditions. In a scientific environment, it would be interesting to explore emotions of specific religious groups and not just how other groups feel about them. Inversely, it would also be valuable to know if a specific emotion has a connection to a faith.

2 Related Work

The connection between religions and emotions has already been considered in substantial research. Mostly, however, it is discussed in the literary field or addressed by surveys and observations. In addition, the focus lies often more on spiritual people than on religious ones.

In chapter "Religion, emotions, and health" of the book "Handbook of Emotion, Adult Development, and Aging" by McFadden and Levin, the authors argue that religion can cause positive emotions that bring salvation from a psychological perspective. [8]

"The Oxford Handbook of Religion and Emotion" discusses both, the mutual influence of religions and emotions, the culture of religions and that religious culture gives rise to emotions [2]. The introduction "The Study of Religion and Emotion" analyzes the emotional component in religion. It is emphasized that religions strongly influence emotions and therefore, religion affects behaviors through emotions. In comparison to many previous studies in this field, modern results have been taken into consideration. There is some progress in the field of emotion research which simplifies to categorize them. In addition, this study already distinguishes between different religions, as well as gender, age and other unambiguous characteristics. It also addresses specific emotions such as love, hope, ecstasy, melancholy and terror in more detail. While this study concludes that feelings and religious affiliation correlate, the practical component is missing from the research. [1]

Another suitable study is "Positive emotions as leading to religion and spirituality" written by Saroglou, Buxant and Tilquin. In this study, three groups "Without Faith", "Religious" and "Spiritual" were distinguished. The results show that both religious and spiritual subjects had more positive feelings during a conversation, although the result was clearer for spiritual subjects. The study suspected that positive emotion reinforced faith. In this study, however, fewer than 200 people were examined. In addition, no distinction was made between the different religions. [12]

The most current study found is from 2014 and was written by Van Cappellen, Toth-Gauthier, Saroglou and Fredrickson. In the empirical study, the positive emotions of religious, spiritual and non-religious people were compared. Two groups were examined. The first group consisted of subjects from European churches and the second consisted of American workers from a university who were interested in meditation. The results show that religious people have more feelings of reverence, gratitude, love and peace and less feelings of pleasure and pride. However, subjects were directly investigated in the study and the results based on their self-perception. In addition, the study made no distinctions between different religions. [14]

Our work examines the mutual relationship between four religions and four emotions in detail. One positive as well as three negative emotions are considered. Since this paper is based on Twitter data, the self-perception bias is limited. The

examination of tweets allows access to a lot of profiles and their data. Based on this, our research question is: *Are there patterns between specific religions and emotions?*

In order to answer this question, we created eight tribes with relevant twitter accounts: four different religion tribes and four different emotion tribes. Based on the datasets, we could analyze the tribe network. The generated data was used in a machine learning approach to find patterns between religions and emotions.

3 Methods

An explorative approach was chosen for this project. The NRC-Affect-Intensity-Lexicon was used to create the emotion tribes [9]. The religion tribes were created by searching famous leaders for each religion and their followers. Network measurements were calculated based on the six honest signals of collaboration [4].

Differences between the word usage are shown by a content analysis of the tweets. We created two Machine Learning models: one for the religion tribes and one for the emotion tribes. The approach and tools that were used in the different project iterations will be discussed further in the following sections.

3.1 Tribe Creation with Galaxyscope

The Website galaxyscope.galaxyadvisors.com provides the Tribe Creator which was used for the tribe creation [3]. Relevant English-speaking accounts were found on Twitter and added via the Twitter Profile Search to a dataset, so-called tribes. Four religion tribes and four emotion tribes were created: Anger (156 members), Buddhism (160 members), Fear (155 members), Christianity (241 members), Joy (264 members), Islam (178 members), Sadness (154 members) and Judaism (172 members). These four emotions were chosen because of the following two reasons. At first machine learning models are more precise if there are less categories. The second reason is the difficulty to distinguish between profiles of specific emotions, e. g. the tribes of Anger and Fear have many common words. The more emotions we include the harder is the distinction of those emotions.

The Twitter accounts were manually analyzed and checked to verify that only suitable Twitter accounts were part of a tribe. The Tribe Creator also creates Hashtag clouds that contain the most frequently used words for a tribe. These were used for validating the reasonableness of the tribe members.

For the religion tribes, well-known personalities (e.g. most famous rabbis or Buddhist monks that are listed in Wikipedia), obvious keywords or keyword phrases (e.g. I am a convinced Christian), and unambiguous hashtags (e.g. #jesusislove) were searched. The emotions were chosen based on the NRC-Affect-Intensity-

Lexicon [9]. The words associated with four emotions: anger, fear, joy and sadness were used to find new tribe members.

3.2 Analyzing data in Condor

We used the software Condor to analyze and visualize our tribe networks. With the "Fetch Tribes" function of Condor, it was possible to easily import our Tribe Creator data. Furthermore, Condor added further members to our manually generated tribes. We processed the datasets and calculated network measurements: Centrality annotations, Betweenness centrality, Degree centrality, Contribution index oscillation, Contribution index annotations, TurnTaking annotations, Calculate sentiment, Calculate influence, Pennebaker Pronoun Frequency, Tribefinder Annotation (necessary to check if and how our tribes are categorized into specific "Alternative Realities"). Condor provides network visualization and wordclouds (positive sentiment: green, negative sentiment: red). Based on these, we checked our tribes for errors.

3.3 Machine Learning with RapidMiner

Using RapidMiner, the resulting datasets could easily be processed. We first selected 24 attributes for the machine learning process: Centralities (Betweenness centrality and Degree centrality), Tribefinder Annotations (Personality, Lifestyle, Alternative-Realities, Recreation and Ideology), Frequency-Attributes (was, my, it, in, the, with, to, but, for, have, and, me, you), Complexity, Sentiment, Contribution index and Emotionality. We trained a random forest model and reached an accuracy of 83.49 % for religions (Table 1) and 87.07 % for emotions (Table 2). The split validation training method was used.

Table 1. Accuracy for religion model: 83.49%

	True Buddhism	True Christianity	True Islam	True Judaism	Class precision
Pred. Buddhism	18461	943	677	11	91.88%
Pred. Christianity	0	13733	0	0	100.00%
Pred. Islam	1519	5679	19857	3999	63.96%
Pred. Judaism	554	188	0	16524	95.70%
Class recall	89.90%	66.88%	96.70%	80.47%	

Table 2. Accuracy for emotion model: 87.07%

	True Anger	True Joy	True Fear	True Sadness	Class precision
Pred. Anger	21165	1199	3080	225	82.45%
Pred. Joy	819	16694	66	449	92.60%
Pred. Fear	0	0	18687	0	100.00%
Pred. Sadness	518	4609	669	21828	79.02%
Class recall	94.06%	74.19%	83.05%	97.00%	

The accuracy of the random forest model was highly dependent on the attribute selection. Based on our data, the accuracy would rise to 100 % for religions and 99.99 % for emotions if all attributes we analyzed in Condor were included in the machine learning process.

The cross-validation method was applied during the training. It did not show significant differences in accuracy (+/- 0.75% for the religions and +/- 1.14% for the emotions) and the model trained with the split validation was later used for the classifications.

After generating the random forest model, it could also be applied on data that had not previously been trained on in order to get a better understanding of the fit of the model. Table 3 shows that the classification for Buddhism worked well with a fraction of 0.747 classified to the correct tribe.

Table 3. Results of additional testing (Buddhism classification)

Index	Nominal value	Absolute count	Fraction
1	Buddhism	41156	0.747
2	Judaism	5455	0.099
3	Islam	4302	0.078
4	Christianity	4150	0.075

The summary of all tribes' fractions that were classified correctly is: Anger (0.623), Buddhism (0.747), Fear (0.706), Christianity (0.605), Joy (0.468), Islam (0.767), Sadness (0.967) and Judaism (0.392). With the help of the emotion random forest model and religion random forest model, the emotions and religions of different samples could now be predicted.

The religion model was applied on the tweets of the emotion tribes in order to classify their religion. This was also done in reverse order (classification of emotions for religion tribes). Based on this we identified patterns between religions and emotions.

3.4 Word usage analysis and visualization with RStudio

In order to get an overview which tribes were similar, the words used were compared tribewise. The word frequency percentage was calculated for each tribe by dividing the occurrence of a word in a tribe by the occurrence in both tribes. These percentages were then displayed using a scatterplot. Each point signifies an individual word, the size how often the word was used in total and the location the percentage of usage in both tribes. Furthermore, R word clouds were created for a better display of word frequency in individual tribes.

3.5 Data Aggregation and Visualization of Machine Learning results with RStudio

The results of the tweet classification are displayed in two separate stacked bar charts. Furthermore, an aggregation of the data was done. The sample was grouped by the Twitter accounts. An account is classified based on the most frequent prediction of its tweets. This was also visualized in two stacked bar charts.

4 Results and Discussion

The preliminary findings, as well as a short discussion about them is shown in the following paragraphs. Afterwards, the results of the prediction of religions for the emotion tribes and emotions for the religion tribes are presented. Furthermore, the result of applying the created models on Anti-Gun Control and Pro-Gun Control tribes as well as the Anti LGBT and Pro LGBT tribes is depicted.

4.1 Network Analysis

Most of the religion actors belonged to the Christianity tribe. A big part of the emotion network was represented by members with the emotion joy or sadness. We processed each dataset with already existing tribe datasets from Condor. The Alternative Reality tribes were of special interest for us because they include Spiritualism, Treehugger, Nerd and Fatherlander. All of our four religion tribes fit perfectly into the existing Spiritualism tribe. The same analysis was done with the emotion tribes but here only Sadness belongs to Spiritualism. The other emotions show a combination of all Alternative Reality tribes.

4.2 Word Usage

The wordclouds show several prominent points. For example, in the Buddhism tribe, it is apparent that the words "Buddhism", "meditation", "Buddhist" and "mind" are words often tweeted. In comparison to the other religions, the usage of words that are connected to daily Buddhist practices stand out in this tribe. The words "meditation", "mind", "dharma", "practice" and "compassion" are all related to the Buddhist lifestyle. Christians and Muslims use their words for god ("god" / "Allah", "god", "lord") and for prophet ("Jesus", "Christ", "lord" / "prophet", "Muhammad"). The Judaism tribe tweets more about itself as a community and country ("Israel"), not as a faith and its principles and components. The usage of Yiddish and Hebrew words is also apparent. Overall, it can be seen that the content of the tweets fits the category they have been assigned. We can see that the tribes created are correct and the data can be used for further analysis.

For the emotion tribes, the Joy tribe has words that signify joy like "love", "happy", "beautiful" and "friend" and therefore fulfills its desired use. The same is observable in the Sadness tribe that tweets about "depression", "stillbirth", "miscarriages" and "mental". However, a point of criticism can be that words like "hope", "support" and "love" also occur. This can be attributed to the fact that these are tweets of specific accounts over a long period of time. Individuals are likely to have emotions other than sadness. Another reason is that support groups are also part of this tribe. Their tweets give advice to counteract sadness and do not only talk about it.

The Fear and Anger tribes seem relatively similar in the words they used. These tribes mostly used words like "realdonaldtrump", "president" and "trump". However, the Fear tribe also talks about "mentalhealth", "war" and "anxiety". Furthermore, the Anger tribe additionally has words like "shit", "bad" and "hate". The two tribes are dominated by political topics during the time when the snapshot was taken (around the congress election in the US in 2018). The policies of the American president and his administration's conduct created a lot of anger between his supporters and critics. This can be observed in the word usage of the Anger tribe. The political topics in the Fear tribe can also be connected to this behavior. The discrepancy of the president's demeanor in comparison to previous presidents and his tendency to announce policies in tweets seem to cause fear for some Americans, which is why political topics are a part of this tribe.

To validate the emotion tribes, additional word clouds were created in Condor. This approach offered the opportunity to identify whether the words were used in a positive or negative context. The wordings of fear and anger were similar and further reflected similar sentiments: trump (positive context), people (negative context), democrats (negative context), president (positive context). In the joy cloud almost all words except "southpark22" stood in a positive context. "southpark22" was probably used in context with sarcasm and/or insults and therefore marked red. Sadness is a combination of both, words in a positive and negative context. Overall, it should be mentioned that the tweets selected were based on the actors in the tribe.

Even though these actors experience more than one emotion they show mainly the specific emotion. Correspondingly the emotion tribes mainly show the targeted emotion.

To further analyze the differences and similarities between tribes in one category and between emotions and religions, we did a pairwise comparison of tweeted words using R. The diagram shows two tribes, one on the y axis and another one on the x axis. The points in blue symbolize different words used in these tribes. The size of the dots shows the overall occurrence of a word and the location symbolizes the percentage of the frequency associated with a specific tribe. Note that the data is not normalized, which results in shift of the points in the direction of the tribe with more tweets. Since for each possible comparison, both axes have at least one point situated on them, we conclude that there are words for each tribe which are exclusive to that tribe. This means that the tribes differ in their usage of vocabulary.

4.3 Emotions and Religions

Figure 1 shows that a large percentage of Christians were predicted to have mostly the emotion of anger. We assume that the result was caused by a high number of Christian accounts on Twitter in general and because the platform only supports short messages that seem to be often anonymous and impulsive.

Sadness is dominated by Muslims and Buddhists. Based on the comparison with the Alternative Reality "Spiritualism", Sadness and Spiritualism are connected with each other. We hypothesize that Buddhists and Muslims are more spiritual than the other religions (see 4.1).

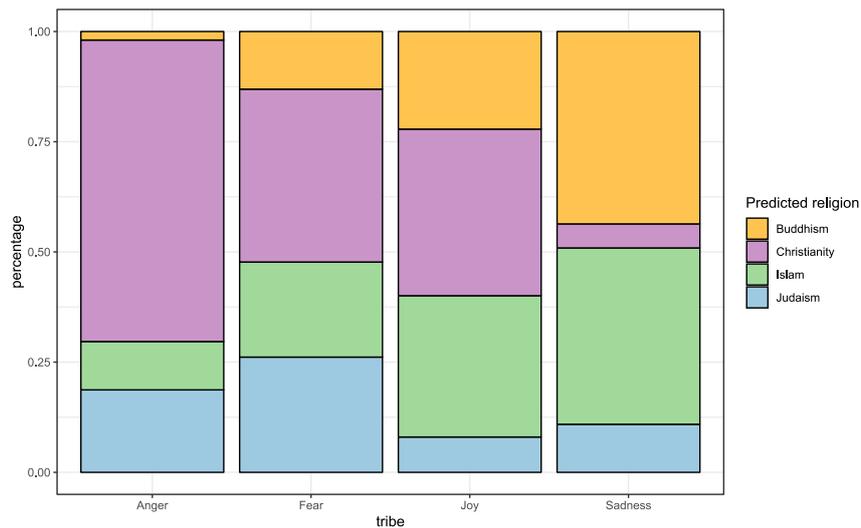**Fig. 1.** Religions predicted for emotions in actor view

Figure 2 shows the emotions predicted for religions. Overall, there is lots of sadness in all religion tribes. We suggest that sadness and negative events lead one to search for something bigger than oneself. Furthermore, there is no anger predicted for Buddhism at all. The largest proportion of fear is predicted for the Judaism tribe.

Fig. 2. Emotions predicted for religions in actor view
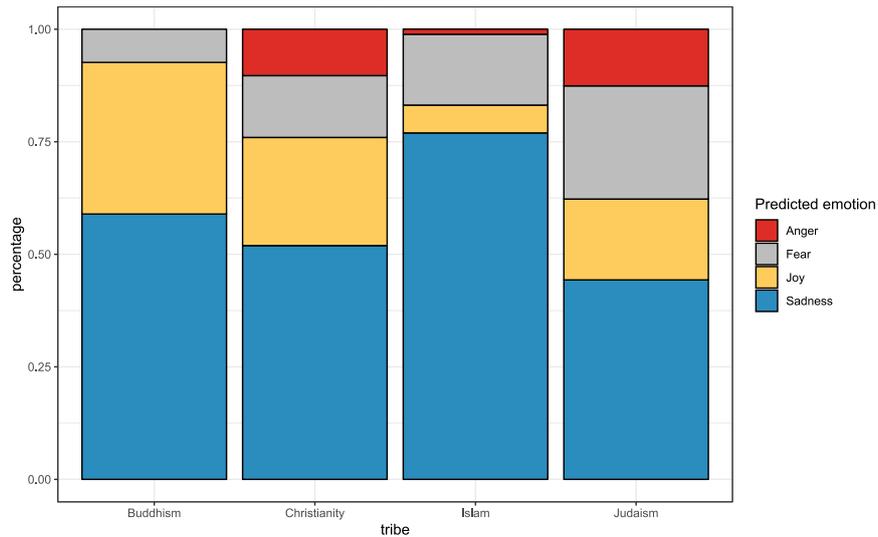
4.4 Further application

The next sections describe further applications of our model. Two different tribe themes are classified according to religion and emotion. In each case pro- and anti-attitude are considered.

4.4.1 Pro-Gun Control and Anti-Gun Control

The topic of gun control is very emotional and volatile. Thus, the tribes of Pro- and Anti-Gun Control were analyzed with our emotion model (Figure 3). The results show some indication about which emotion is predominant. The Pro-Gun Control tribe contains mostly emotion of anger, whereas in the Anti-Gun Control tribe, the emotion of fear dominates. However, in each of the tribes both emotions, anger and fear are presented with a high percentage. This could be due to the fact that the Pro-Gun Control group considers guns to be dangerous and evil without any benefits whereas the Anti-Gun Control group feels a threat to their safety and Second Amendment right to bear arms to protect themselves.
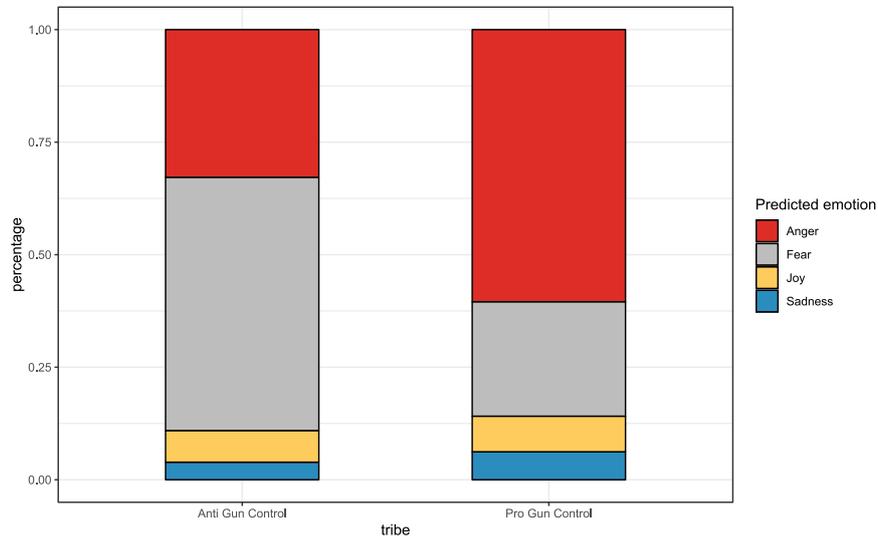
**Fig. 3.** Emotions predicted for Gun Control in actor view

Figure 4 shows that for the Pro-Gun Control as well as for the Anti-Gun Control Tribe the largest number of actors are Christians. There is also a conspicuous number of Jews predicted for Pro- and Anti-Gun Control. Buddhists are not predicted for Anti-Gun Control at all. This result suggests again that Buddhists are more peaceful (see 4.3).

Fig. 4. Religions predicted for Gun Control in actor view
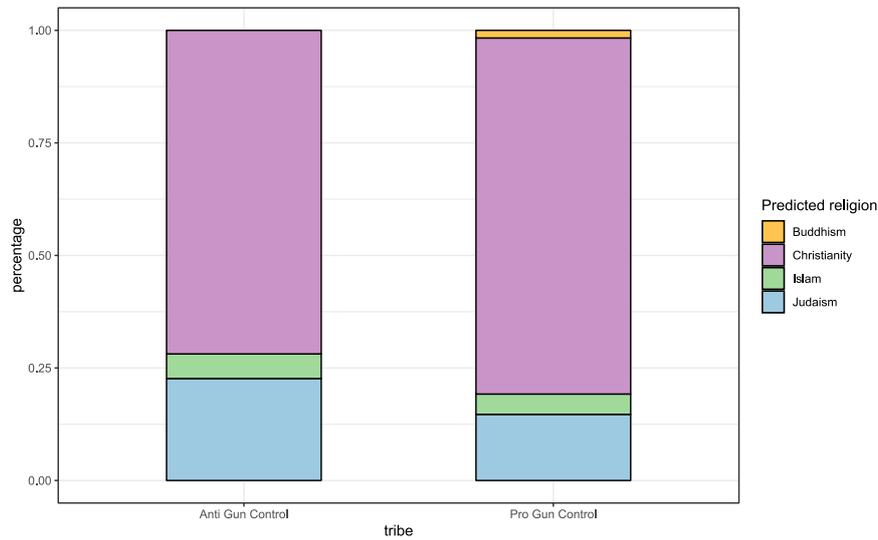
4.4.2 Pro-LGBT and Anti-LGBT

The emotion predominating Pro-LGBT is fear (Figure 5). All other emotions are almost evenly distributed. Anti-LGBTs are predominated by anger and fear. The emotion joy is barely there.

Fig. 5. Emotions predicted for LGBT in actor view
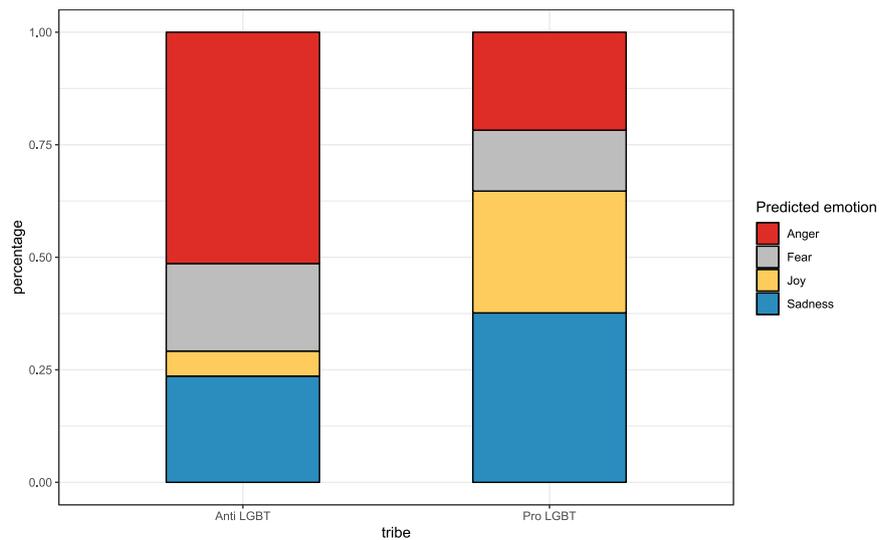
The most predicted religion for the Anti-LGBTs and the Pro-LGBTs is Christianity (Figure 6). We assume that, especially in the western world, LGBT is a controversial topic currently and therefore many Christians are involved. Christians are maybe less afraid of coming out and therefore, dominate the Pro-LGBT group. In both categories there are almost no Buddhists predicted. For Buddhism, LGBT seems not to be a relevant topic. An interesting result is that Islam is predicted for about a quarter of LGBTs. We assume that especially modern Muslims have an account on Twitter, and they are proud of their open-minded ideology.

Fig. 6. Religions predicted for LGBT in actor view
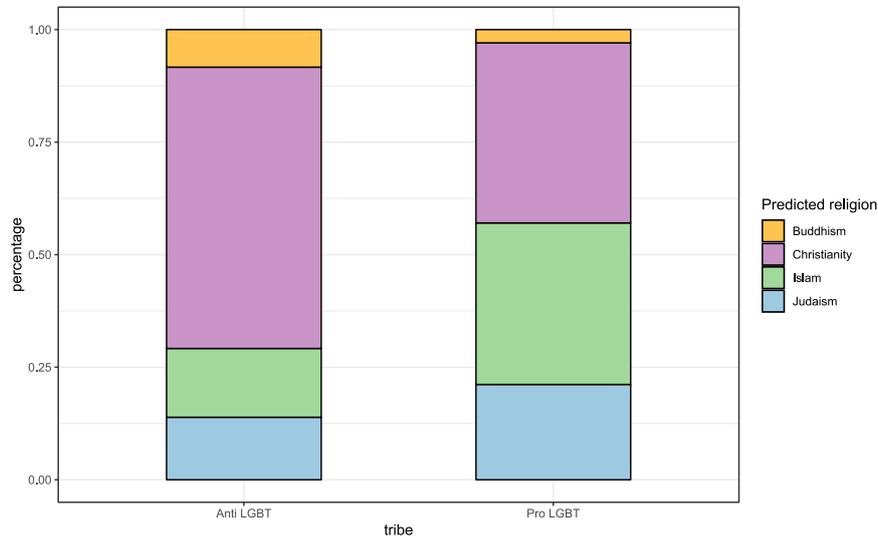
5 Conclusion

The aim of this paper was to discover conspicuous connections between different religions and emotions. Previous studies indicate that there is a connection between different religions and positive and negative emotions [6]. Therefore, our results of this explorative quantitative analysis based on twitter networks gives a first overview of the connections between specific religions and specific emotions. We also found a pattern between Spiritualism and Sadness in general which is mentioned in research [13]. Important findings in this context were highlighted and discussed. Hypotheses derived from our work and its results can be summarized as:

H1a: Sadness leads to Spiritualism.
H1b: Spiritualism leads to Sadness.
H2a: Sadness leads to Religion.
H2b: Religion leads to Sadness.
H3: Judaism is positively correlated to fear.
H4a: Buddhism is negatively correlated to anger.
H4b: Buddhism is positively correlated to joy.

5.1 Limitations

Limitations of our work will be discussed in the following section. First, we assumed that tweets of one Twitter account include predominantly one emotion and therefore profiles were categorized in one specific emotion tribe. A different approach could be to analyze only tweets and assign a tweet to one emotion without regard to actors or Twitter profiles. Using this approach, the fact that a person experiences different emotions at different times and also tweets with different states of mind would be taken into consideration.

Our work only searched for English Twitter accounts and therefore other religions might be underrepresented. Muslims for example might mostly tweet in Arabic language while Jews might tweet in Yiddish. English-speaking population is mainly Christian [10]. Besides the language limitation, some religions could be less active in using technologies than others. Buddhists may use platforms like Twitter less in general.

Although our dataset was very large, it is not ensured that our sample is representative for the chosen religions and emotions. Furthermore, the chosen religions and emotions could be extended (e.g. by Hinduism and surprise). By analyzing additional test data with RapidMiner (see 3.3) we realized that the classification of our machine learning model was not optimal. It ranged from a fraction of 0.392 (Judaism) to 0.967 (sadness).

5.2 Future research

Our work represents a static analysis conducted at a specific point of time. Future research could analyze the tribes over a longer time period to check if certain events influence the emotion and religion tribes and how stable or easily influenceable they are.

Additional characteristics, e.g. impulsiveness or aggressiveness could be added to the emotion tribes to get more precise results. Additionally, an Atheism tribe could be added to see how Atheism differs from the religions regarding its emotions.

Our research is based on a network analysis and the tweet content is only indirectly included (e.g. represented by sentiment and emotionality) in the machine learning model. Further research could concentrate on language processing and use the tweet content as additional attributes for the model. It also would be interesting to check whether the machine learning algorithms would be more suitable for predictions with the used attributes.

Our research shows that members of the Sadness tribe are especially spirituals and every religion member belongs to Spirituality. Therefore, future research could focus on correlations of Spirituality and/or Religiousness and basic emotions. Additionally, correlations of sadness to Spirituality and/or Religiousness could be examined.

Additional qualitative research that interviews the examined persons behind the Twitter profiles would be interesting to experience how they interpret our findings. Doing this emotions could be measured directly.

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