**Introduction-**

we will be giving a presentation on our findings from analyzing KLM's and other airline's tweets. The main objective of our analysis is providing KLM with observations and recommendations for their twitter response team. Using data we were able to analyze how well KLM is giving announcements or responding to customers while also comparing the results with other airlines. Using our analysis KLM is able to increase customer satisfaction and improve their twitter service.

**Methods and Technical Details**

We were given a dataset that was taken from the Twitter API and this dataset consisted of 6.5 million tweets from a number of airlines, starting from 22 May 2019 until 30 March 2020. As you can see in the pipeline, it shows how we started off with raw data. The raw data was cleaned by removing the corrupt tweets we found when loading the json files. This helped reduce the amount of tweets down to 3.9 million tweets. To reduce loading times, we also removed many columns that were unnecessary to our analysis. All tweets were put in a single SQL Database, which we then used for further data analysis. We then went ahead with the mining of the conversations. A conversation involves a minimum of two tweets between at least two people. This has to include an original tweet, followed by a reply that has to be made within 28 minutes. We created a function that allows us to return entire conversations by inputting the tails of every conversation. This function is used to loop through a conversation, starting from its tail, upwards towards its parent tweet with each iteration. After this step, we started working on our sentiment model. Our sentiment analysis model was trained on a Kaggle dataset consisting US airline tweets. To predict whether a tweet is positive, neutral or negative, we used the logistic regression model and trained it on root words of the tweets. After this every probability is scaled from –1 to 1 using this ML model. Finally, this model's accuracy was 79% correct in predicting the right label. In the remainder of the pipeline, you can see we made visualizations and based on our findings we came up with recommendations for KLM. These findings and visualizations will be discussed in the next section.

**Engagement-**

To begin with, we analysed the engagement rate for KLM and their primary competitors, with whom we have compared KLM for all comparisons. We calculated this engagement rate by taking the amount of conversations in which an airline was tagged, and the amount of those conversations in which the airline actively participated. Then we took the percentage of that slice. Actively participating means that the airline replied within the conversation. However, a customer's reply to an announcement does not count as the airline participating.

**Conversations-**

As previously mentioned, we applied the sentiment analysis model on our conversations. We then analysed the change in sentiment after a response and plotted it against the time it took to respond. Intuitively you might say that responding faster will yield better change in sentiment, however it turns out that the change in sentiment is neglegible. This change in sentiment is calculated as the change in sentiment between a tweet before a KLM reply and a tweet after the reply within a conversation. This basically tells us that spending excessive amount of time to ensure fast replies is a waste of resources for KLM.

**Impact of response-**

We have then thoroughly analysed the change of sentiment through the course of a conversation to attempt to find the effect of replying versus not replying within a conversation. For KLM and its top competitors we have taken the change in sentiment for the first to the last tweet in every conversation and grouped this by if the airline themselves participated by replying within the conversation. Then we plotted the results in this violinplot. Intuitively you might say that the airline replying to a conversation has a positive impact on the change of sentiment, but it turns out that is in fact not the case. What we can not say however, is if replying does change specifically the sentiment of a customer with an issue or complaint. A possible recommendation could then be to reply to such complaints in a private message. This will prevent other twitter users from interfering.

**Announcements-**

Finally, we have also analysed announcements and the overall sentiment towards KLM after certain types of announcements. It is hard to get a statistical number on good or bad types of announcements since there is no real way to classify these announcements. Instead, we did manual analysis and found the following:

Announcements that ask for customer interaction leave a lot of space for negative replies, especially announcements that mention the past. Many customers share negative experiences that they have previously had in the replies to these announcements. Also announcements that are very simple and straight forward often show a small boost to overall sentiment. These types of announcements can range from a simple picture to a message supporting an event, for example the pride month. These announcements leave very little space for negative replies and are thus great for getting KLM on potential customers timelines.

**Discussion & Conclusion**

During our research, we have come across some findings which give us a lot of useful information. But there are some limitations to these findings.  
 First off, the sentiment analysis cannot detect sarcasm. Sarcasm is usually used to mock someone and when somebody makes a statement which appears to be positive, but is in fact sarcastic, the overall sentiment is negative. However, the sentiment analysis will perceive this as positive. The same goes for sarcastic statements that appear to be negative, perceived as negative by our model.  
 Secondly, the conversation algorithm does skip a few conversations. The running time is very large, so we let it run in slices to decrease running time. But because of this a few conversations will be lost. However, this small percentage of loss of conversations is acceptable, since the running time is decreased by such a vast amount, the positives outweigh the negatives in this situation.  
 Also, we can see the difference in the impact of KLM responding frequently to their customers on Twitter versus when they respond infrequently. But the one thing we cannot see, but what could be regarded as useful information, is what the impact of an airline not responding at all on Twitter is. Because there is no airline who does not respond at all to the tweets, such a situation never occurs and therefore we are not able to investigate it or draw conclusions from it.  
 Language also forms a limitation. This is because for the sentiment analysis, no tweets have been translated to English when the posted tweet was not in English. If the tweets that are not in English were to be translated to English, this would cost a large amount of time. So we had to make a decision between the running time and the accuracy in the sentiment analysis, and in this case we chose the running time to be of more importance. Also, because we deemed the quantity of English tweets to be of a sufficient level, we find that the accuracy is not compromised too much.  
Also, a quick note on the reliability of our findings: if our sentiment model is as accurate on our data set as it was on the test data set, we can conclude that our findings are reliable. Otherwise, we can conclude our findings to not be as reliable.

So to conclude, we have found that it is not worth it for KLM to have a dedicated Twitter team. To have a dedicated Twitter team, the positive effects of such a team should be clearly visible and outweigh the cost such a team has. We found that the announcements KLM posts can have a positive impact and can be useful to inform customers, but the replying by KLM does not have the positive effect desired.

**Recommendations**

We do have some recommendations for KLM, the first recommendation we have for KLM is to refrain from posting announcements that attempt to interact with customers. Because such announcements give room for customers to share their negative experiences, it is best not to post these types of announcements at all. On the other hand, announcements that do not give much room for a customer to react show a more positive impact and have overall more positive replies. So such announcements should be posted more, instead of the ones giving room for the customers to interact.  
 The second recommendation we have for KLM is that since replying does not have a large enough desired positive impact, KLM is not recommended to put a large amount of effort in replying. However, they are likely better off answering to complaints and issues in private messages. Furthermore, we also have briefly looked at other social media platforms such as TikTok that other airlines have successfully used for promotional purposes. We believe we can aid KLM in analysing whether branching over to TikTok or other modern social media can be beneficial for them. We believe we can aid KLM in such a project in the future.