

INTRODUCTION

The proportion of category 4 and 5 hurricanes has increased in the US in the past two decades [1]. These increasingly powerful hurricanes have also caused increasing amounts of damage, which not only exacerbates natural-disaster social problems, but it also necessitates larger responses and more information to guide them. For these reasons, it is important to measure hurricane social issues and response effectiveness. This project seeks to create one method of doing this, using tweets and machine learning (ML) to examine how Irma-related tweets changed in September 2017.

METHODOLOGY

10,784 unique, Irma-related tweets from September 2017 were collected using Twitter's API. These tweets were labeled both for content (Code1) and purpose (Code2). These tweets were then cleaned by removing all punctuation, non-English text, duplicates, retweets, and hyperlinks, leaving the dataset with 1337 unique tweets. The original and cleaned tweets were then randomly duplicated to create new (oversampled) datasets, containing 10000 tweets in each category of Code1 and Code2. Eight Doc2Vec ML models were then created to predict both Code1 and Code2, using various combinations of normal tweets, cleaned tweets, oversampled tweets, and non-oversampled tweets (see figure 1).

A dataset of 5938 unlabeled tweets was gathered from September 2017. The tweets in this dataset were cleaned, and the oversampled and cleaned Doc2Vec models were used to predict both Code1 and Code2. The resulting dataset was graphed to highlight Irma tweet composition for Code1 and Code2, for September 2017 (see figures 2 and 3).

Figure 1: Doc2Vec Model Accuracies

Dependent Variable	Text Type	Sampling	Model Accuracy
Code1	Original	Normal	17.5%
Code1	Cleaned	Normal	18.6%
Code1	Original	Oversampled	38.1%
Code1	Cleaned	Oversampled	43.3%
Code2	Original	Normal	11.1%
Code2	Cleaned	Normal	15.3%
Code2	Original	Oversampled	20.6%
Code2	Cleaned	Oversampled	31.6%

Figure 2: Irma Tweet Content Over Time (Predicted)

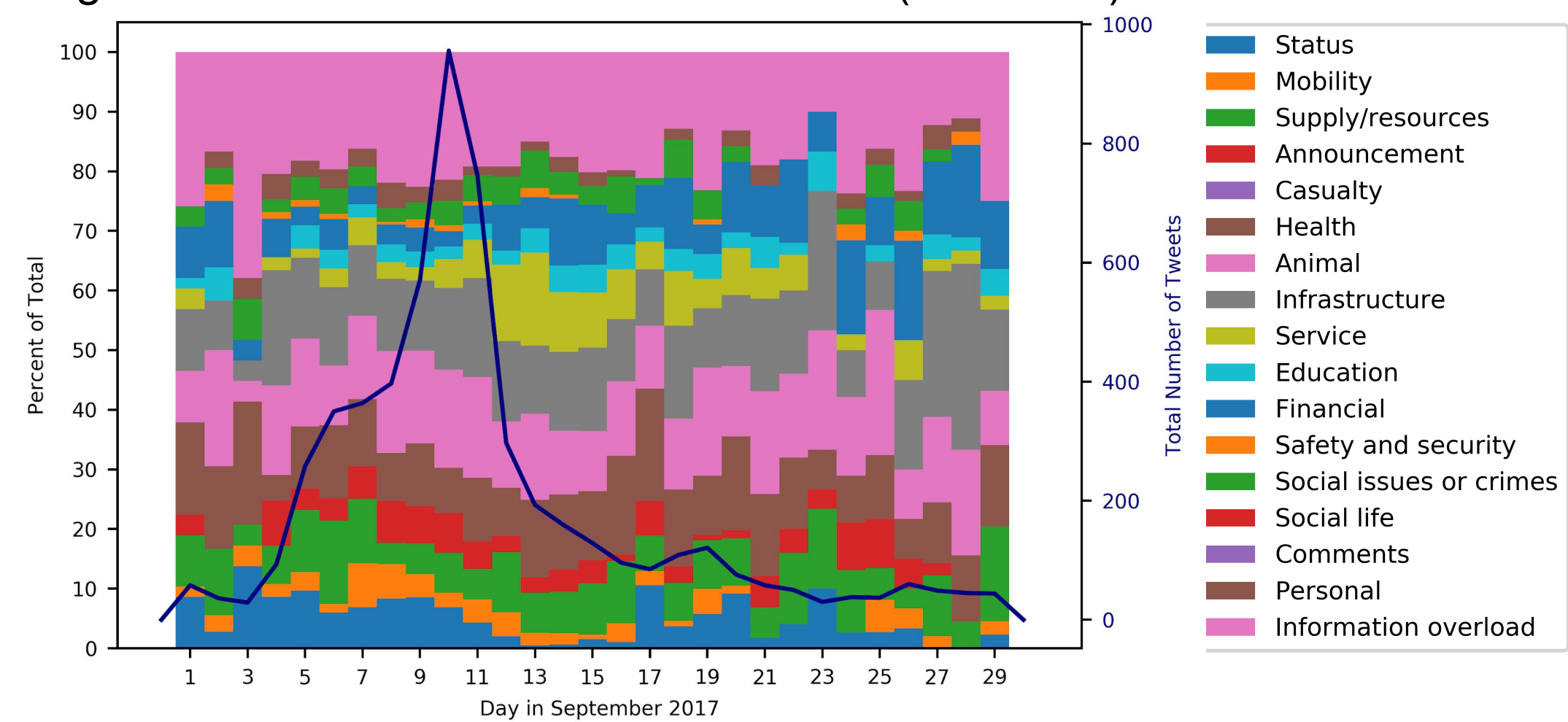
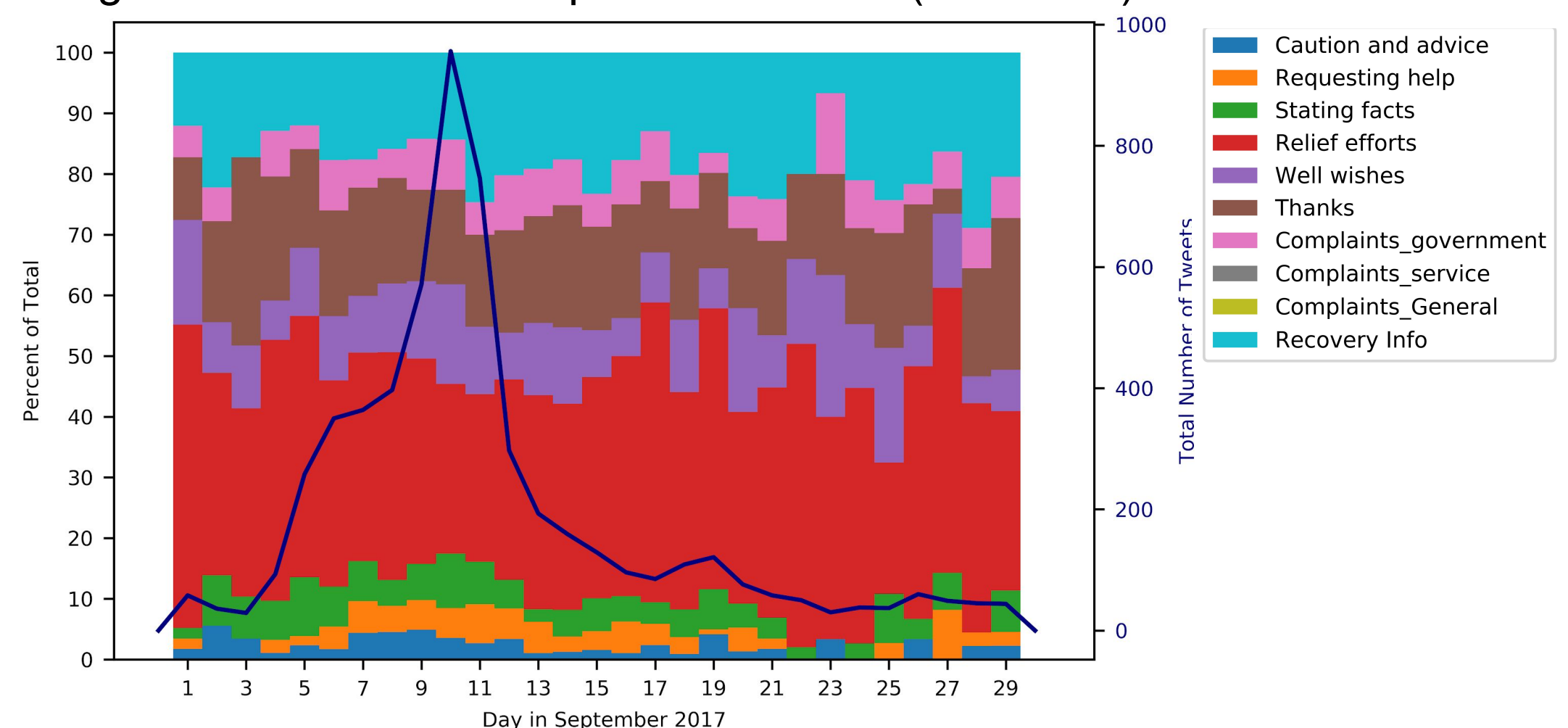


Figure 3: Irma Tweet Purpose Over Time (Predicted)



RESULTS

- The total number of Irma-related tweets dramatically increased after Irma made landfall on September 10th
- Tweet composition remained relatively constant
- The models did not appear to represent the relationships between words and the categories they fit into ('relief efforts' was predicted a lot before the hurricane made landfall)
- The models found that the only complaints in this sample were directed at the government, primarily regarding infrastructure
- Most tweets of appreciation were related to health, infrastructure, and social issues/crimes
- Most requests for help related to animals
- The Code2 model predicted 'recovery info' and 'relief efforts' the most, despite the fact that these categories were relatively small in the training set

Figure 4: Composition of Tweet Purpose*

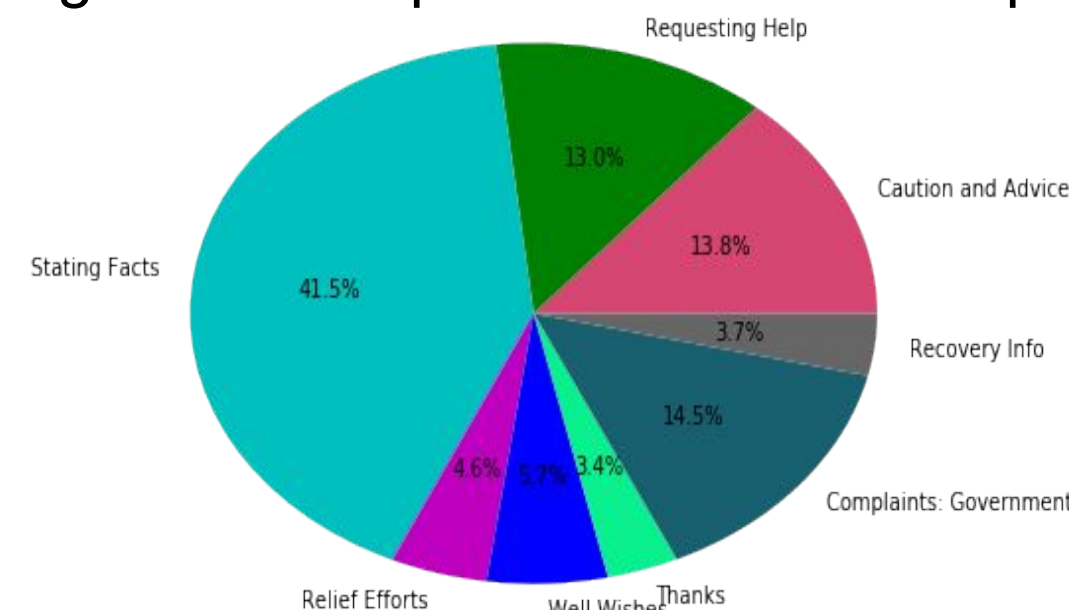
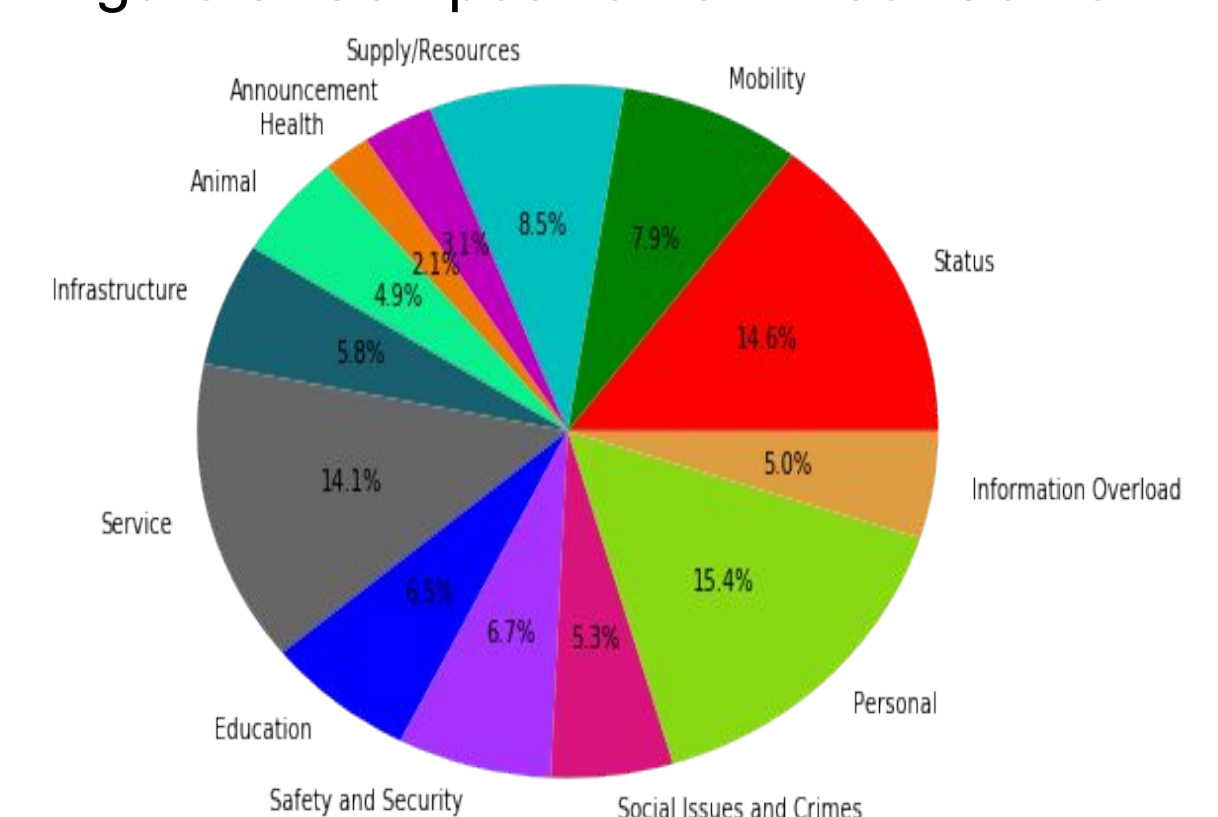


Figure 5: Composition of Tweet Content*



*From the manually coded training dataset

CONCLUSION

While the models' predictions were inaccurate due to a small sample size of fewer than 1400 training tweets, the models' accuracies of 43/31% suggest that more data could yield better results. By analyzing the results of a more accurate model, future researchers can determine which hurricane problems impact people the most and inform hurricane response groups on how to address them.

REFERENCES

1. Holland, G., & Bruyère, C. L. (2013). Recent intense hurricane response to global climate change. *Climate Dynamics*, 42(3-4), 617-627. <https://doi.org/10.1007/s00382-013-17130>