

Spam/Ham Email Classifier


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1. Introduction

1.1 For this capstone project, I will be designing a classifier to classify spam and ham emails. This project is to practice designing a classifier that will model and predict whether or not an email has keywords belonging to a spam email. We will be extracting data from our email dataset and observe features within the emails.

```
In [19]:  # create a new DataFrame with only boroughs that contain the word Toronto
toronto_df_new = toronto_df_new[toronto_df_new['Borough'].isin(borough_with_toronto)].reset_index(drop=True)
print(toronto_df_new.shape)
toronto_df_new.head()
```

(39, 5)

Out[19]:

| | PostalCode | Borough | Neighborhood | Latitude | Longitude |
|---|------------|-----------------|--------------------------------|-----------|------------|
| 0 | M4E | East Toronto | The Beaches | 43.676357 | -79.293031 |
| 1 | M4K | East Toronto | The Danforth West, Riverdale | 43.679557 | -79.352188 |
| 2 | M4L | East Toronto | The Beaches West, India Bazaar | 43.668999 | -79.315572 |
| 3 | M4M | East Toronto | Studio District | 43.659526 | -79.340923 |
| 4 | M4N | Central Toronto | Lawrence Park | 43.728020 | -79.388790 |



1.2 Business Problem

For this assignment, we will be addressing the problem of spam emails that cause issues to all email owners. Spam emails cause a huge issue creating false information and clickbait that can scam users of their cash. From creating a classifier for spam and ham emails we want to be able to remove the risk from email usage and eliminate a huge proportion of spam emails.



1.3 Data

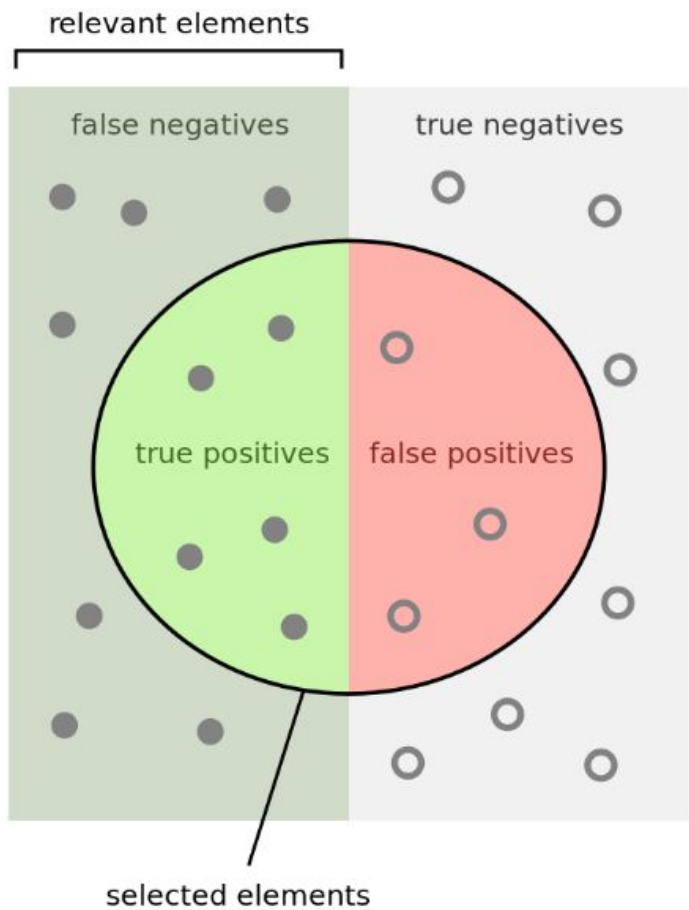
We will be utilizing an online dataset of training and testing data for spam/ham emails. The emails will have a variety of features of spam or ham emails. The source of the data encompasses a wide variety of emails from generic sources.

```
url: http://boingboing.net/#85534171
date: not supplied
```

```
arts and letters daily, a wonderful and dense blog, has folded up its tent due
to the bankruptcy of its parent company. a&l daily will be auctioned off by the
receivers. link[1] discuss[2] (_thanks, misha!_)
```

```
[1] http://www.alldaily.com/
[2] http://www.quicktopic.com/boing/h/zlfterjnd6jf
```

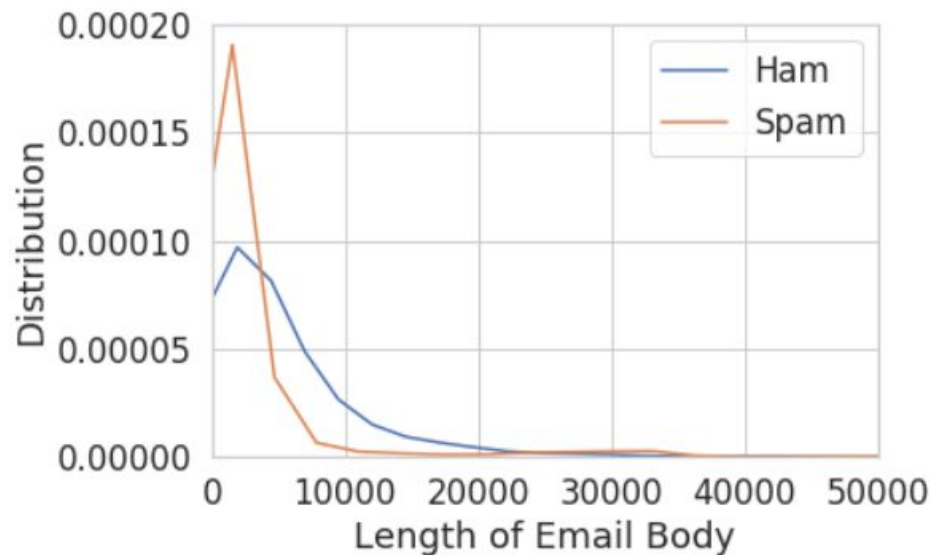
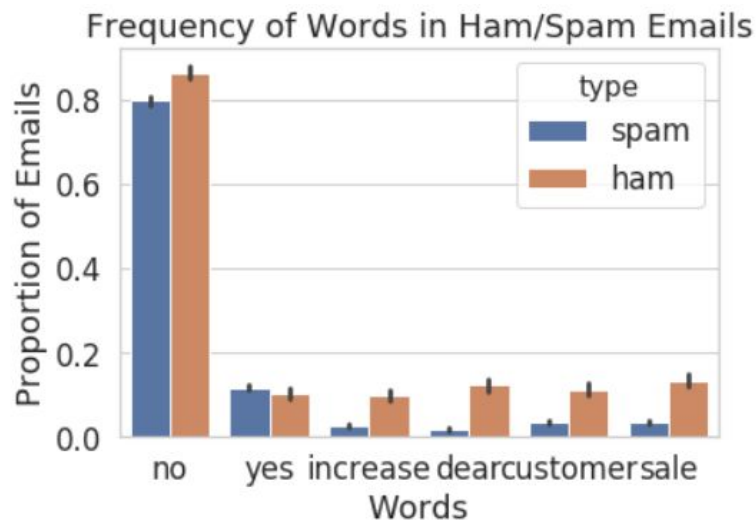
```
<html>
<head>
</head>
<body>
<font size=3d"4"><b> a man endowed with a 7-8" hammer is simply<br>
  better equipped than a man with a 5-6"hammer. <br>
<br>would you rather have<br>more than enough to get the job done or fall =
short. it's totally up<br>to you. our methods are guaranteed to increase y=
our size by 1-3"<br> <a href=3d"http://209.163.187.47/cgi-bin/index.php?10=
004">come in here and see how</a>
</body>
</html>
```





2.1 Methodology

For our methodology, we first cleaned up the data and observed any details that might signify relation to spam or ham categories. For our exploratory data analysis we observed all of the features for our data and identified some keywords that would be perfect for predicting if an email should fall under the spam category. The data featured a great deal of information but many emails that had keywords such as money, free, special, offer, or followed a JSON formatting, had a high rate of identification for spam/ham.



Out[13]:

| | id | subject | email | spam |
|------|------|---|---|------|
| 7657 | 7657 | Subject: Patch to enable/disable logi | while i was playing with the past issues, it a... | 0 |
| 6911 | 6911 | Subject: When an engineer flaps his wings | url: http://diveintomark.org/archives/2002/10/... | 0 |
| 6074 | 6074 | Subject: Re: [Razor-users] razor plugins for m... | no, please post a link | 0 |
| 4376 | 4376 | Subject: NYTimes.com Article: Stop Those Press... | this article from nytimes.com | 0 |
| 5766 | 5766 | Subject: What's facing FBI's new CIO? (Tech Up... | <html> | 0 |
| ... | ... | ... | ... | ... |
| 5734 | 5734 | Subject: [Spambayes] understanding high false ... | >>>> "tp" == tim peters | 0 |
| 5191 | 5191 | Subject: Reach millions on the internet!! | in dear consumers, increase your business sale... | 1 |
| 5390 | 5390 | Subject: Facts about sex. | in forwarded-by: flower | 0 |
| 860 | 860 | Subject: Re: Zoot apt/openssh & new DVD playin... | on tue, oct 08, 2002 at 04:36:13pm | 0 |
| 7270 | 7270 | Subject: Re: Internet radio - example from a c... | chris haun wrote | 0 |


7513 rows x 4 columns



3.1 Results


For the results of our test, we find that there was an unproportional level of emails that had keywords such as 'money', '<html>', 'sold separately', 'opt-in service', 'new and free', 'vip membership', 'are unbelievable', 'need product', '</table>\n\n', 'align="center"', 'we accept visa', 'state, zip', 'can cancel', 'opportunity', 'income', 'potential', 'free', 'dollars', 'sex', 'career', 'increase', '</blockquote>', 'grants', 'free money', '<td bordercolor=', 'all mailing lists', 'click here'. We found that there was a significant amount of information in the emails that could lead someone to classifying it through generic keywords. Although we didn't find a classifier that could predict 99 or 90% of correct emails (spam/ham) we found enough information to calculate and predict around a 85% range for a correct classification.

4.1 Discussion



Based on our experiments and testing, we know that spam emails follow a specific pattern of common keywords. We know that spam emails oftentimes look for people that are seeking out free offers, opportunities, and money. Keywords that generally incite attention for readers or promote usage of credit cards offer a high probability of being within spam emails. The hardest portion of the keyword search is finding words that do not exist in ham emails. Isolating words that only exist in spam emails is difficult, but can appear in specific phrases. Just from adding html, sold separately, money, or vip membership, we drastically increased the probability of predicting the right values. For others that are replicating this classifier, I would search for the most common words in either dataset and not appearing in the other dataset. From identifying the best non-overlapping words in the strings, we are able to identify what works best for either classification category.

5.1 Conclusion.



In conclusion, we require a careful analysis of each individual email keyword system and need to conduct exploratory data analysis to devise our best classifier. From utilizing enough tools within our data science toolkit we are able to navigate through the different spam and ham emails. Overall, our classifier predicted within a 85% probability whether an email is spam or ham.



References :

List of neighborhoods in Toronto:

https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M

Foursquare Developer Documentation:

<https://developer.foursquare.com/docs>