Parker Williamson
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Springboard Data Science Career Track

Capstone Project 2 Final Report – Text Mash

Problem

Improve interactions between people and improve user experience. Matching people and finding fun activities are very labor intensive manual process and very important for people's life experiences. Understand who people are and what they are likely to want is one of the most important things to identify to really make a difference in most people's lives.

Client

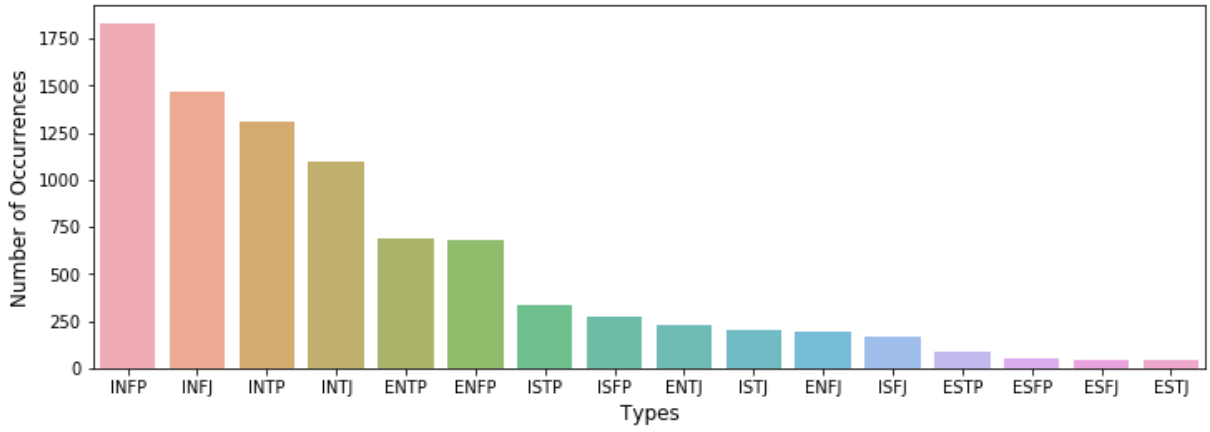
Any apps would be able to use the personality traits to improve the experience. Personality traits can be used to pair like-minded people for dating, assistance or finding what activities all people in a group would be most likely to enjoy based on all of their personalities. It could also be used to present information in the way each type of person finds most appealing. It could even be used to understand how an email would make you seem (optimistic, extroverted, ext). If the solution is strong enough it could be useful enough to start a business around.

Dataset

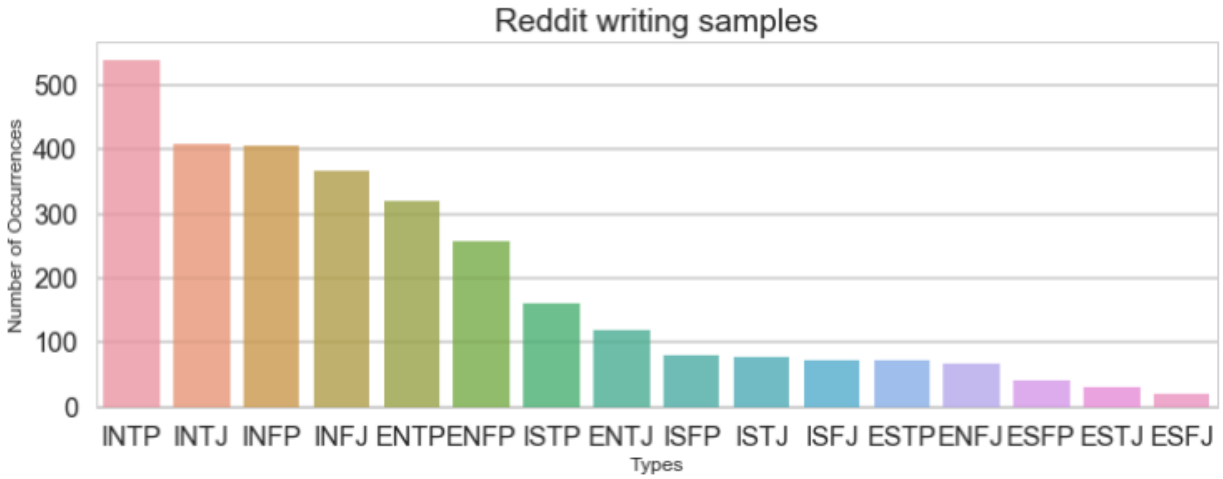
I focused on accurately predicting MBTI personality types. The MBTI raw data I will get from Kaggle's Myers Briggs dataset (https://www.kaggle.com/datasnaek/mbti-type). Some personality types didn't post as much so I will try to find more data to make a large enough sample, so that can have more examples of the types less vocal on forums. That extra data I will collected from Reddit's MBTI subbreddits which have posters self labelled type and separate subreddits for different types. Text data was normalized using (http://www.dt.fee.unicamp.br/~tiago/smsspamcollection/).

Findings

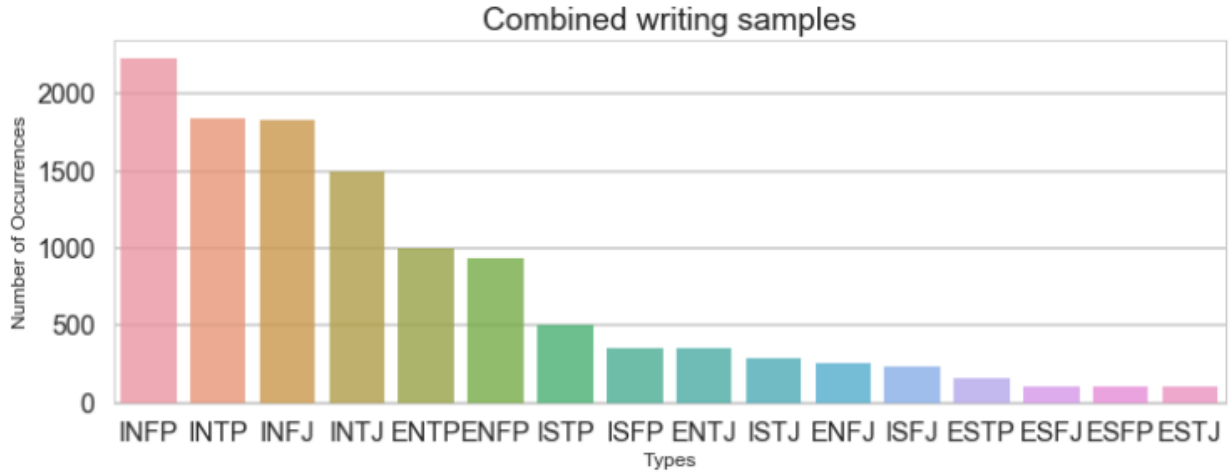
The initial Kaggle dataset is biased towards introversion, and so are the subreddits which means some personality types are more likely to post on forums. Although that means that the personality traits are more likely to influence what people enjoy, that makes it harder to collect an unbiased dataset. To try and achieve an unbiased dataset I combined the Kaggle dataset with the data I collected from reddit.



The Kaggle dataset's bias is show above with the clear variation between the introverted and extroverted types. The reddit database's distribution is shown below, it is biased as well but also helps to raise the number of examples of the uncommonly posting types.



The combined samples with some extra Reddit are shown below.



To clean the text data I removed English stop words, replaced URLs with <URL> and replaced all the 4 letter personality types with <MBTI>. For the existing Kaggle dataset sample the <MBTI> replacement factored in at about 20% of some of the models, so eliminating that means there may need more data or better initial text analysis. The accuracy general accuracy of predicting the test type from the original data without the Myers Brigg class in the text is shown below.

I tried stemming the word (excluding suffixes), but it made two of the types go up and two go down by nearly the same amount. Since stemming is slow I then excluded it in future models.

```
Accuracy on test data:     0.277354
Testing report:
              precision    recall  f1-score   support

        ENFJ       0.00      0.00      0.00        24
        ENFP       1.00      0.01      0.02        93
        ENTJ       0.00      0.00      0.00        42
        ENTP       0.00      0.00      0.00        93
        ESFJ       0.00      0.00      0.00        15
        ESFP       0.00      0.00      0.00         8
        ESTJ       0.00      0.00      0.00        10
        ESTP       0.00      0.00      0.00        14
        INFJ       0.27      0.25      0.26       191
        INFP       0.27      0.81      0.40       218
        INTJ       0.35      0.07      0.11       163
        INTP       0.30      0.49      0.37       185
        ISFJ       0.00      0.00      0.00        23
        ISFP       0.00      0.00      0.00        27
        ISTJ       0.00      0.00      0.00        31
        ISTP       0.00      0.00      0.00        42

avg / total       0.27      0.28      0.19      1179
```

Based on the image above is clear that the model is not good at predicting all the personality traits at once. The predictions for each individual traits are 60-75% accurate depending on the training test split.

```
Thinking/Feeling
Accuracy on training data: 0.750259
Training report:
              precision    recall  f1-score   support

          0       0.78      0.69      0.73      5184
          1       0.73      0.81      0.77      5431

avg / total       0.75      0.75      0.75     10615

Accuracy on test data:     0.710772
Testing report:
              precision    recall  f1-score   support

          0       0.72      0.63      0.67       556
          1       0.70      0.79      0.74       623

avg / total       0.71      0.71      0.71      1179
```

I tested a number of different models; the main difference between the different models was how much they predicted the less common class. Both XGboost and linear SVC models suffered because they predicted the more common class too much even with an inverse weighting. The other three models, MultinomialNB, Logistic Regression and SGD classifier were all fairly similar, but Logistic Regression had the highest F1 score of .71. That shows that Logistic Regression is the optimal model to use since CNN and RNN over fit as well.

I also tested the accuracy of predicting my and a couple close friend's personality types from my texting history and compared them to their stated MBTI. The difference between texting and forum

posts made the predictions all the same until I normalized the results to a dataset of texting I found online.

	MBTI	Text_Count
0	ISTJ	23055
1	ESTJ	3957
2	INTJ	1003
3	INTP	989
4	INTJ	893
5	ENFP	636
6	ESFP	537
7	ESTP	508
8	INTJ	415
9	ENFJ	384
10	ISTJ	354
11	ENFP	340
12	INTJ	290
13	ISTJ	265
14	ISTJ	221

When I only use 100 different users from each type there was a lot more variance and although the training accuracy was greater the testing accuracy was very unhelpful. It had been estimating the most likely and there was not enough new info to accurately estimate using.

```
Accuracy on training data: 0.765972
Training report:
              precision    recall  f1-score   support

        ENFJ       0.82      0.96      0.88        89
        ENFP       0.34      1.00      0.51        97
        ENTJ       0.90      0.81      0.85        89
        ENTP       0.95      0.86      0.90        92
        ESFJ       0.87      0.74      0.80        92
        ESFP       1.00      0.45      0.62        87
        ESTJ       0.98      0.55      0.70        88
        ESTP       0.99      0.76      0.86        90
        INFJ       1.00      0.66      0.79        85
        INFP       0.51      0.97      0.67        94
        INTJ       0.97      0.73      0.83        91
        INTP       1.00      0.78      0.88        91
        ISFJ       0.93      0.92      0.93        93
        ISFP       0.88      0.77      0.82        91
        ISTJ       0.98      0.57      0.72        84
        ISTP       1.00      0.68      0.81        87

avg / total       0.88      0.77      0.78      1440
```

The accuracy on the test data to each personality type is low for the smaller sample size of 100 users per type.

Accuracy on test data: 0.075000

Testing report:

	precision	recall	f1-score	support
ENFJ	0.09	0.09	0.09	11
ENFP	0.01	0.33	0.03	3
ENTJ	0.29	0.18	0.22	11
ENTP	0.14	0.12	0.13	8
ESFJ	0.25	0.25	0.25	8
ESFP	0.00	0.00	0.00	13
ESTJ	0.67	0.17	0.27	12
ESTP	0.00	0.00	0.00	10
INFJ	0.00	0.00	0.00	15
INFP	0.06	0.33	0.10	6
INTJ	0.00	0.00	0.00	9
INTP	0.00	0.00	0.00	9
ISFJ	0.00	0.00	0.00	7
ISFP	0.17	0.11	0.13	9
ISTJ	0.00	0.00	0.00	16
ISTP	0.00	0.00	0.00	13
avg / total	0.11	0.07	0.07	160

Each estimation individually is around 65% on its own, just all 4 are hard to get right at the same time.

Intorvert/Extrovert

Accuracy on training data: 0.738052

Training report:

	precision	recall	f1-score	support
0	0.49	0.82	0.61	1986
1	0.92	0.71	0.80	5798
avg / total	0.81	0.74	0.75	7784

Accuracy on test data: 0.675062

Testing report:

	precision	recall	f1-score	support
0	0.42	0.67	0.51	1023
1	0.86	0.68	0.76	2987
avg / total	0.74	0.68	0.69	4010

Intuitive/Sensing

Accuracy on training data: 0.758993

Training report:

	precision	recall	f1-score	support
0	0.37	0.75	0.49	1210
1	0.94	0.76	0.84	6574
avg / total	0.85	0.76	0.79	7784

Accuracy on test data: 0.695511

Testing report:

	precision	recall	f1-score	support
0	0.26	0.52	0.35	623
1	0.89	0.73	0.80	3387
avg / total	0.79	0.70	0.73	4010

Thinking/Feeling
Accuracy on training data: 0.740365
Training report:

	precision	recall	f1-score	support
0	0.78	0.65	0.71	3789
1	0.71	0.83	0.77	3995
avg / total	0.75	0.74	0.74	7784

Accuracy on test data: 0.718703
Testing report:

	precision	recall	f1-score	support
0	0.77	0.61	0.68	1951
1	0.69	0.83	0.75	2059
avg / total	0.73	0.72	0.71	4010

Judging/Perceiving
Accuracy on training data: 0.707862
Training report:

	precision	recall	f1-score	support
0	0.79	0.71	0.74	4705
1	0.61	0.71	0.66	3079
avg / total	0.72	0.71	0.71	7784

Accuracy on test data: 0.628678
Testing report:

	precision	recall	f1-score	support
0	0.71	0.64	0.68	2424
1	0.53	0.61	0.56	1586
avg / total	0.64	0.63	0.63	4010

The types assigned based on texting history vary a lot but none of the 4 people I know have an accurate assignment.

	MBTI	Text_Count
0	ISTJ	23055
1	ESTJ	3957
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4	INTJ	893
5	ENFP	636
6	ESFP	537
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Including the reddit data decreased the test accuracy by about 2%, but the Kaggle MBTI data was not as applicable to average texting, because it is based on text where people are talking about their personalities. Adding the Reddit data helps prevent overfitting, for example, one of the most strongly weighted words (towards extroversion) is socionics. Socionics is not a word used in many texting conversations, but it was used fairly commonly in the MBTI forum drawn from for the Kaggle dataset.

The introverted words do tend to make sense as more intellectual or emotional.

Introverted words	P(Introverted | Extroverted)
linux	0.64
lucid	0.64
fantasy	0.62
genre	0.62
neat	0.62
sky	0.62
poetry	0.62
genres	0.61
relief	0.61
daydream	0.61
fond	0.61
movement	0.60
anna	0.60
rain	0.60
stare	0.60
existence	0.60
64	0.60
adopted	0.60
ordinary	0.60
possess	0.60
Extroverted words	**P(Introverted | Extroverted)**
nts	0.40
fucks	0.40
awww	0.40
du	0.40
yall	0.40
omg	0.40
stark	0.40
xd	0.40
charming	0.40
bc	0.40
didn	0.40
subtype	0.40
charm	0.40
det	0.40
mod	0.40
sensors	0.40
racist	0.39
owo	0.39
en	0.39
ben	0.39

Overall it is clear that the MLP classifier is an okay, but not accurate enough model for personality prediction based on text. It is around 65-70% accurate per Meyers Briggs personality trait. To be in line with the normal method of testing personality it would need to be around 85% accurate. This does show how Reddit can be used to expand the dataset some, and how different types of posts tend to indicate different personality types.