Classification of Emotions for Text Messages

Capstone Presentation

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WHO ARE WE AND WHAT DO WE DO?

WHO ARE WE

Team of data scientist in a communications department in a renowned Social Media Platform provider.

PROJECT OF INTEREST

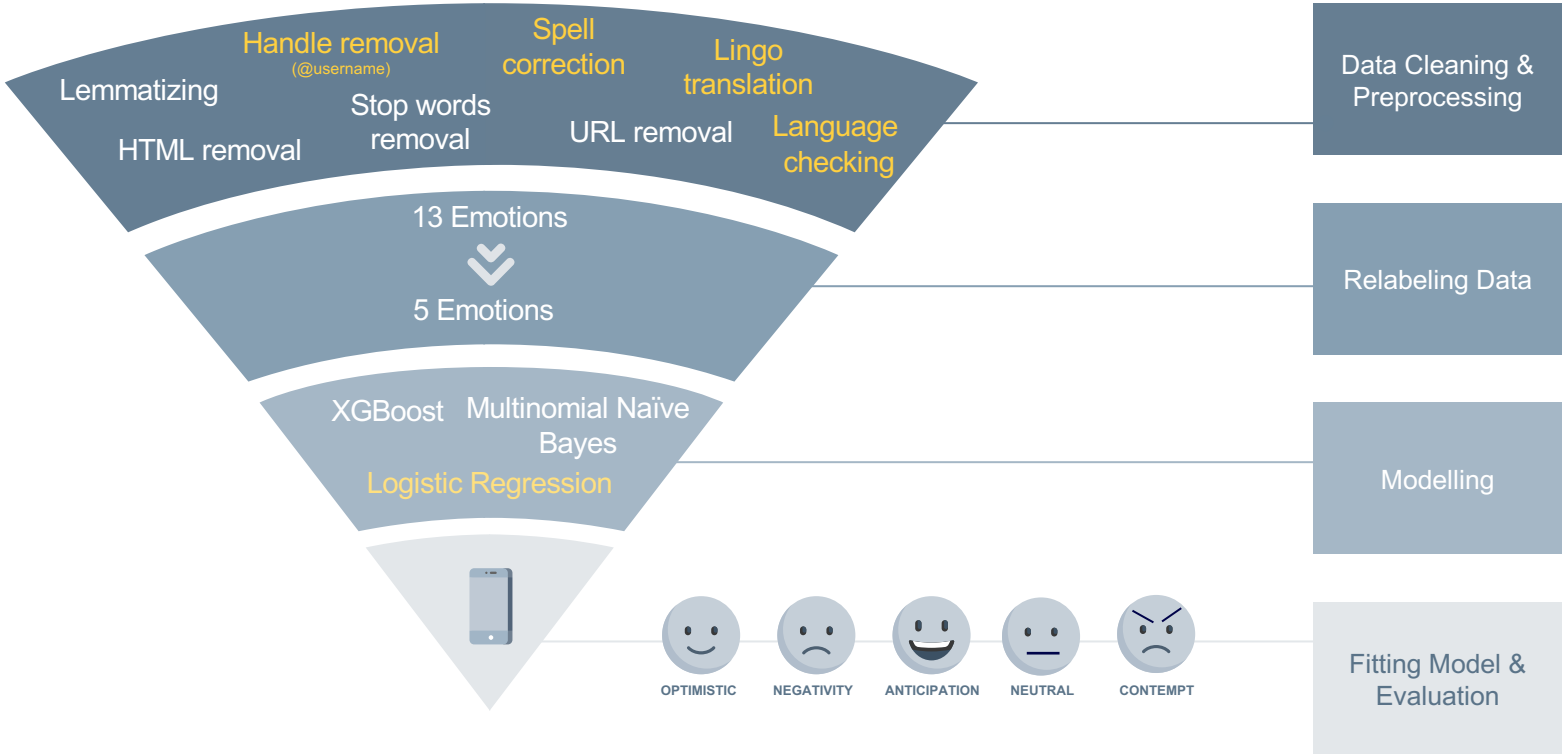
Build a casual chat sentiment analyzer as a value-added product for users of our communications' platform

In collaboration with the Software Engineering team

OVERALL METHODOLOGY

40K tweet data from a similar study

±2k tweet data (anger/hate) to supplement main dataset



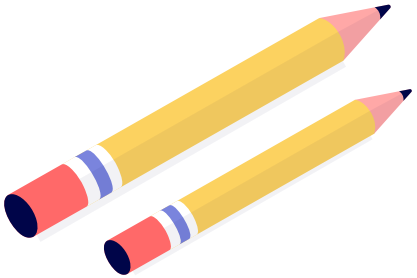
CLEANING AND PREPROCESSING

BASIC CLEANING:

- HTML, URL, HANDLE REMOVAL
- STOPWORDS, LEMMATIZING

ADDITIONAL CLEANING:

- LANGUAGE CHECKER
- SPELLING CHANGES
- LINGO TRANSLATION
- RECLASSIFICATION OF LABELS



- Using Spacy Spell Checker to filter for non-English content
- Parsing texts with 'unknown' language for Symspell's spell correction

For variations of 'haha'

```
def replace_hah(string):
    results_1 = re.sub(r"\S+hah\S+",'haha',string)
    results_2 = re.sub(r"\S+aha\S+",'haha',results_1)
    results_3 = re.sub(r"hah\S+",'haha',results_2)
    results_vf = re.sub(r"hah",'haha',results_3)
    return results_vf
```

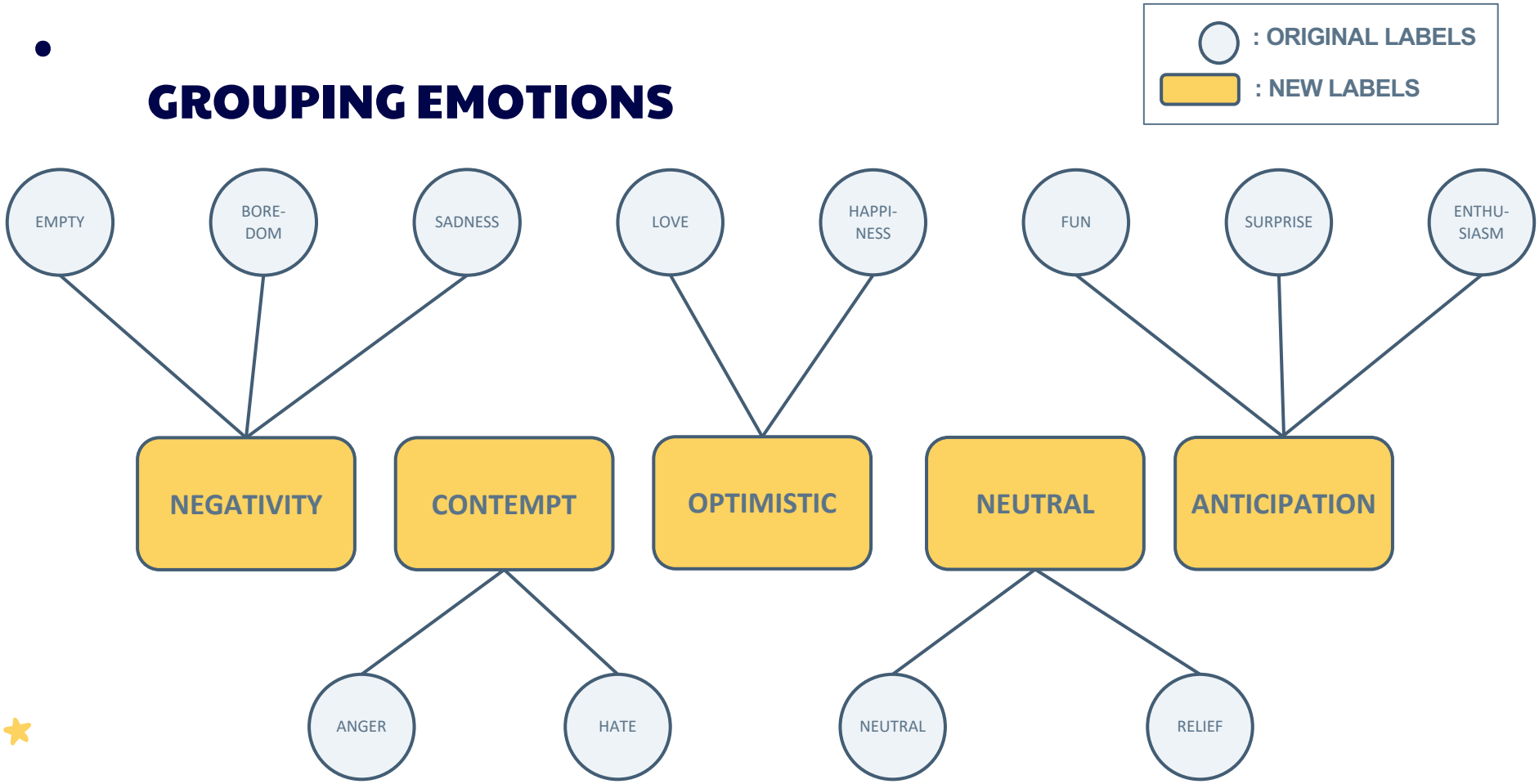
Snippet of Lingo Dictionary

	short	long
7721	zomfg	oh my fucking god
7722	zomg	Oh my God
7723	zomgzorrz	oh my god
7724	zup	what's up?

- Keyword: "Happy"
- Keyword: "Thanks"

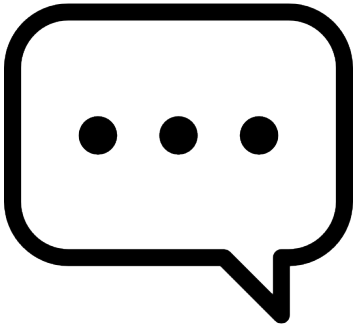
NEUTRAL → HAPPY

GROUPING EMOTIONS



FEATURE EXTRACTION

EXTRACTING NUMBER OF PUNCTUATIONS IN EACH TEXT MESSAGE



ELLIPSIS

Omitted section of text

QUESTION MARKS

Doubt or uncertainty

EXCLAMATION MARKS

Loudness or excitement

MODELLING

LOGISTIC REGRESSION

Excellent for feature inference

XGBOOST

Modified tree-based model that prevents overfitting

$$P(A|B) = \frac{P(B|A)\ P(A)}{P(B)}$$

MULTINOMIAL NAÏVE-BAYES

Statistically driven & known for NLP purposes

MODELLING RESULTS

BASELINE MODEL

```
msg_emotion
1                0.351789
2                0.235196
3                0.223409
4                0.113611
5                0.075995
dtype: float64
```

- Baseline accuracy: 35%

I'M 16% BETTER THAN BASELINE!

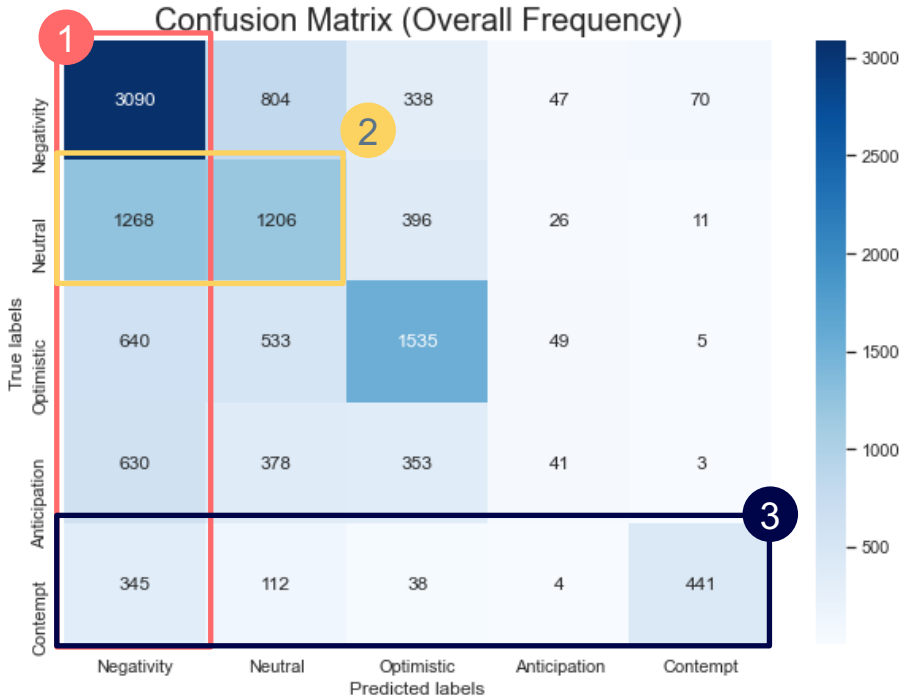
AFTER GRID SEARCH & MODEL TUNING

#	Models Tested	Accuracy	F1	Precision	Recall
1	Logistic Regression	0.51	0.48	0.50	0.51
2	XGBoost	0.50	0.48	0.49	0.50
3	Multinomial Naive Bayes	0.48	0.46	0.46	0.48

QUALITATIVE INTERPRETATION IS KEY!

UNDERSTANDING MISCLASSIFICATION

CONFUSION MATRIX



1. General Misclassification <u>INTO</u> Negativity class

2. High Misclassification between Negativity-Neutral pairs

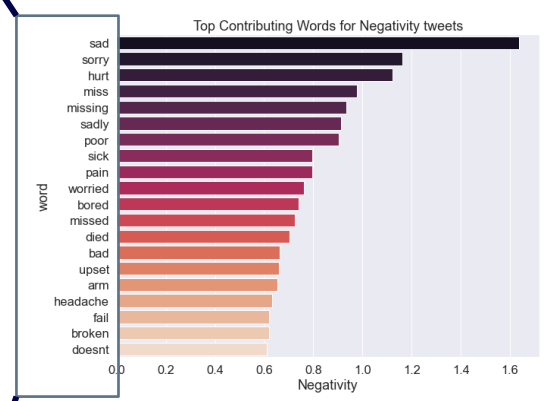
3. Misclassification from Contempt to Negativity

TOP CONTRIBUTING WORDS (NEGATIVITY & CONTEMPT)

NEGATIVITY

NEGATIVITY

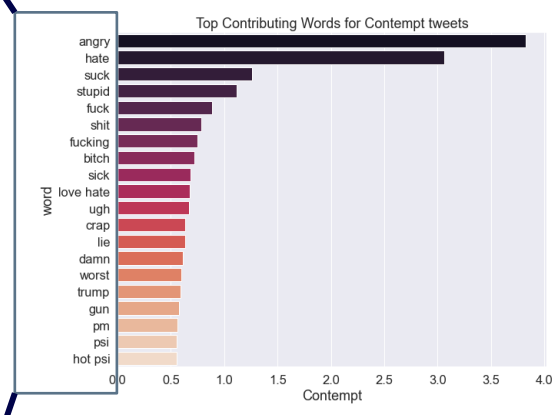
sad
sorry
hurt
miss
missing
sadly
poor
sick
pain
worried
bored
missed
died
bad
upset
arm
headache
fail
broken
doesnt



CONTEMPT

CONTEMPT

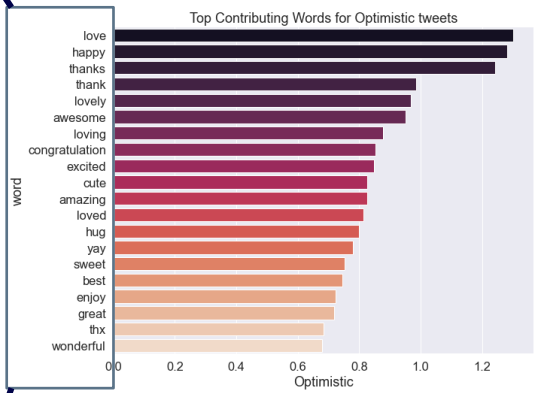
angry
hate
suck
stupid
fuck
shit
fucking
bitch
sick
love hate
ugh
crap
lie
damn
worst
trump
gun
pm
psi
hot psi



TOP CONTRIBUTING WORDS (OPTIMISTIC & ANTICIPATION)

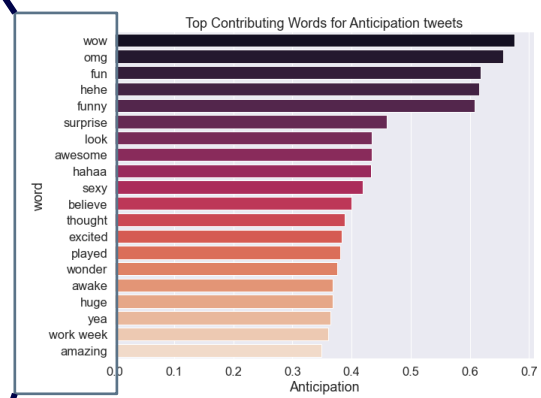
OPTIMISTIC

love
happy
thanks
thank
lovely
awesome
loving
congratulation
excited
cute
amazing
loved
hug
yay
sweet
best
enjoy
great
thx
wonderful

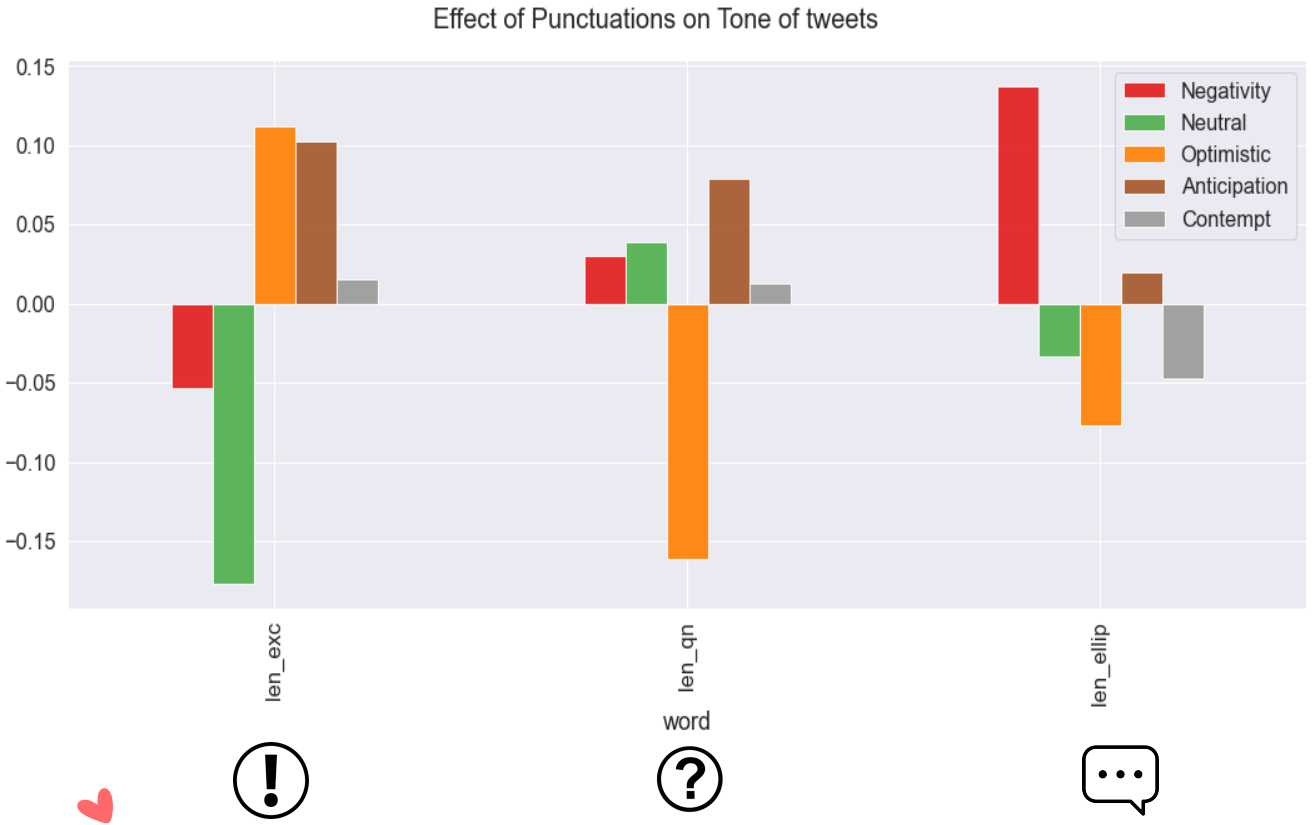


ANTICIPATION

wow
omg
fun
hehe
funny
surprise
look
awesome
hahaa
sexy
believe
thought
excited
played
wonder
awake
huge
yea
work week
amazing



EFFECT OF PUNCTUATIONS



Positive correlation with:
Optimistic & Anticipation

Negative correlation with:
Optimistic

Negative correlation with:
Optimistic

Positive correlation with:
Negativity

Misclassified Classes:

Optimistic-Negativity Pair

PREDICTED

“Took a math test today. The day before the test, the teacher says bring your calculator. Luke was confident. Teacher decided no calcs.”

ACTUAL

PREDICTED

Good luck with the design....remember the little people Heading to bed, goodnight!

ACTUAL

CONCLUSION: ORIGINALLY DATA COULD BE BETTER LABELLED

Misclassified Classes:

Contempt-Optimistic Pair

PREDICTED

I missed this little ferocious one. This is my cat when she was a kitten
[image link]

ACTUAL

PREDICTED

Shout out to my moms for waking me up so prematurely! Preciate it

ACTUAL

CONCLUSION: ORIGINALLY DATA COULD BE BETTER LABELLED

CONCLUSION: SARCASM IS A KEY CHALLENGE IN NLP SENTIMENT ANALYSIS

FITTING OUR MODEL INTO CHAT CONVERSATIONS

Word Cloud Analysis

OPTIMISTIC

NEUTRAL

NEGATIVITY

ANTICIPATION

CONTEMPT

HOW HAVE OUR MODEL FARED IN PREDICTING EMOTIONS OF TEXTS?

EXAMPLE: ANTICIPATION

112	Hahahahhaa Shall we play amongst us?? The latest hottest game that everyone is playing now
76	Wow so hardworking man
118	right now when I sit on it , it is even very squeaky every night my back aches And it is not pleasant. Lol. Nonsensical chats. So funny haha.
82	😂 Don't go too overboard ok Take some time off to travel the earth Or perhaps just lepak And watch some movies With your girlfriend Huh! I'm your best friend how can I not know that you have a girlfriend???
48	So excited Shall we go for pre drinks??? We can go to Lego Land or watch star wars together Perhaps that would be a fun filled night
115	I mean If you're an imposter you kill people But if you are a crew you try to hide and determine the imposter?? Heard is fun from my friends Why don't you consider streaming your game play online? Can perhaps earn some money I mean you are already super high profile to begin with With 10k followers on your instagrsm I'm sure there is a place for you!
66	nah he has turned around and became a better person less abusive more tolerant nicer person altogether. Amazing
114	Yes! We should all call our friends and play together! Haha Im sure it will be super fun playing this game together My friends and i are addicted to it I am ditching dota already Like all of us are ditching dota We are only playing amongst us I am already earning big bucks. Dont need the additional stress of keeping up my image both online and offlne Not easy you know Fake people are disgusting My worst enermy
96	Wow our make up are from there? Surprise surprise 🤗 Why are you surprised Dumb of you not to know that???

Disclaimer: None of these messages were truly exchanged.

Messages were generated for testing purposes only.

HOW HAVE OUR MODEL FARED IN PREDICTING EMOTIONS OF TEXTS?

EXAMPLE: NEGATIVITY

	msg
65	Your boss has been giving shit to you lately isn't it
24	And how I need to see a doctor all the time
30	So pissed off.
104	sure. now it feels like i am being interviewed or interrogated by you. I have been a systems engineer for 4 years before moving into a more administrative role
51	Let's surprise our friends??? I'm so so so looking forward to our gathering next week
108	I mean not easy to get the job but once I am a pilot my life is great No la we are always vigilant everytime we fly Autopilot is just a saying Work hours are long man I fly to New York 20 hours you knw I have to be awake for at least 15 hours during these flightd Yes I have been
37	Damn You rich kid I can only afford to eat at ananas cafe you knw I brought my mum to hawker centre so I can treat her to a mesl
103	We should talk about more neutral conversations Perhaps you tell me what specially you are doing at your job?
7	Miss boyfriend ah Hahahahahha
68	Shouldn't work in this kind of environment Not good for your mental health and wellbeing

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HOW HAVE OUR MODEL FARED IN PREDICTING EMOTIONS OF TEXTS?

@&(#@!#

EXAMPLE: CONTEMPT

	msg
26	I am angry Pissed off at how you are so capable unlike me A useless chap
95	Btw do you know about mining mica products in a rural part of india? Our make up products are from there Very very lethal and deathly Incredibly horrifying Child abuse and stuff I feel like im trying to quarrel with myself I HATE work I hate life I hate everyone!!! [redacted] everything!
28	Angry angry angry Sleeping whole day
25	wow don't be upset dont be angry
18	Super lazy and unsuccessful Really hate it that she is so so sucky in what she does and lazes around all day
14	Awesome will always know that you're here to support me Anyways I really hate my dog My dog has the worst sucky shit ever He poops everywhere around the house And doesn't pee at the right placr He pees even on my bed and sofa CAN YOU BELIEVE IT?????!!!!! Stupid dog! Good for you This fake conversation is not easy to sustain What should we talk about How is your job
56	Why? Your temper sucks man I really cannot stand it It is pissing people off [redacted] hell
54	Lol You coward So annoying man Anyhow also get angry
29	why are you angry? yearh tweeter is giving me a headache! i am currently scraping data from the internet and it is NOT easy at all

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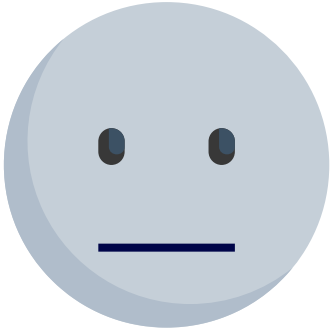
Final Evaluation

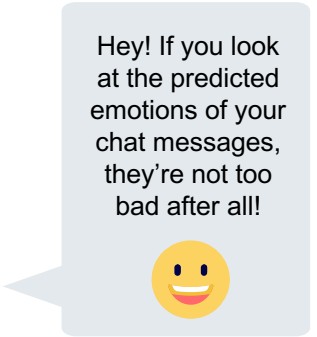
QUANTITATIVE STANDPOINT:



NEUTRAL

QUALITATIVE STANDPOINT:

OPTIMISTIC!

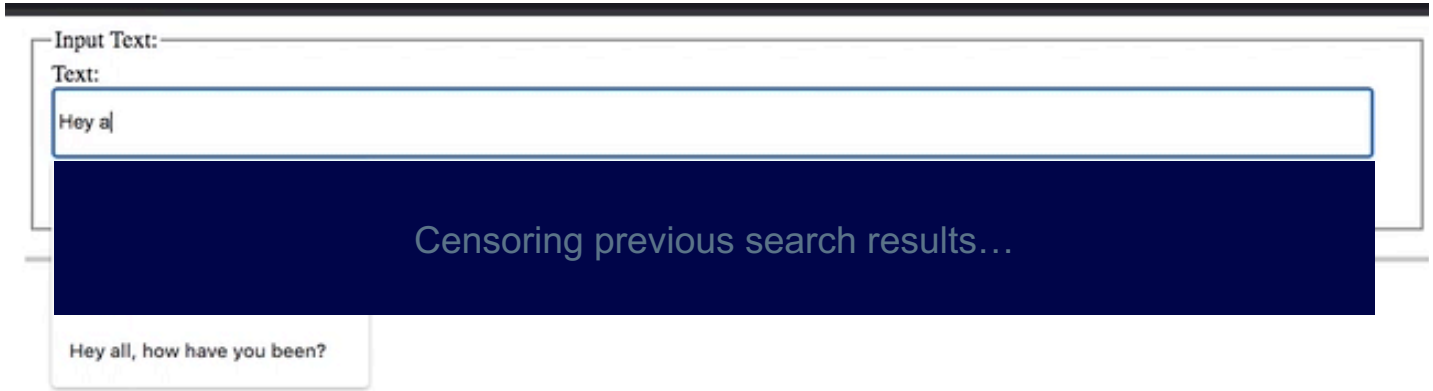


LIMITATIONS & NEXT STEPS

LIMITATIONS

1. Lack of open-source chat conversations.
    - Costly to obtain emotion labels for chat conversations even if conversations are available.
2. Use of original tweet data that exhibit degrees of mislabeling by manual annotators that skew our dataset.
3. Insufficient data for certain emotion classes (ie. Contempt, Anticipation)
4. General NLP difficulties: Dealing with Sarcasm, Stretched words (ie. Tireeeeed), dual meanings, spelling mistakes and more.

NEXT STEPS:

1. Passover prototype to Software Engineering team for initial implementation
2. Conduct the experiment for a second time with newly scraped tweets (by hashtags), ensuring balanced dataset.
    1. Account for key spelling mistakes, stretched words, commonly misspelled words (ie 'haaahaa').
    2. Explore more emotion classes (ie. Disgust, Horror) as we scrape more data from Twitter.

TESTING TIME!