Predicting Tweet Sentiments

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DSI-26

Social Media Strategy

Social monitoring +
Social listening

Home
Explore
Notifications
Messages
Bookmarks
Lists
Profile
More
Tweet

Esther
@estherified

Twitter
14.9K Tweets

Follow

Twitter
@Twitter

What's happening?!

everywhere about.twitter.com Born March 21
Joined February 2007

5 Following **60.9M** Followers

Followed by Pics With a Story, Mind Blowing, and elffiex

Tweets | Tweets & replies | Media | Likes

Twitter @Twitter · Feb 18
we asked the engineers if we could pin a DM and they said NO! YOU CAN PIN SIX!

Search Twitter

You might like

YouTube @YouTube — Follow
National Geographic @NatGeo — Follow
Windows @Windows — Follow

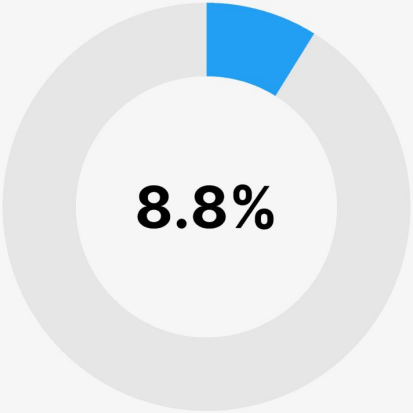
Show more

Messages

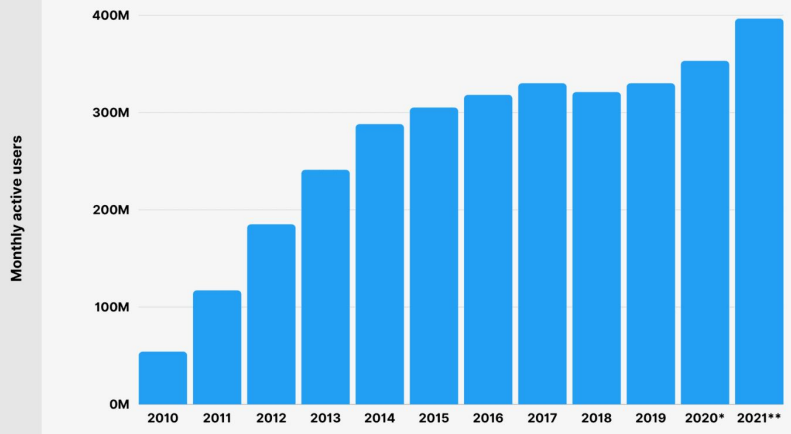
Some Twitter Statistics

- Twitter currently has 396.5 million users (as of 5/2/22)
- Twitter has 206 million daily active users
- Twitter is most popular among users aged 25-34
- Worldwide, men use Twitter more than women (68% vs 32%)
- On average, Twitter US users spend 158.2 minutes per month on the app
- In the US, 52% of Twitter users report using Twitter daily

Twitter has 8.85% of the world's overall social media user base



Twitter user growth



Apple
0 Tweets

Text

Follow

Apple
@Apple

Apple.com

Cupertino, CA Joined September 2011

0 Following **7.5M** Followers

Not followed by anyone you're following

Tweets | Tweets & replies | Media | Likes

Who to follow

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Trends for you

Music · Trending
Korean
122K Tweets

Music · Trending
Queen
276K Tweets

Celebrities · Trending

Messages

← Tweet

सॅम
@storywala_sam

Dear @Apple ,
I just bought iPhone 12 Mini for my younger brother, he setup his own face id but how the hell his iPhone unlocked by my face 😂??

I paid ₹ 50,000 for this security, I want refund 😡.
@AppleSupport

10:43 PM · Feb 28, 2022 · Twitter for Android

2 Quote Tweets **12** Likes

Tweet your reply — Reply

Nikhil Bhosale @nikhil_bhosale · 1h
Replying to @storywala_sam @Apple and @AppleSupport
Zedge वापरणारी पोरं अजून आहेत हे बघून बरं वाटलं
4 · 7

पप्या @win98761 · 1h
🤣🤣🤣🤣🤣🤣
2

ट्रंप तात्या (अमेरिकावाले) @trumptatya64 · 1h
Replying to @storywala_sam @Apple and @AppleSupport
@Apple User just want to Show that He purchased Iphone.. Thanks
1 · 3

Apple Support @AppleSupport · 1h
Replying to @storywala_sam
Thanks for reaching out. We are here to help!

We first would like to get some more information from you, can you please join us in a DM?

← Tweet

Greg's Maker Corner
@greghuber

MacBook Pro update. Wow, @Apple really blew me away with this replacement machine. I was not expecting anything like this to replace my old 2015 MBP that had a botched battery repair. I was hoping for a dusty refurb. Looks like I'm gonna stay a loyal customer. :)

5:24 AM · Feb 28, 2022 · Twitter for iPhone

25 Likes

Tweet your reply — Reply

Richard Knight @rmknight · 19h
Replying to @greghuber and @Apple
Stuff like this and proper stores you can visit keeps me a apple user. Even when I was a Microsoft consultant.
1 · 3

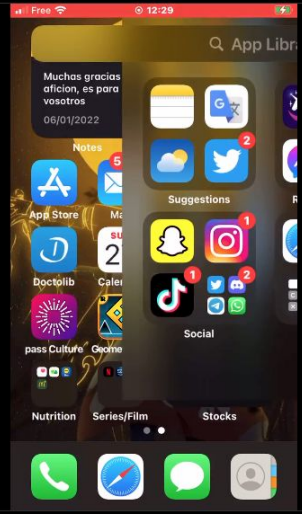
Greg's Maker Corner @greghuber · 19h
Yeah.. absolutely. I wasn't sure how this one was gonna turn out. They really went above and beyond in the end. I don't know what other tech companies would end up replacing a 6 year old machine with a new one.
5

Francisco Sanchez @fcolyra · 1h
Replying to @greghuber and @Apple
Nice! So glad to hear!!!
1

← Tweet

Honnest FCB fan
@LMFANFCB

@Apple I spotted this. Can you please fix it please ?



0:12 9 views

7:31 PM · Feb 27, 2022 · Twitter for iPhone

Tweet your reply — Repl

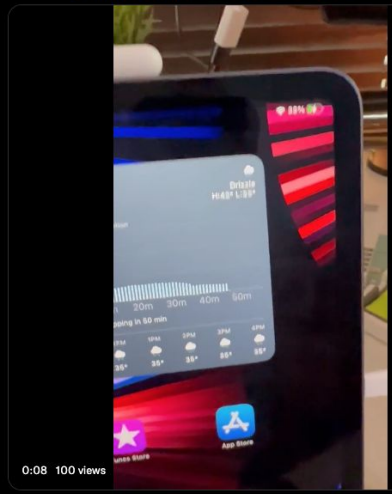
Apple Support @AppleSupport · 18h
Replying to @LMFANFCB
We'd be glad to check into this with you as we understand how this can interrupt your experience if you aren't expecting it. Check out the follow resource to see if a Zoom feature is enabled. If not, send us a DM with y iOS version.
s.apple.com/dE4x5r9g2w

Send us a private message
1

← Tweet

Thomas Edward
@thomasedward_pm

Can anyone explain why this is happening? Seems like a bug. @Apple @AppleSupport #ios15



0:08 100 views

11:55 PM · Feb 24, 2022 · Twitter for iPhone

2 Likes

Tweet your reply — Reply

Apple Support @AppleSupport · Feb 25
Replying to @thomasedward_pm
We know it's important for your device to charge correctly. We're happy to help. When you disconnect your charger, does the battery percentage decrease? Also, what specific device are you using?

Join us in DM.

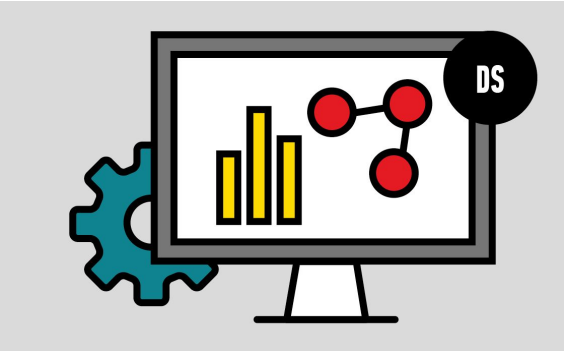
Send us a private message

Objectives

What do we want to accomplish?

Business objective:

How can Apple use social media to further lower customer attrition?



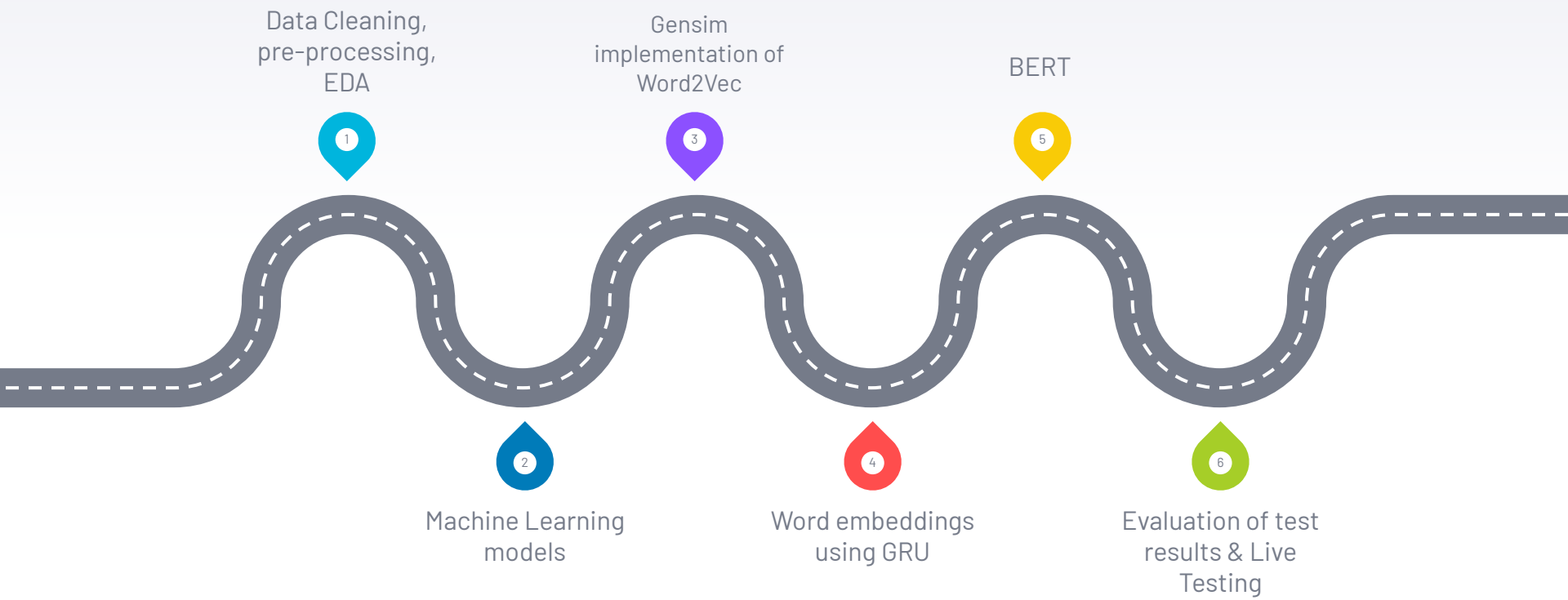
Data science objective:

Can we accurately predict negative and non-negative tweets?

Data Overview

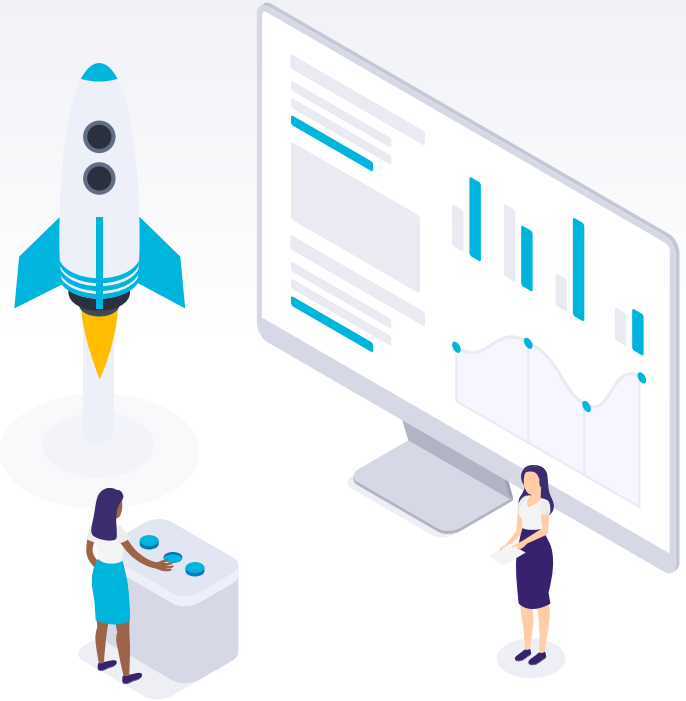
Feature	Data type	Dataset	Description
sentiment	bool	train/test	Sentiment of tweet: 0 for Non-negative tweets; 1 for Negative tweets
date	obj	train	Date & time of tweet
text	obj	train/test	Tweet posted

Workflow


Data Cleaning, pre-processing, EDA
1
Machine Learning models
2
Gensim implementation of Word2Vec
3
Word embeddings using GRU
4
BERT
5
Evaluation of test results & Live Testing
6

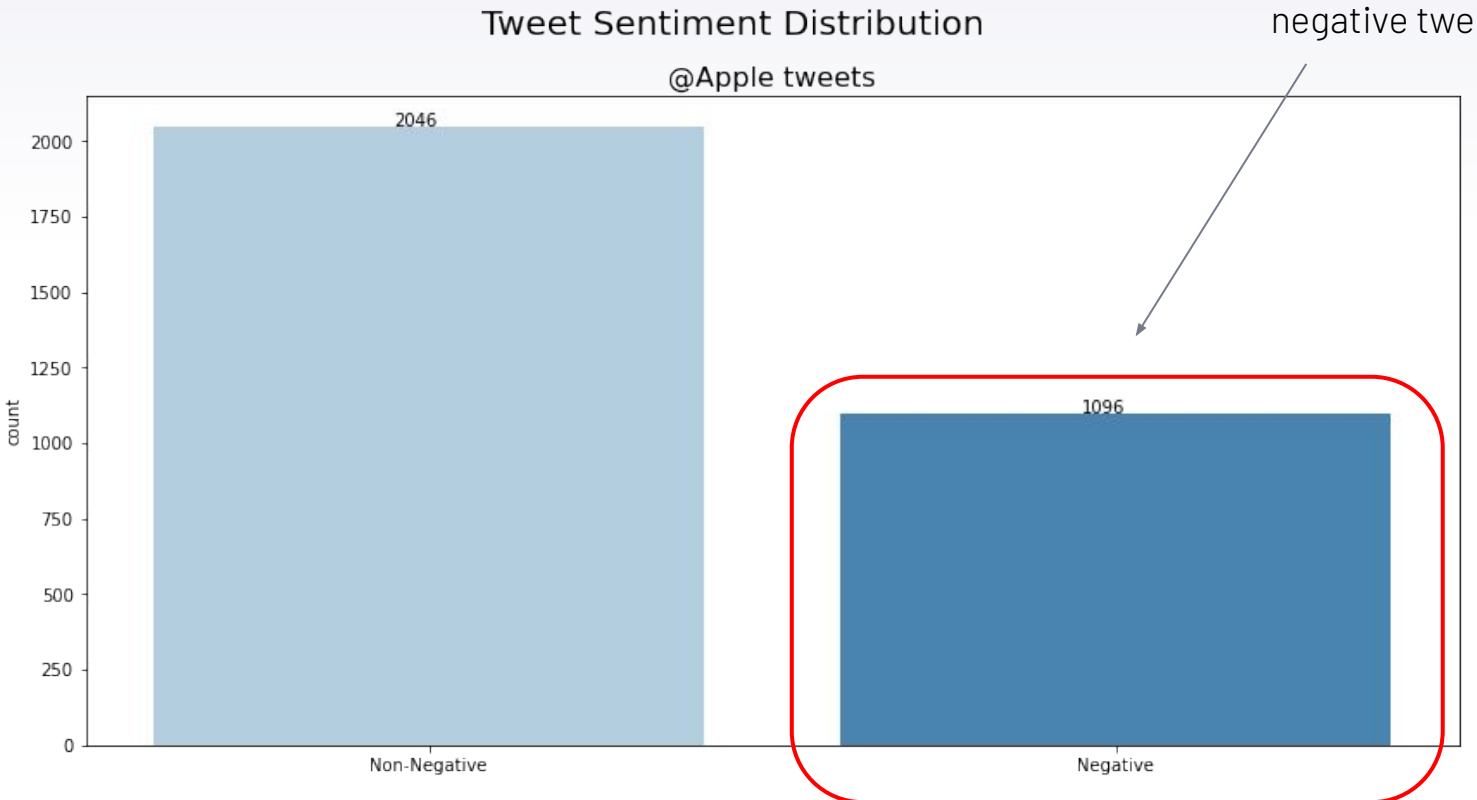
1

Data Cleaning & Exploratory Data Analysis

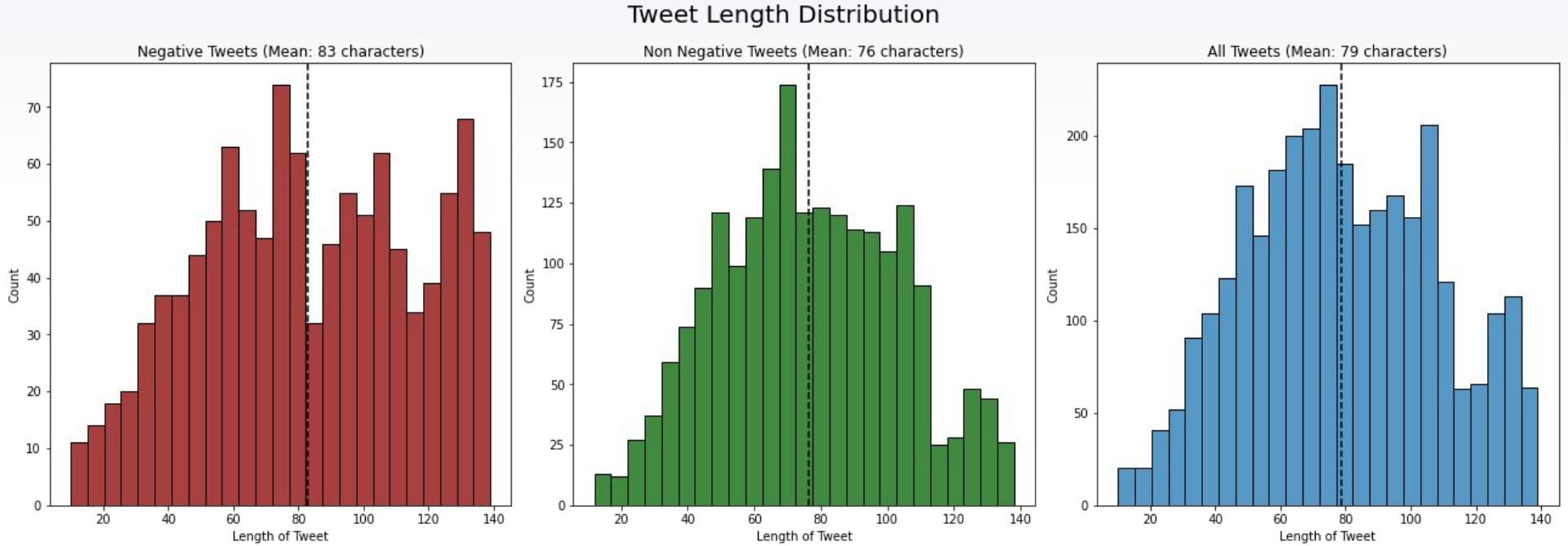


Sentiment Distribution

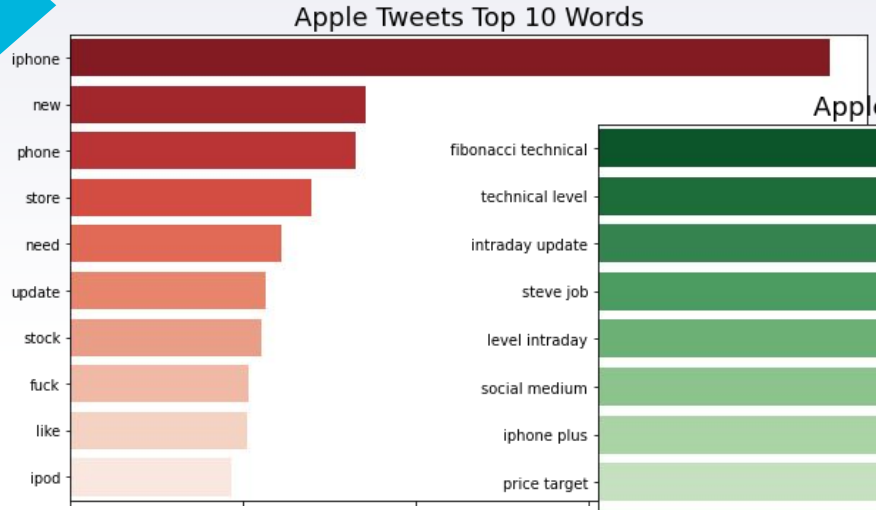
Goal: Predict negative tweets

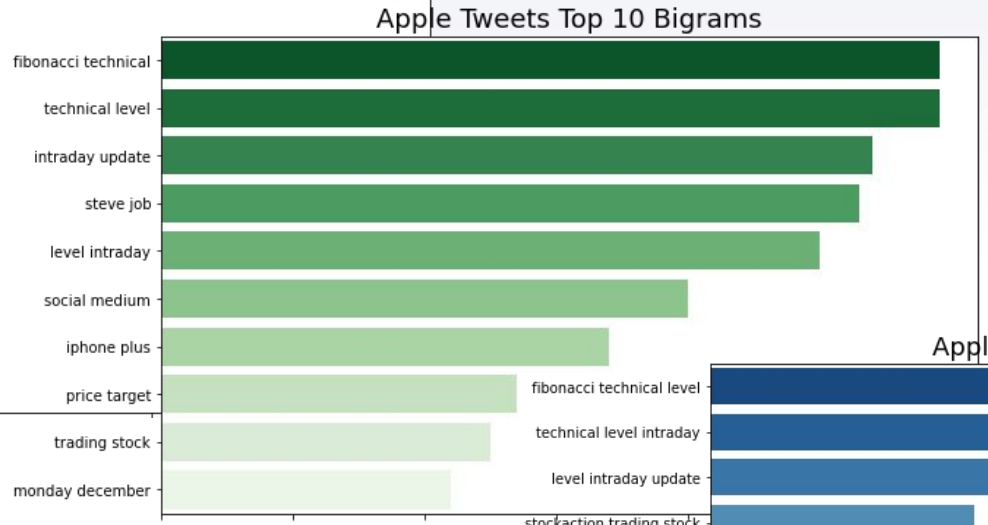


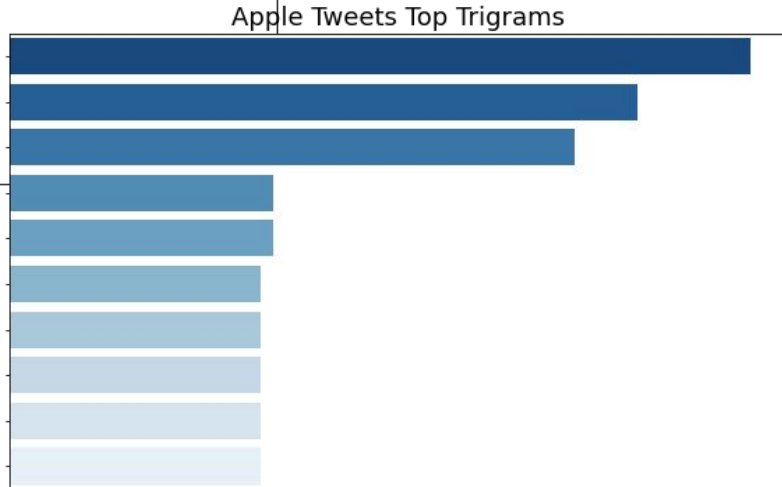
EDA on tweet length



EDA: Top n-grams

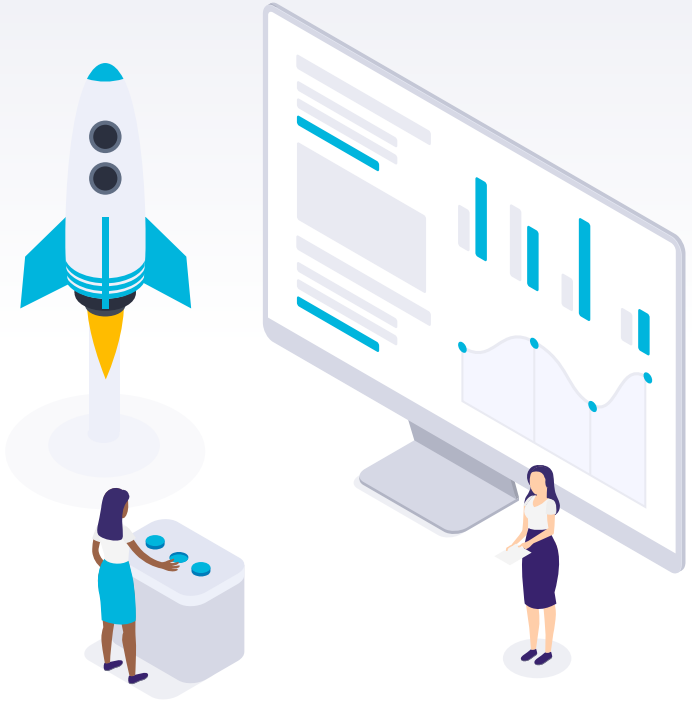






2

Machine Learning (ML) modelling



Baseline

```
[ ] # Baseline
    y = train_df['sentiment']
    y.value_counts(normalize=True)
```

```
0    0.651178
1    0.348822
Name: sentiment, dtype: float64
```

~ 35% chance of classifying it as a negative tweet

- Model = imbalanced

ML models

Vectorizers

- CountVectorizer
- TfidfVectorizer

Models

- Logistic Regression
- Complement Naive Bayes
- K Nearest Neighbor

Metrics

- F1 score
- Recall
- Accuracy

Results

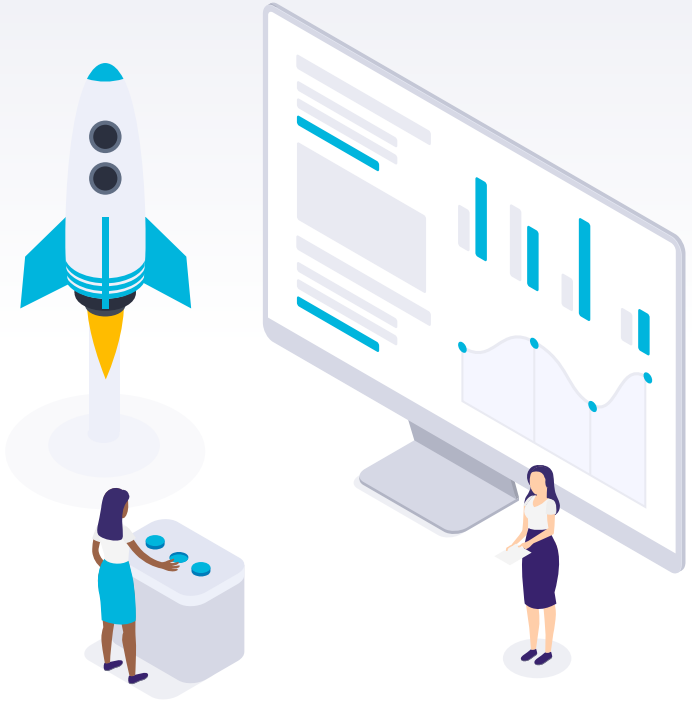
model	vectorizer	train	test	train_acc	val_acc	roc	precision	recall	smote
cnb	cvec	0.841605	0.725410	0.880621	0.786963	0.791914	0.657993	0.808219	1
cnb	cvec	0.841379	0.713693	0.881019	0.780604	0.781718	0.653992	0.785388	0
lr	cvec	0.951848	0.695238	0.965778	0.796502	0.766260	0.726368	0.666667	0
cnb	tvec	0.801494	0.682203	0.851970	0.761526	0.755385	0.636364	0.735160	0
cnb	tvec	0.807447	0.680498	0.855949	0.755167	0.753698	0.623574	0.748858	1

Best performing ML model:

Complement Naive Bayes with CountVectorizer on a Smoted dataset

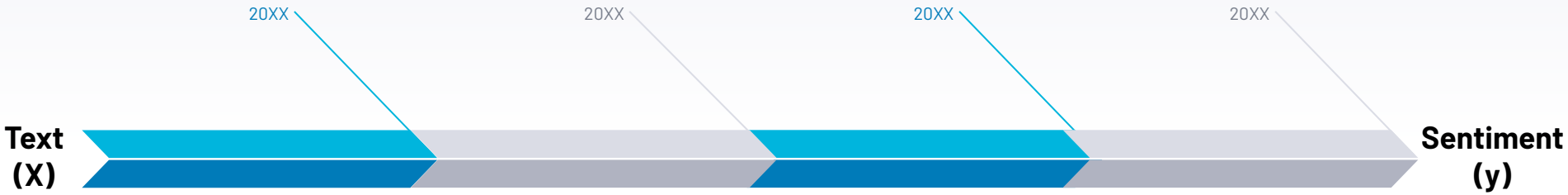
3

Deep Learning Models



Architecture

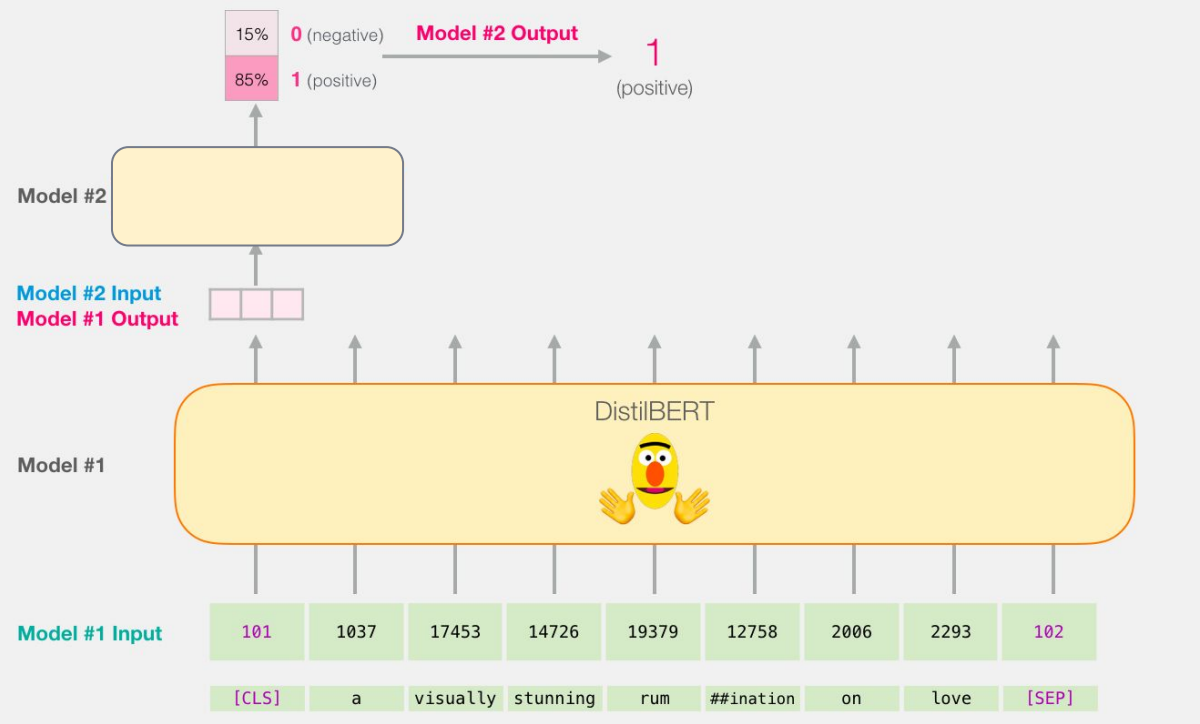
Word embedding models



Embedding	Deep Network	Fully Connected Layer	Output Layer
External Library or train dataset	GRU/LSTM	Dense	Sigmoid

Architecture

Word embedding models



Deep Learning models

Word2Vec

- Uses Gensim library to pre-train model for embedding layer
- GRU Network

Word Embeddings

- Uses train dataset to pre-train model for embedding layer
- GRU Network

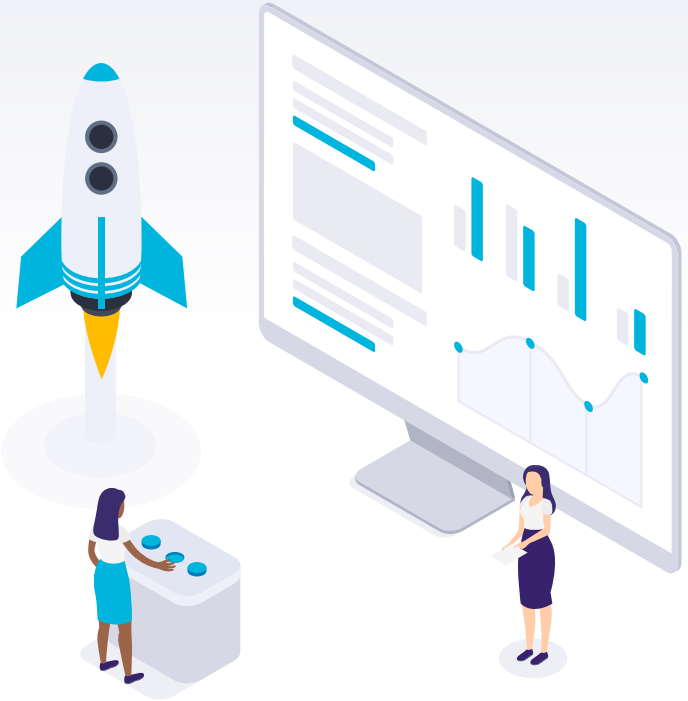
BERT

- Uses BertTokenizer for encoding
- BertForSequenceClassification

4

Result Evaluation

Based on testing set



Testing scores

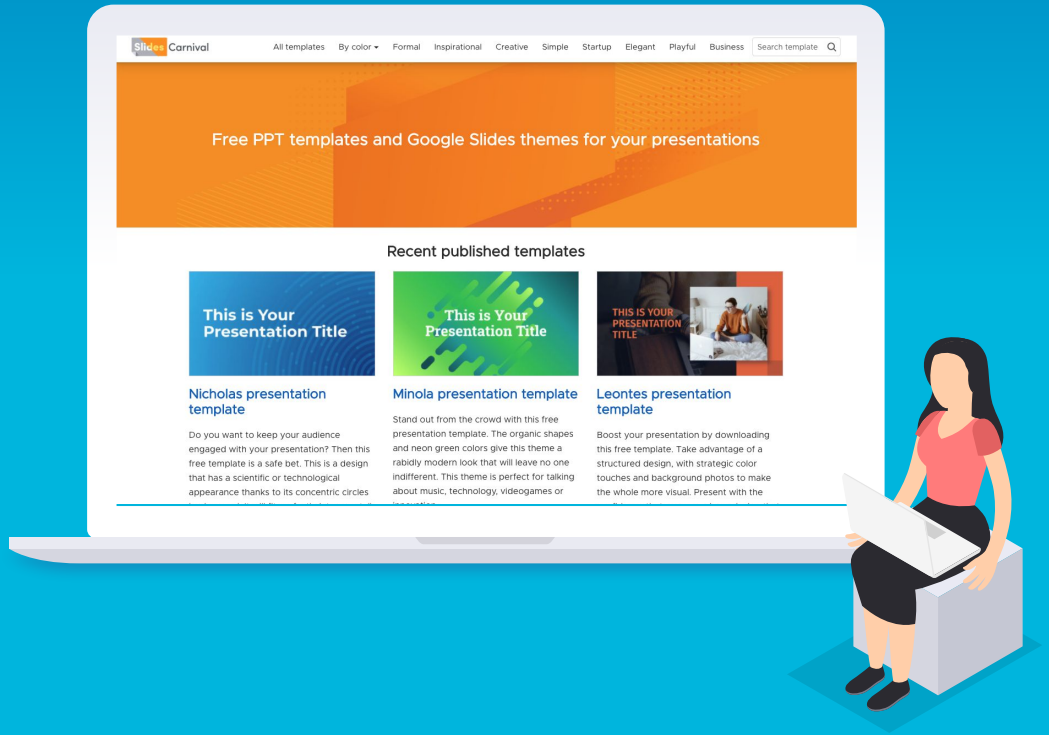
Best performing model: BERT

model	accuracy	precision	recall	f1	misclassification	specificity
BERT	0.959360	0.951684	0.951684	0.951684	0.040640	0.964931
cnb-cvec-smote	0.904294	0.835443	0.962099	0.894309	0.095706	NaN
word_embedding	0.714724	0.991111	0.325073	0.489572	0.285276	0.997881
w2v	0.627607	0.780142	0.160350	0.266022	0.372393	0.967161

Model Challenges

	text	sentiment	bert_predict	check
10	Facebook CEO Mark Zuckerberg criticizes Apple $AAPL aapl	1	0	1
36	PCAudioLabs is in and Apple is out at Emanon Records Apple was premium product Now it is an average product with a premium price	1	0	1
65	Nasdaq big fall FB Baba Twtr Linkd Apple fell-6% on Monday See whether follow up	1	0	1
109	ohaiigloria hahahamark apple explain yourselves	1	0	1
114	appleipad irig For the price to connect my guitar I could buy a real amp loud enough to perform ripoff	1	0	1

Live Testing



Future improvements

- Train on a wider set of data (eg. live scraping of news articles/ reviews)
- Extract out overall sentiment for a certain period
- Sentiment confidence

THANK YOU!

Credits

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
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- Titles: Raleway
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