SENTIMENT ANALYSIS WITH NAIVE BAYES

ON TWITTER DATASET

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WHAT SENTIMENT ANALYSIS IS?

THE PROCESS OF COMPUTATIONALLY IDENTIFYING AND CATEGORIZING OPINIONS EXPRESSED IN A PIECE OF TEXT, IN ORDER TO DETERMINE WHETHER THE WRITER'S ATTITUDE TOWARDS A PARTICULAR TOPIC IS POSITIVE, NEGATIVE, OR NEUTRAL.

WHY IS IT USEFUL?

ALLOWS SOCIAL MEDIA MONITORING IN ORDER TO GET AN OVERVIEW OF THE PUBLIC OPINION BEHIND CERTAIN TOPICS.

SOURCE: ANALYTICS VIDHYA COMPETITION

data - DataFrame

Index	id	label	tweet	clean_tweet
0	1	0	@user when a father is dysfunctional and is so selfish he…	when a father is dysfunctional and is so selfish he drags his kids into his dysfunction.
1	2	0	@user @user thanks for #lyft credit i can't use cause they…	thanks for #lyft credit i can't use cause they don't offer wheelchair vans in pdx. #d
2	3	0	bihday your majesty	bihday your majesti
3	4	0	#model i love u take with u all the time in urð ±!!! ð…	#model i love u take with u all the time in urð ±!!! ð ð ð ð ð ¦ð ¦ð ¦
4	5	0	factsguide: society now #motivation	factsguide: society now #motiv
5	6	0	[2/2] huge fan fare and big talking before they leave. cha…	[2/2] huge fan fare and big talking before they leave. chaos and pay disputes when they get
6	7	0	@user camping tomorrow @user @user @user @user @user @use…	camping tomorrow dannyâ ¦
7	8	0	the next school year is the year for exams.ð ¯ can't thi…	the next school year is the year for exams.ð ¯ can't think about that ð #school #exams
8	9	0	we won!!! love the land!!! #allin #cavs #champions #clevel…	we won!!! love the land!!! #allin #cavs #champions #cleveland #clevelandcavaliers â ¦
9	10	0	@user @user welcome here ! i'm it's so #gr8 !	welcome here ! i'm it's so #gr8 !
10	11	0	â ¥ #ireland consumer price index (mom) climbed from pre…	â ¥ #ireland consumer price index (mom) climbed from previous 0.2% to 0.5% in may #blog
11	12	0	we are so selfish. #orlando #standwithorlando #pulseshooti…	we are so selfish. #orlando #standwithorlando #pulseshooting #orlandoshooting #biggerproble
12	13	0	i get to see my daddy today!! #80days #gettingfed	i get to see my daddy today!! #80days #gettingf
13	14	1	@user #cnn calls #michigan middle school 'build the wall' …	#cnn calls #michigan middle school 'build the wall' chant '' #tcot
14	15	1	no comment! in #australia #opkillingbay #seashepherd #h…	no comment! in #australia #opkillingbay #seashepherd #helpcovedolphins #thecove #helpco
15	16	0	ouch...junior is angryð É#got7 #junior #yugyoem #omg	ouch...junior is angryð É#got7 #junior #yugyoem #omg
16	17	0	i am thankful for having a paner. #thankful #positive	i am thankful for having a paner. #thankful #positive
17	18	1	retweet if you agree!	retweet if you agree!
18	19	0	its #friday! ð smiles all around via ig user: @user #c…	its #friday! ð smiles all around via ig user: #cookies make people
19	20	0	as we all know, essential oils are not made of chemicals.	as we all know, essential oils are not made of chemicals.
20	21	0	#euro2016 people blaming ha for conceded goal was it fat r…	#euro2016 people blaming ha for conceded goal was it fat rooney who gave away free kick kno
21	22	0	sad little dude.. #badday #coneofshame #cats #pissed #fu…	sad little dude.. #badday #coneofshame #cats #pissed #funny #laughs
22	23	0	product of the day: happy man #wine tool who's it's the…	product of the day: happy man #wine tool who's it's the #weekend? time to open up &
23	24	1	@user @user lumpy says i am a . prove it lumpy.	lumpy says i am a . prove it lumpy.
24	25	0	@user #tgif #ff to my #gamedev #indiedev #indiegamedev …	#tgif #ff to my #gamedev #indiedev #indiegamedev #squad!
25	26	0	beautiful sign by vendor 80 for $45.00!! #upsideofflorida …	beautiful sign by vendor 80 for $45.00!! #upsideofflorida #shopalyssas #love

TOKENIZATION

BREAKING UP A SENTENCE OR PARAGRAPH INTO SPECIFIC TOKENS OR WORDS. WITHOUT IDENTIFYING THE TOKENS, IT IS DIFFICULT TO IMAGINE EXTRACTING HIGH LEVEL INFORMATION FROM TEXT.

STOPWORDS REMOVAL

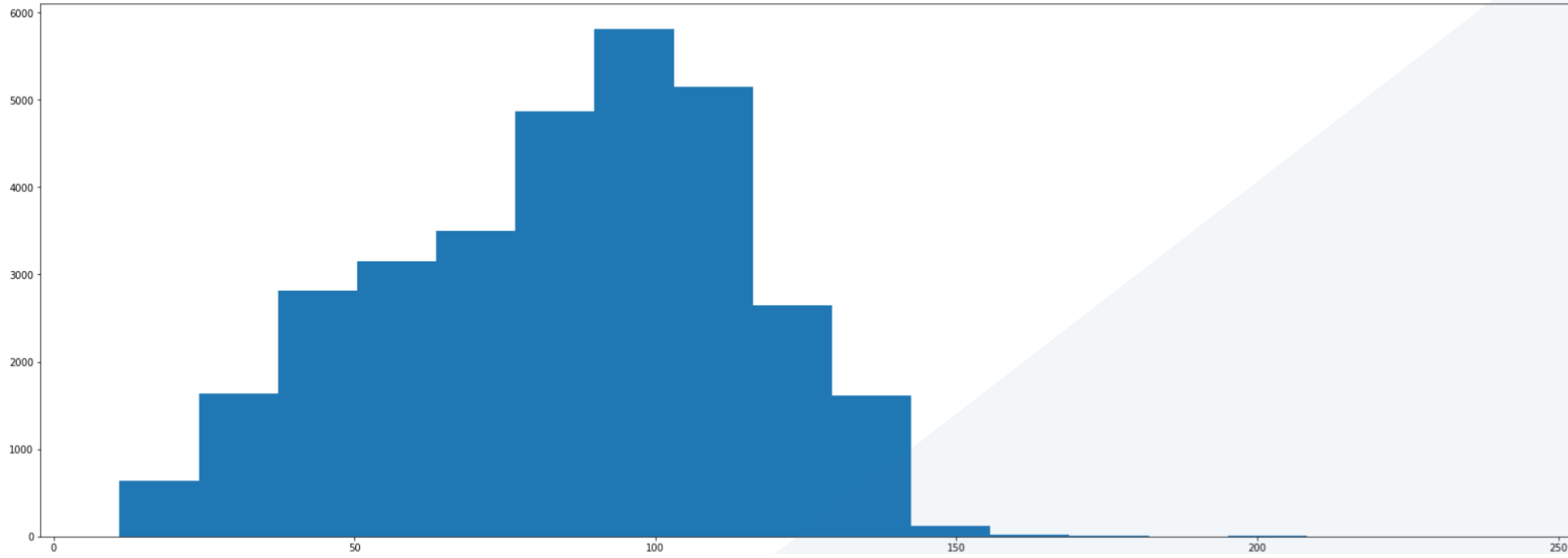
REMOVING CONJUNCTIONS, ADJECTIVE, ETC, IN ORDER TO MAKE THE INPUT DATA MORE MEANINGFUL TO THE ALGORITHM

STEMMING

REDUCING INFLECTED (OR SOMETIMES DERIVED) WORDS TO THEIR WORD STEM, BASE OR ROOT FORM

PUNCTUATIONS, NUMBERS, AND SPECIAL CHARACTERS REMOVAL

TWITTER @USER REMOVAL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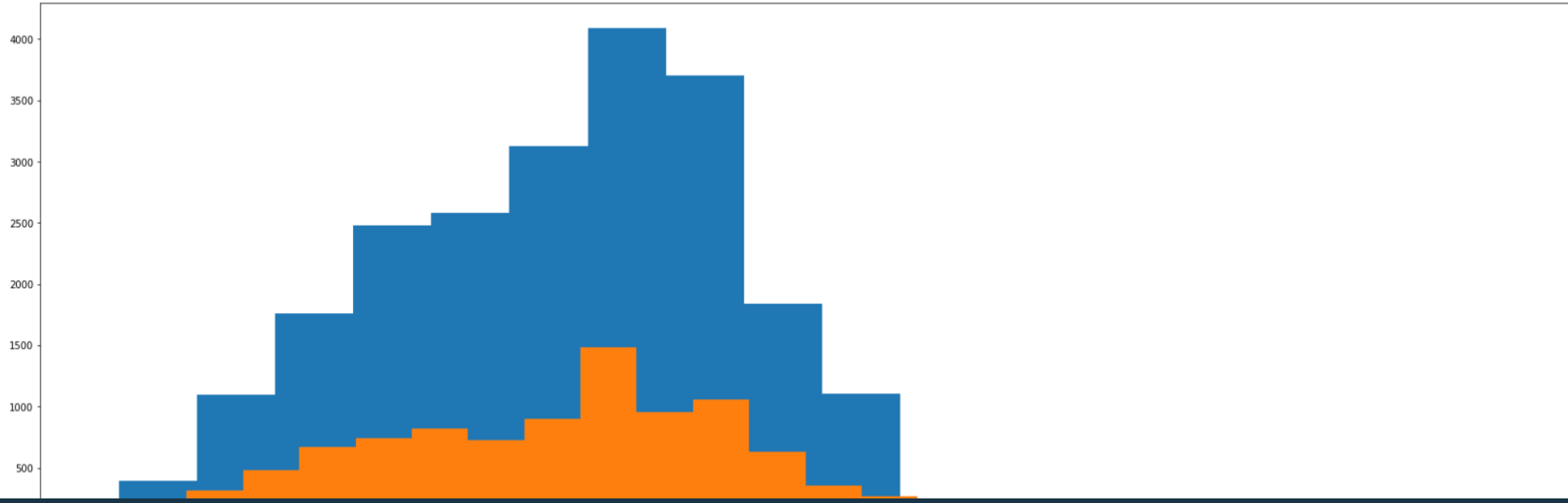
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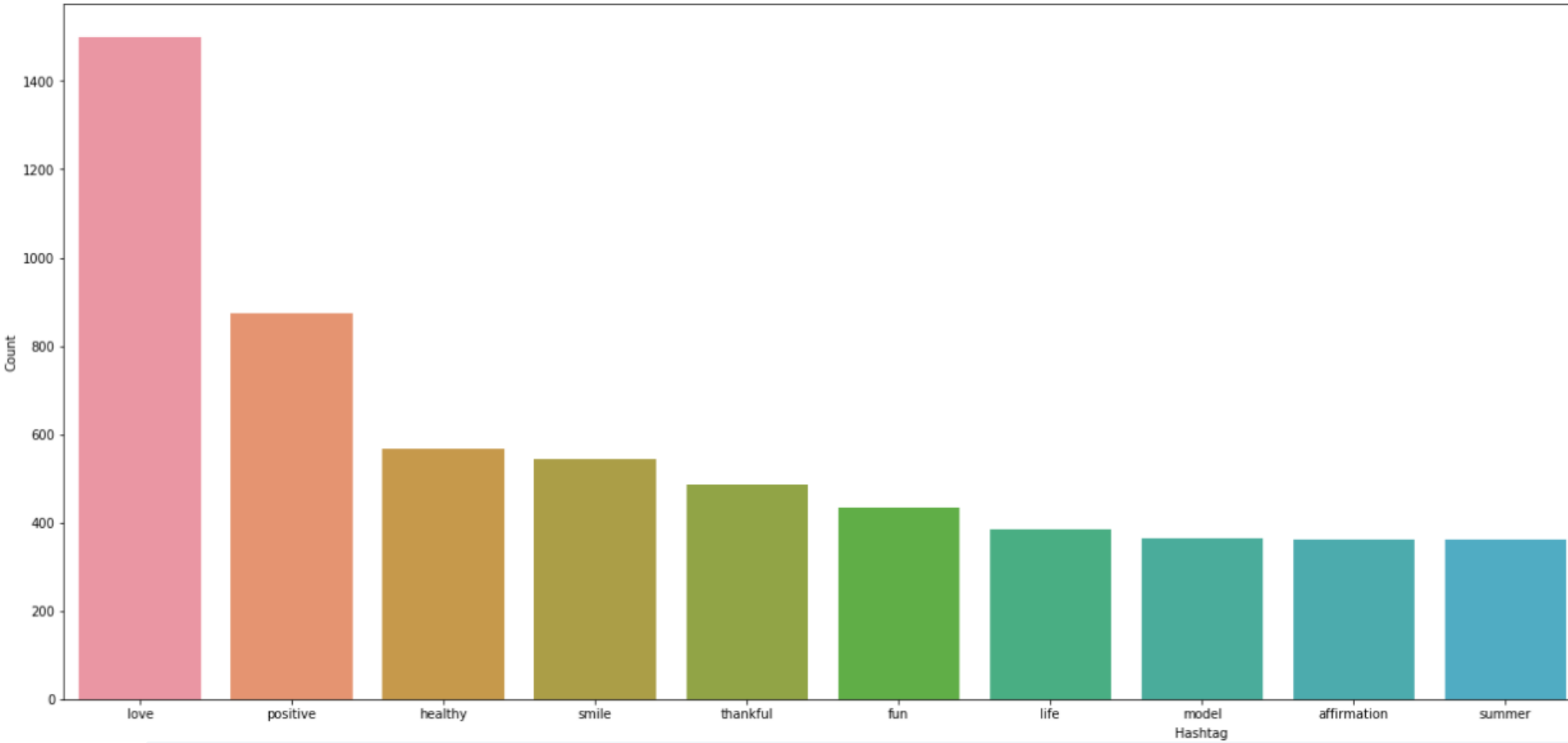
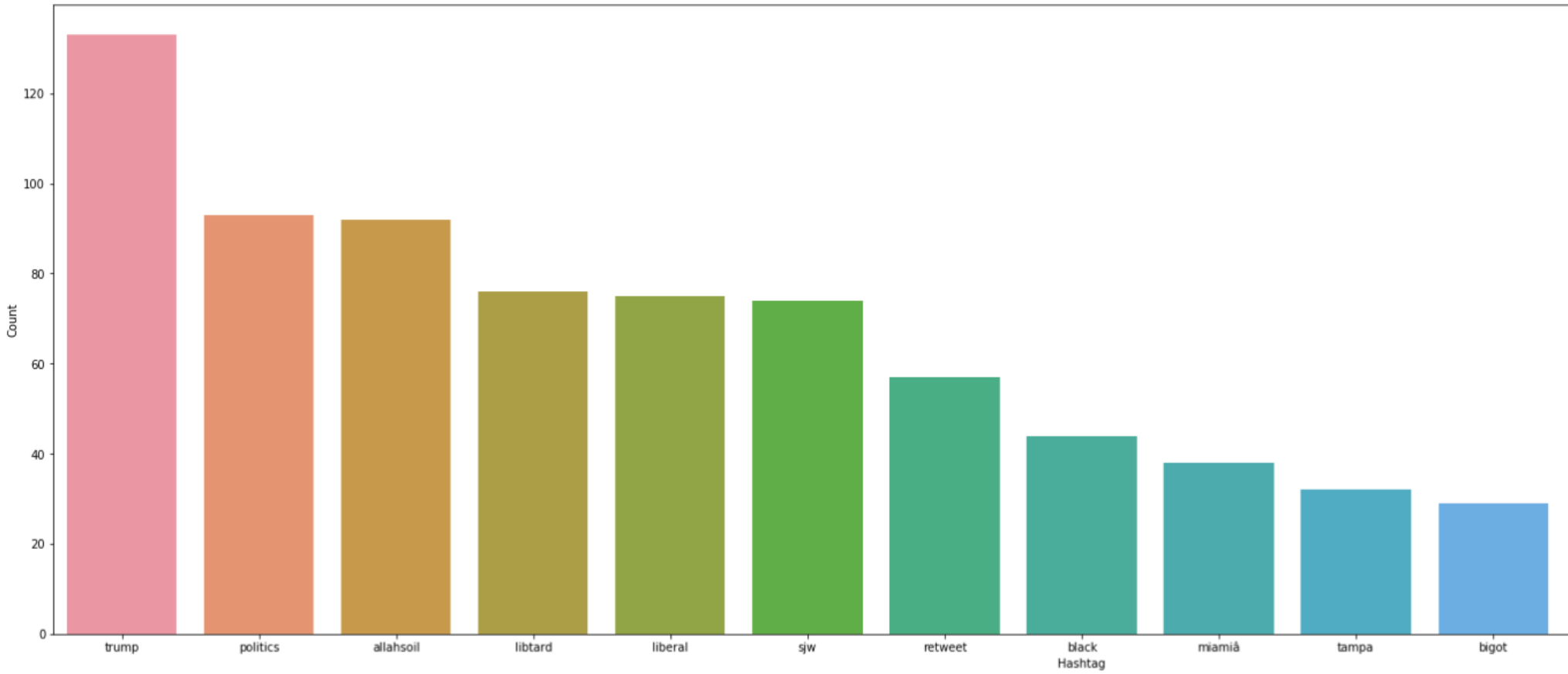
POSITIVE #HASHTAGS



NEGATIVE #HASHTAGS

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smile
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weekend
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girl
thankful positive
summer
beautiful
time
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positive affirmation
i_am positive
father day
tomorrow
going
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friday
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world
family
first
wait
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great
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go
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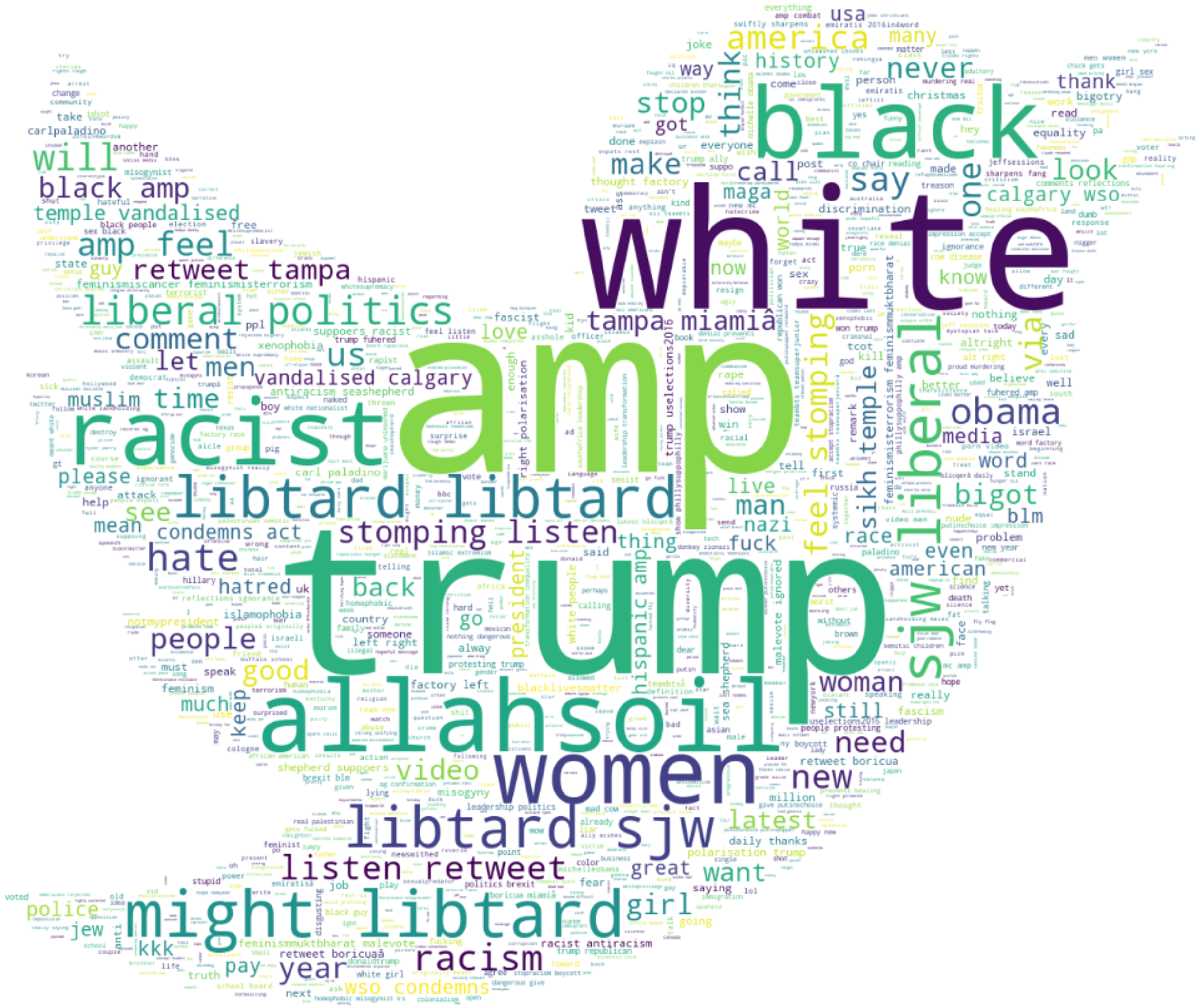
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TERM FREQUENCY-INVERSE DOCUMENT FREQUENCY

- TF-IDF IS AN INFORMATION RETRIEVAL TECHNIQUE THAT WEIGHS A TERM'S FREQUENCY (TF) AND ITS INVERSE DOCUMENT FREQUENCY (IDF).
- EACH WORD OR TERM HAS ITS RESPECTIVE TF AND IDF SCORE. THE PRODUCT OF THE TF AND IDF SCORES OF A TERM IS CALLED THE TF*IDF WEIGHT OF THAT TERM.
- THE HIGHER THE TF*IDF SCORE (WEIGHT), THE RARER THE TERM AND VICE VERSA.

NAIVE BAYES CLASSIFIER

SUPERVISED LEARNING ALGORITHMS BASED ON APPLYING BAYES' THEOREM WITH THE "NAIVE" ASSUMPTION OF CONDITIONAL INDEPENDENCE BETWEEN EVERY PAIR OF FEATURES GIVEN THE VALUE OF THE CLASS VARIABLE.

$$P(y \mid x_1, \ldots, x_n) = \frac{P(y)P(x_1, \ldots x_n \mid y)}{P(x_1, \ldots, x_n)}$$

THE GENERAL IDEA OF NAIVE BAYES:

- REPRESENT A DOCUMENT X AS A SET OF (W, A FREQUENCY OF W) PAIRS.
- FOR EACH LABEL Y, BUILD A PROBABILISTIC MODEL P(X| Y = Y) OF DOCUMENTS IN CLASS Y.
- TO CLASSIFY, SELECT LABEL Y WHICH IS MOST LIKELY TO GENERATE X:

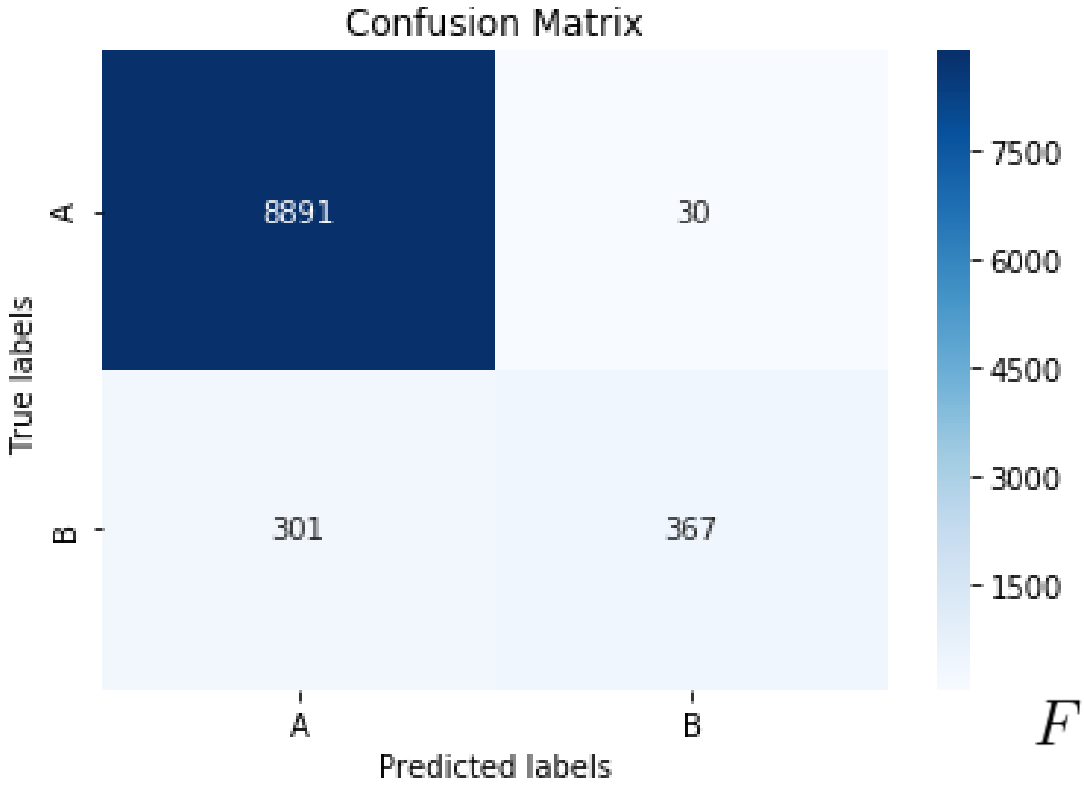
$$\hat{y} = \underset{y}{argmax} P(X|y) * P(y)$$

ASSUMPTIONS:

- THE ORDER OF THE WORDS IN DOCUMENT X MAKES NO DIFFERENCE BUT REPETITIONS OF WORDS DO.
- WORDS APPEAR INDEPENDENTLY OF EACH OTHER, GIVEN THE DOCUMENT CLASS.

OBJECTIVE:

CLASSIFY TWEET AS NEGATIVE OR POSITIVE



$$Accuracy = \frac{TP + TN}{Total} = 0.9654$$

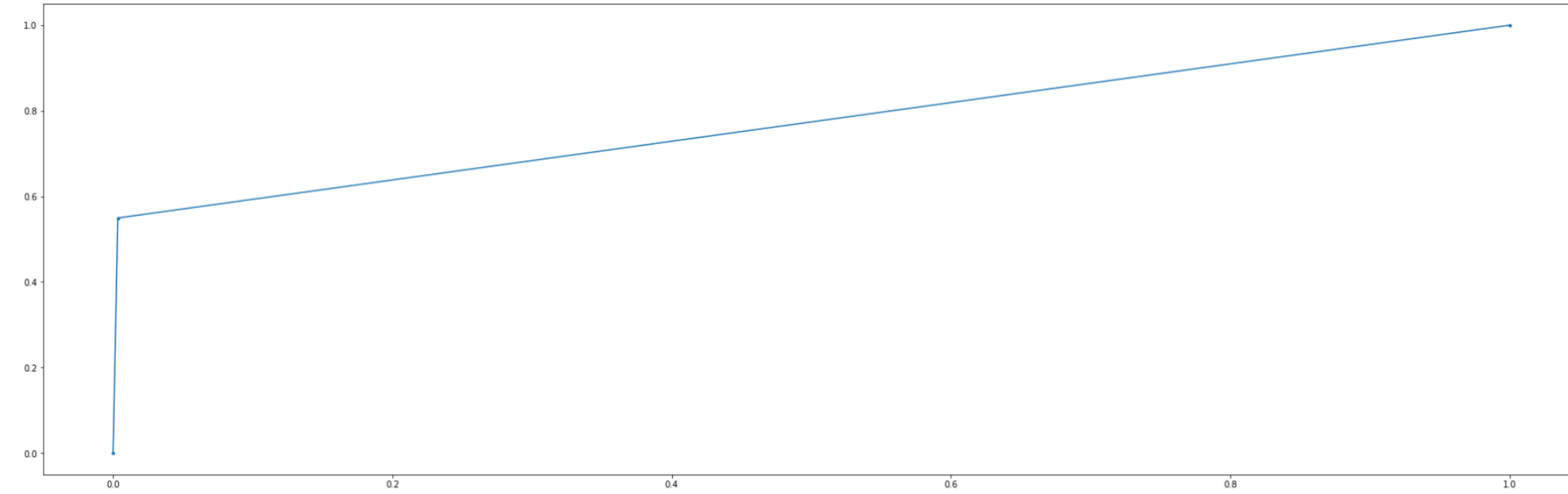
$$Precision = \frac{TP}{TP + FP} = 0.9244$$

$$Recall = \frac{TP}{TP + FN} = 0.5494$$

$$F1 = \frac{2 \cdot precision \cdot recall}{precision + recall} = 0.6892$$

ROC CURVE:

AREA UNDER THE CURVE=0.7730



CONCLUSIONS

NEVER STOP AT ACCURACY. PERMORMANCE IS STILL GOOD EVEN WHEN EVALUATED WITH OTHER MEASURES BUT GIVEN SOME NEGATIVE TWEETS NOT RECOGNISED, IT IS NOT THAT GOOD.

THE PROBLEM IS THE RECOGNITION OF NEGATIVE TWEETS. POSSIBLE DEVELOPEMENTS ARE:

- BUILDING A MORE BALANCED DATASET
- EXPLOITING MORE ADVANCED ALGORITHM FOR CLASSIFICATION

THANK YOU ALL FOR THE ATTENTION

SOURCES:

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