

NLP Project - Twitter_Sentiment_Analysis

This Project is build by using concepts of Natural Language Processing field of Machine Learning to identify hate speech in tweets from

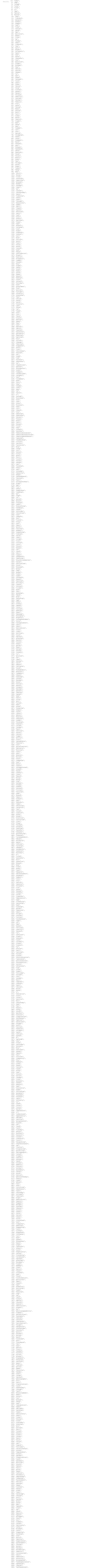
Discription

Data Details

tweeter social news app.

given a training sample of tweets and labels, where

• label '1' denotes the tweet is racist/sexist





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406, 408, 408, 43, 21, 43, 12, 43, 12, 43, 12, 43, 13, 14, 14, 14, 14, 14, 14, 14, 14, 14, 14	C. 30, 441, 41291, 1129, 1109, 400, 401, 212, 4121, 112, 411), 1209, 120
406, 4088, 433, 213, 434, 437, 434, 434, 434, 434, 434, 43	9, 20, 124, 1247, 125, 125, 125, 125, 125, 125, 125, 125
406, 408, 408, 406, 408, 408, 408, 408, 408, 408, 408, 408	9, 20, 1421, 1423, 1421, 1421, 1422, 1423, 1421, 1421, 1421, 1422, 1423, 1421,
406, 4088, 43, 21, 48 43, 21, 8 406, 4088, 43, 21, 8 43, 21, 8 43, 123, 8 43, 123, 8 43, 123, 8 43, 123, 8 43, 123, 8 43, 123, 8 43, 123, 8 43, 7, 31 43, 7, 31 43, 7, 31 409, 41 1, 1, 1, 1 1, 2, 7 43, 7, 16 1, 1, 1, 1 1, 2, 2, 23 13, 160, 1 1, 1, 1, 1 1, 2, 2, 3 1, 1, 1, 1 1, 2, 2, 3 1, 1, 1, 1 1, 2, 2, 3 1, 1, 1, 1 1, 2, 3, 1 1, 2, 3, 1 1, 2, 3, 1 1, 2, 3, 1 1, 3, 7, 2 1, 2, 3, 1 1, 2, 3, 2 1, 3, 3, 1 1, 4, 3, 1 1, 4, 4, 1 1, 4, 4, 1 1, 4, 4, 1 1, 2, 3, 3, 4 1, 4, 3, 5 1, 4, 3, 5	1. C.
406, 408, 408, 408, 408, 408, 408, 408, 408	S. A. S. C. M. S. C. S.
40 40<	S. A. C.

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5], [1169, 4659, 4660], [1, 4661, 4662, 2455, 70, 4663, 949], [18, 122, 4, 772, 676, 771, 117, 559, 161], [14, 58, 7, 4664, 4, 1154, 2456, 4665, 1618], [1, 44, 37, 4666, 4667, 1647, 23, 4668], [1308, 713, 4669, 1309, 455, 19, 4670, 1125, 2432, 67, 163, 1285], [34, 22, 102, 2144, 77], [698, 4671, 1046, 7, 4672, 79, 76, 4673, 4674], [24, 88, 2457, 1233, 2458, 2458, 2459], [43, 123, 19, 10, 679], ...] In [38]: sequences matrix train = sequence.pad sequences (sequences train, maxlen=max len) In [39]: sequences_matrix_train 0, ..., 3142, 914, 3143], array([[Ο, Ο, Out[39]: [0, 1, 31, ..., 6, 1445, 3144], 0, 0, ..., 668, 3149, 1446], [Ο, Ο, 0, ..., 3131, 3132, 1978], [0, 0, ..., 7988, 322, 2], 0, ..., 547, 276, 7990]], dtype=int32) Ο, [Ο, [In [40]: # First document sequences matrix train[0] Out[40]: array([0, 0, 488, 666, 666, 1443, 3141, 3142, Ο, Ο, Ο, 914, 3143], dtype=int32) **Artificial Neural Network** Using GRU architechure In [41]: model = Sequential() model.add(Embedding(vocab_len+1,500,input_length=max_len,mask_zero=True)) model.add(GRU(16,activation='tanh')) model.add(Dense(16,activation="relu")) model.add(Dropout(0.2)) # output layer model.add(Dense(1,activation='sigmoid')) In [42]: model.summary() Model: "sequential" Output Shape Layer (type) Param # ______ (None, 13, 500) embedding (Embedding) 3995500 (None, 16) gru (GRU) 24864 (None, 16) 272 dense (Dense) (None, 16) dropout (Dropout) dense 1 (Dense) (None, 1) 17 ______ Total params: 4,020,653 Trainable params: 4,020,653 Non-trainable params: 0 In [43]: model.compile(loss='binary_crossentropy',optimizer='adam') In [47]: model.fit(sequences_matrix_train,y_train_bal,batch_size=100,epochs=50) Epoch 1/50 37/37 [==== ======== - 7s 70ms/step - loss: 0.6583 Epoch 2/50 Epoch 3/50 Epoch 4/50 Epoch 5/50 Epoch 6/50 Epoch 7/50 Epoch 8/50 Epoch 9/50 Epoch 10/50 Epoch 11/50 Epoch 12/50 Epoch 13/50 Epoch 14/50 Epoch 15/50 Epoch 16/50 Epoch 17/50 Epoch 18/50 Epoch 19/50 Epoch 20/50 Epoch 21/50 37/37 [= Epoch 22/50 Epoch 23/50 Epoch 24/50 Epoch 25/50 Epoch 26/50 Epoch 27/50 Epoch 28/50 Epoch 29/50 Epoch 30/50 Epoch 31/50 Epoch 32/50 Epoch 33/50 Epoch 34/50 Epoch 35/50 Epoch 36/50 Epoch 37/50 Epoch 38/50 Epoch 39/50 Epoch 40/50 Epoch 41/50 Epoch 42/50 Epoch 43/50 Epoch 44/50 Epoch 45/50 Epoch 46/50 Epoch 47/50 Epoch 48/50 Epoch 49/50 Epoch 50/50 <keras.callbacks.History at 0x7fed47a8ae10> Out[47]: In [48]: sequences_matrix_test = sequence.pad_sequences(tok.texts_to_sequences(x_test), maxlen=max_len) In [49]: sequences matrix test 0, ..., 68, 133, 1669], array([[Out[49]: 0, ..., 4645, 4645, 2522], 0, [0, 0, ..., 621, 38, 2534], Ο, [0, ..., 519, 721, 706], Ο, 5, 0, 0, ..., 2, 1007], Ο, [0, ..., 161, 152, 138]], dtype=int32) Ο, Ο, [**Prediction and Evaluation** In [50]: y_pred=model.predict(sequences_matrix_test) In [51]: y pred = $np.where(y pred \ge 0.5, 1, 0)$ array([[0], Out[51]: [0], [0], [0], [0], [0]]) In [52]: from sklearn.metrics import classification_report In [53]: print(classification_report(y_test,y_pred)) precision recall f1-score support

 0.98
 0.84
 0.91

 0.27
 0.82
 0.40

 5960 433 accuracy 0.84 6393 0.63 0.83 0.94 0.84 macro avg 0.65 6393 0.87 weighted avg 6393 **Machine Learning Model** Vectorization In [58]: # CountVectorizer cv = CountVectorizer() x_train_cv = cv.fit_transform(x_train_bal) x_test_cv = cv.transform(x_test) In [59]: x_test_cv.toarray() array([[0, 0, 0, ..., 0, 0, 0], $[0, 0, 0, \ldots, 0, 0, 0],$ $[0, 0, 0, \ldots, 0, 0, 0]]$ In [60]: # TfidfVectorizer tf = TfidfVectorizer() x train tf = tf.fit transform(x train bal) x test tf = tf.transform(x test)In [61]: from sklearn.linear_model import LogisticRegression from sklearn.metrics import confusion_matrix,classification_report,accuracy_score **Logistic Regression** In [62]: lr=LogisticRegression() lr.fit(x_train_tf,y_train_bal) LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True, Out[62]: intercept_scaling=1, l1_ratio=None, max_iter=100, multi_class='auto', n_jobs=None, penalty='12', random_state=None, solver='lbfgs', tol=0.0001, verbose=0, warm start=False) **Prediction and Evaluation** In [63]: ypred_lr=lr.predict(x_test_tf) In [64]: print(accuracy_score(ypred_lr,y_test)) print(confusion_matrix(ypred_lr,y_test)) print(classification_report(ypred_lr,y_test)) 0.8531206006569686 [[5082 61] [878 372]] precision recall f1-score 0 0.85 0.99 0.92 5143 0.86 0.30 0.44 1250 6393 6393 0.85 accuracy 0.86 0.68 macro avg 0.64 weighted avg 0.85 0.85 0.82 6393 **Support Vector Classifier** In [65]: from sklearn.svm import SVC In [67]: svc=SVC() svc.fit(x_train_tf,y_train_bal) SVC(C=1.0, break_ties=False, cache_size=200, class weight=None, coef0=0.0, decision function shape='ovr', degree=3, gamma='scale', kernel='rbf', max iter=-1, probability=False, random state=None, shrinking=True, tol=0.001, verbose=False) In [68]: ypred svc=svc.predict(x test tf) In [69]: print(accuracy_score(ypred_svc,y_test)) print(confusion_matrix(ypred_svc,y_test)) print(classification_report(ypred_svc,y_test)) 0.8676677616142656 [[5176 62] [784 371]] precision recall f1-score support 0.87 0.99 0.92 5238 0.32 0.47 1155 0.86 0.87 6393 accuracy macro avg 0.86 0.65 0.70 6393 0.87 0.87 0.84 6393 weighted avg **Decision Tree Classifier** In [70]: from sklearn.tree import DecisionTreeClassifier In [72]: dt= DecisionTreeClassifier() dt.fit(x_train_tf,y_train_bal) DecisionTreeClassifier(ccp alpha=0.0, class weight=None, criterion='gini', max_depth=None, max_features=None, max_leaf_nodes=None, min_impurity_decrease=0.0, min_impurity_split=None, min_samples_leaf=1, min_samples_split=2, min_weight_fraction_leaf=0.0, presort='deprecated', random state=None, splitter='best') **Prediction and Evaluation** In [73]: ypred dt=dt.predict(x test tf) In [74]: print(accuracy_score(ypred_dt,y_test)) print(confusion matrix(ypred dt,y test)) print(classification_report(ypred_dt,y_test)) 0.7289222587204756 [[4300 73] [1660 360]] precision recall f1-score support 0 0.72 0.98 0.83 4373 0.83 0.18 0.29 2020 accuracy 0.73 6393 0.78 0.58 macro avg 0.56 6393 weighted avg 0.76 0.73 0.66 6393 **Prediction on testing Data** In [75]: df_test = pd.read_csv("/content/drive/MyDrive/Ml\AI/NLP_Itvedant/test.csv") df_test.head() Out[75]: id tweet **0** 31963 #studiolife #aislife #requires #passion #dedic... 1 31964 @user #white #supremacists want everyone to s... safe ways to heal your #acne!! #altwaystohe... **2** 31965 **3** 31966 is the hp and the cursed child book up for res... 3rd #bihday to my amazing, hilarious #nephew... **4** 31967 In [76]: df test.shape (17197, 2)Out[76]: In [77]: # WordCloud wc = WordCloud(width = 500, height = 500,background color ='white', min_font_size = 10) wc.generate(''.join(df test["tweet"])) plt.figure(figsize = (8,8),dpi=80) plt.imshow(wc) plt.axis("off") plt.show() know to day thankful positive much fathers day lookthank really **We** home model lovewill direct week sunday i_am positive In [78]: y=df test['tweet'] #studiolife #aislife #requires #passion #dedic... Out[78]: @user #white #supremacists want everyone to s... safe ways to heal your #acne!! #altwaystohe... is the hp and the cursed child book up for res... 3rd #bihday to my amazing, hilarious #nephew... thought factory: left-right polarisation! #tru... 17192 feeling like a mermaid $\tilde{\eth}\Box\Box\Box$ #hairflip #neverre... 17193 17194 #hillary #campaigned today in #ohio((omg)) &am... 17195 happy, at work conference: right mindset leads... my song "so glad" free download! #shoegaze ... 17196 Name: tweet, Length: 17197, dtype: object In [79]: lbl=[] In [80]: # def predict tweet(tweet): tweet=clean text(tweet) tweet cv = cv.transform([tweet]) prediction = lr.predict(tweet cv) lbl.append(prediction) return prediction[0] In [81]: def predict_tweet(tweet): tweet_cv = cv.transform([tweet]) prediction = lr.predict(tweet cv) lbl.append(prediction[0]) return prediction[0] In [82]: for i in y: predict_tweet(i) In [83]: lbl

[1257, 1608, 98, 796, 4388, 50, 306, 18, 109, 376],

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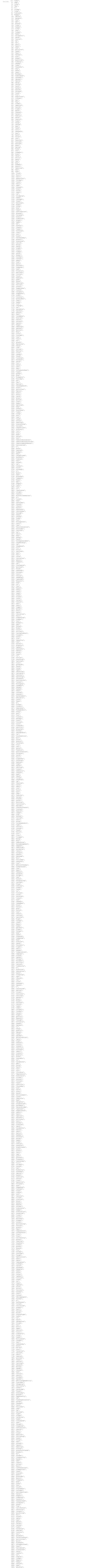
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0,1,0,1,0,0,0,0,0,0,0,0,0,0,1,1,0,0,0,1 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, In [84]: len(lbl) 17197 Out[84]: In [85]: df_test['lebel']=1b1 In [86]: df_test.head() Out[86]: tweet lebel **0** 31963 #studiolife #aislife #requires #passion #dedic... **1** 31964 @user #white #supremacists want everyone to s... **2** 31965 safe ways to heal your #acne!! #altwaystohe... **3** 31966 is the hp and the cursed child book up for res... **4** 31967 3rd #bihday to my amazing, hilarious #nephew... Data Augmentation Technique - Handling Data Imbalance In [87]: pip install nlpaug Requirement already satisfied: nlpaug in /usr/local/lib/python3.7/dist-packages (1.1.8) Requirement already satisfied: requests>=2.22.0 in /usr/local/lib/python3.7/dist-packages (from nlpaug) (2.23. Requirement already satisfied: numpy>=1.16.2 in /usr/local/lib/python3.7/dist-packages (from nlpaug) (1.19.5) Requirement already satisfied: pandas>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from nlpaug) (1.3.4) Requirement already satisfied: $pytz \ge 2017.3$ in /usr/local/lib/python3.7/dist-packages (from pandas $\ge 1.2.0- nlpa$) ug) (2018.9) Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from pandas>= 1.2.0->nlpaug) (2.8.2) Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.7.3->pandas>=1.2.0->nlpaug) (1.15.0) Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests>=2.22.0->n lpaug) (2.10) Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-package s (from requests>=2.22.0->nlpaug) (1.24.3) Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests>=2.2 2.0->nlpaug) (3.0.4) Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests>=2.2 2.0->nlpaug) (2021.5.30) In [88]: import nlpaug.augmenter.word as naw In [89]: import nltk nltk.download('averaged_perceptron_tagger') [nltk data] Downloading package averaged perceptron tagger to /root/nltk_data... [nltk_data] Package averaged_perceptron_tagger is already up-to-[nltk_data] Out[89]: In [94]: df_aug = df_train.copy() aug_texts = [] df_balalnced = df_aug[df_aug['label'] == 1] aug = naw.SynonymAug(aug_src='wordnet') texts = df_balalnced['tweet'].tolist() for text in texts: augmented_texts = aug.augment(text, n=12) for augmented in augmented_texts: aug_texts.append(augmented) print(len(aug_texts)) temp = pd.DataFrame({'tweet': aug_texts}) print(temp) temp['label'] = 1 $df_aug = pd.concat([df_aug, temp], axis=0)$ df_aug = df_aug.reset_index()
df_aug = df_aug.drop(columns=['index']) del temp, df_balalnced 26868 0 drug user cnn call michigan middle shoal wall ... 1 user cnn call michigan middle schooltime wall ... 2 exploiter cnn call michigan middle school bulw... 3 user cnn cry michigan middle school wall chant... user cnn call michigan middle school day rampa... 26863 drug user sikh temple vandalised calgary wso c... 26864 user sikh temple vandalise calgary wso condemn... 26865 user sikh temple vandalised calgary wso condem... 26866 user sikh temple vandalise calgary wso condemn... 26867 user sikh synagogue vandalised calgary wso con... [26868 rows x 1 columns] In [95]: sns.countplot(data=df_aug, x='label') <matplotlib.axes._subplots.AxesSubplot at 0x7fec41359210> Out[95]: 30000 25000 20000 5 15000 10000 5000 label In [96]: df_aug.head() Out[96]: id label tweet sent_len **0** 1.0 0 user father dysfunctional selfish drag kid dys... 8.0 **1** 2.0 0 user user thanks lyft credit ca use cause offe... 14.0 **2** 3.0 0 bihday majesty 2.0 **3** 4.0 0 model love u take u time 6.0 **4** 5.0 factsguide society motivation 3.0 **Training and Testing Data** In [97]: x = df_aug["tweet"].values y = df_aug["label"].values In [98]: $x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=1)$ In [99]: max(sent_len) Out[99]: In [100... np.quantile(sent_len,0.95) Out[100... In [101... $max_len = 13$ **Tokenization** In [102... # Tokenization tok = Tokenizer(char level=False, split=' ') tok.fit_on_texts(x_train) In [103... tok.index_word





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sequences matrix train = sequence.pad sequences (sequences train, maxlen=max len) In [108... sequences_matrix_train array([[1, 19, 1021, ..., 51, 14849, 919], Out[108... 125, 7632, ..., 186, [1249, 55**,** 1], 0, ..., 6694, [Ο, Ο, Ο, Ο, 0, ..., 676, 9659, 32018], [Ο, 0, ..., 12778, 13566, 32021], [Ο, 0, 5476, 5577, ..., 582, 5622, 462]], dtype=int32) **RNN Network** In [109... model = Sequential() model.add(Embedding(vocab len+1,500,input length=max len,mask zero=True)) model.add(SimpleRNN(16,activation='tanh')) model.add(Dense(16,activation="relu")) model.add(Dropout(0.2)) # output layer model.add(Dense(1,activation='sigmoid')) In [110... model.summary() Model: "sequential 1" Layer (type) Output Shape Param # (None, 13, 500) 16011500 embedding_1 (Embedding) simple_rnn (SimpleRNN) (None, 16) 8272 dense_2 (Dense) (None, 16) 272 dropout 1 (Dropout) (None, 16) 0 (None, 1) dense_3 (Dense) ______ Total params: 16,020,061 Trainable params: 16,020,061 Non-trainable params: 0 In [111... model.compile(loss='binary crossentropy',optimizer='adam') In [113... model.fit(sequences matrix train,y train,batch size=100,epochs=25) Epoch 1/25 Epoch 2/25 Epoch 3/25 Epoch 4/25 Epoch 5/25 Epoch 6/25 Epoch 7/25 Epoch 8/25 Epoch 9/25 Epoch 10/25 Epoch 11/25 Epoch 12/25 Epoch 13/25 Epoch 14/25 Epoch 15/25 Epoch 16/25 Epoch 17/25 Epoch 18/25 Epoch 19/25 Epoch 20/25 Epoch 21/25 Epoch 22/25 Epoch 23/25 Epoch 24/25 Epoch 25/25 <keras.callbacks.History at 0x7fec3f28d950> Out[113... In [115... sequences matrix test = sequence.pad sequences(tok.texts to sequences(x test), maxlen=max len) In [116... sequences_matrix_test array([[0, 0, 0, ..., 734, 347, 150], Out[116... 94, ..., 94, 5821, 2796], [0, 2226, 0, ..., 560, 16, 1998], Ο, Ο, Γ 8, 531], 0, 0, ..., 681, [0, 0, ..., 2551, 35, 122], [0, Ο, 0, ..., 1446, 5556, 1748]], dtype=int32) [**NN Model Prediction and Evaluation** In [117... y pred=model.predict(sequences matrix test) In [118... $y_pred = np.where(y_pred \ge 0.5, 1, 0)$ y pred array([[1], Out[118... [1], [1], . . . , [1], [0], [1]]) In [119... from sklearn.metrics import classification report print(classification_report(y_test,y_pred)) precision recall f1-score support 0.99 0.96 0.98 0.96 0.99 0.98 5725 0.98 11766 accuracy

 0.98
 0.98
 0.98
 11766

 0.98
 0.98
 0.98
 11766

 macro avg weighted avg

[84, 2268, 315, 243, 213, 81],

[1, 1, 1, 56, 1, 1996, 4269, 97, 2920, 1569, 3770, 75], [5, 1731, 2759, 481, 3975, 627, 8420, 4737, 5, 172, 784, 6],