

News Article Classification - Shreyas Lal

File Path Confirmation

```
import os
for dirname, _, filenames in os.walk('/kaggle'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

/kaggle/lib/kaggle/gcp.py
/kaggle/input/intelligence-sig-NLP-Task/sample_submission.csv
/kaggle/input/intelligence-sig-NLP-Task/news_train.csv
/kaggle/input/intelligence-sig-NLP-Task/test.csv
/kaggle/input/dataset/news_train.csv
/kaggle/input/dataset/test.csv
```

Import Libraries

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from wordcloud import WordCloud
```

Load the dataset

```
df_train =
pd.read_csv('/kaggle/input/intelligence-sig-NLP-Task/news_train.csv')
df_test =
pd.read_csv('/kaggle/input/intelligence-sig-NLP-Task/test.csv')
```

Step 1: Exploratory Data Analysis (EDA)

Check the first few rows of the train dataset

```
print(df_train.head())
```

	ID	News_title \
0	1	Do men enjoy sex more, or women? The Mahabhara...
1	2	Why you should eat the Demonetisation laddoo
2	3	Is the world headed for a new Cold War?
3	4	Demonetisation is all about Modi, either you'r...
4	5	Why electoral bonds won't clean up political f...

	News_headline	Category
0	[Book Extract] From Anushasana Parva, translat...	Arts

1	One laddoo equals to one lakh in your Jan Dhan...	humour
2	The battle lines have become very clear with R...	politics
3	How many times should this hypocritical drama ...	business
4	Union finance minister Arun Jaitley needs to p...	politics

Check the shape of the datasets

```
print(f"Train shape: {df_train.shape}")
```

```
Train shape: (15576, 4)
```

```
print(f"Test shape: {df_test.shape}")
```

```
Test shape: (3484, 3)
```

Get info on the dataset

```
print(df_train.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15576 entries, 0 to 15575
Data columns (total 4 columns):
#   Column          Non-Null Count  Dtype
---  -
0   ID               15576 non-null  int64
1   News_title       15576 non-null  object
2   News_headline    15500 non-null  object
3   Category         15576 non-null  object
dtypes: int64(1), object(3)
memory usage: 486.9+ KB
None
```

```
print(df_train.describe())
```

```

              ID
count  15576.000000
mean    7788.500000
std     4496.548232
min       1.000000
25%    3894.750000
50%    7788.500000
75%   11682.250000
max   15576.000000
```

Check for missing values

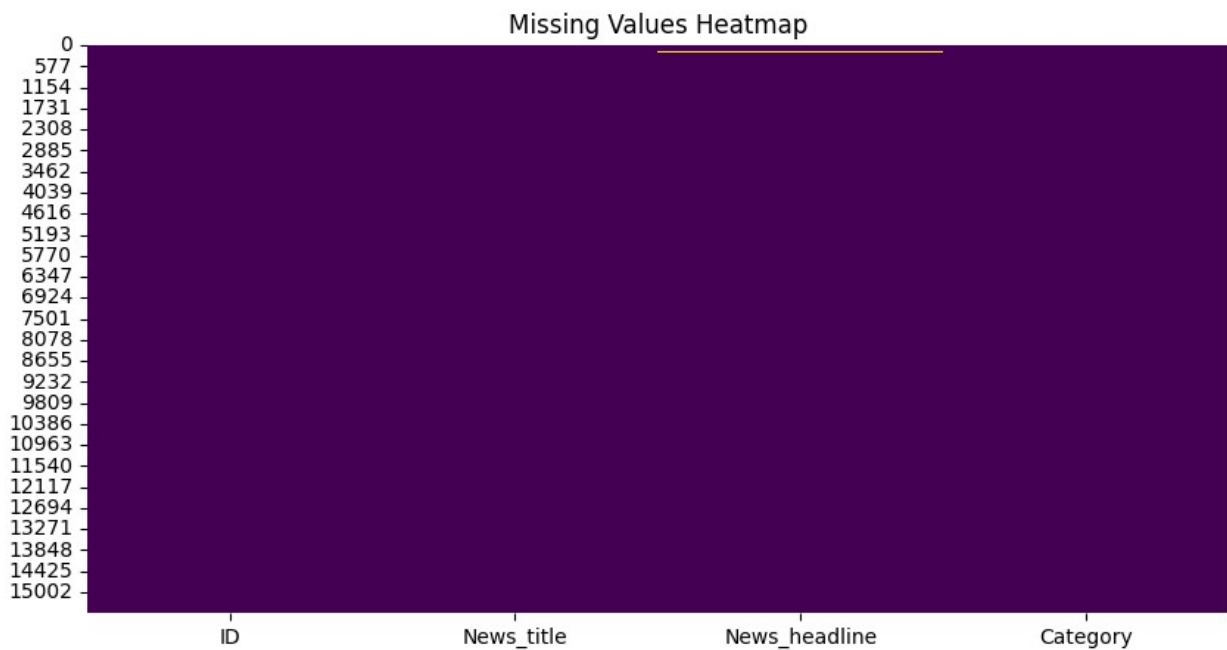
```
print(df_train.isnull().sum())
```

```
ID          0
News_title   0
```

```
News_headline    76
Category          0
dtype: int64
```

Visualize Missing Values

```
plt.figure(figsize=(10, 5))
sns.heatmap(df_train.isnull(), cbar=False, cmap='viridis')
plt.title('Missing Values Heatmap')
plt.show()
```



Check distribution of categories

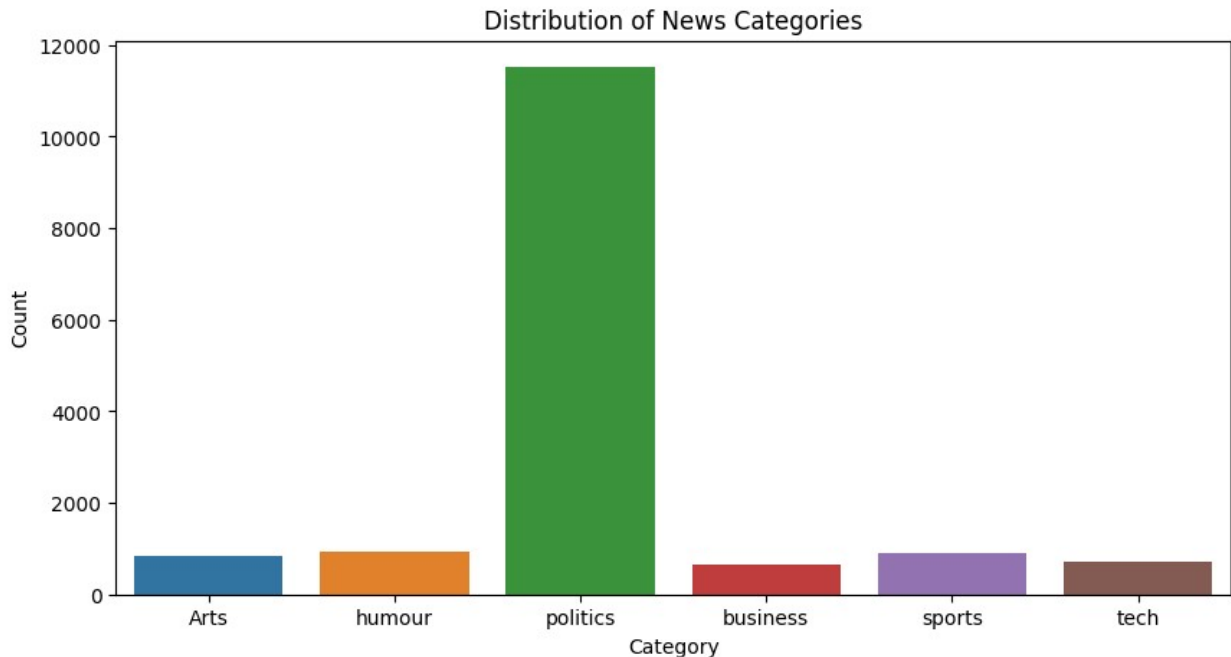
```
print(df_train['Category'].value_counts())
```

```
Category
politics    11519
humour       941
sports       898
Arts         841
tech         728
business     649
Name: count, dtype: int64
```

Distribution of Target Classes

```
plt.figure(figsize=(10, 5))
sns.countplot(data=df_train, x='Category')
```

```
plt.title('Distribution of News Categories')
plt.xlabel('Category')
plt.ylabel('Count')
plt.show()
```



Word Cloud from the News_headline

```
print(df_train.columns)

Index(['ID', 'News_title', 'News_headline', 'Category'],
      dtype='object')

import matplotlib.pyplot as plt
from wordcloud import WordCloud

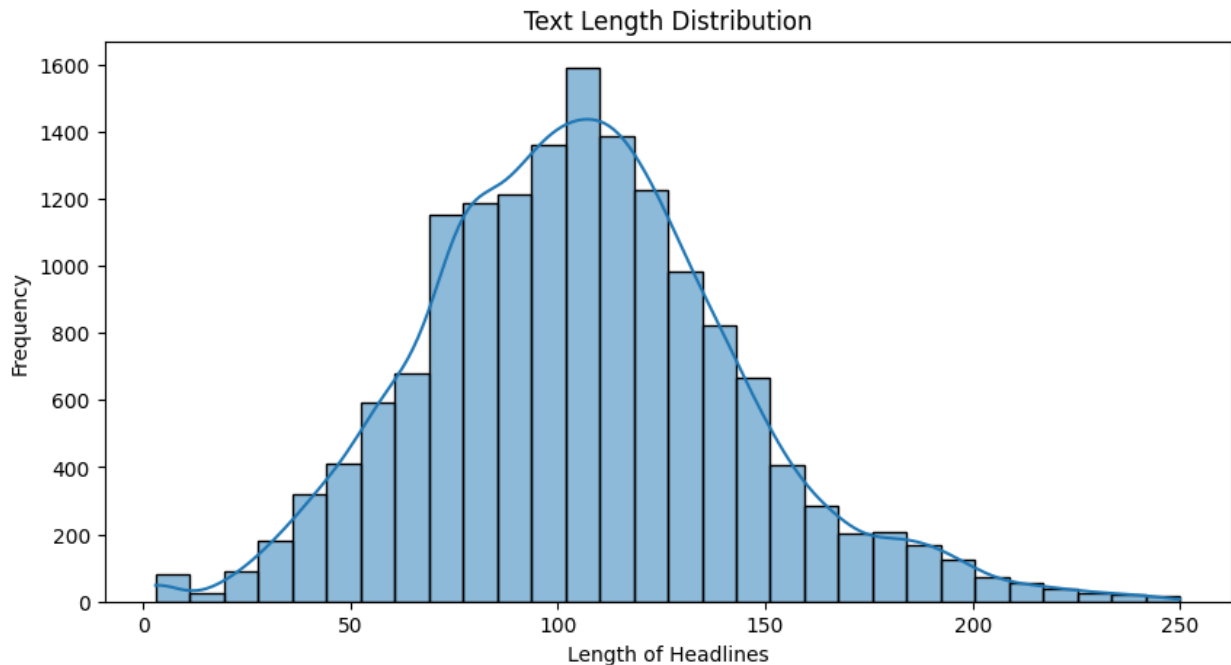
# Ensure all entries in the News_headline column are strings
df_train['News_headline'] = df_train['News_headline'].astype(str)

# Generate word cloud from the News_headline
plt.figure(figsize=(10, 5))
wordcloud = WordCloud(width=800, height=400,
                      background_color='white').generate('
'.join(df_train['News_headline']))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')
plt.title('Word Cloud of News Headlines')
plt.show()
```

[illegible]

```
df_train['text_length'] = df_train['News_headline'].apply(len)
```

```
/opt/conda/lib/python3.10/site-packages/seaborn/_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed
in a future version. Convert inf values to NaN before operating
instead.
  with pd.option_context('mode.use_inf_as_na', True):
```



Statistical Analysis

```
average_length = df_train['text_length'].mean()
std_deviation = df_train['text_length'].std()
min_length = df_train['text_length'].min()
max_length = df_train['text_length'].max()
median_length = df_train['text_length'].median()

print("Average text length:", average_length)
print("Standard deviation of text length:", std_deviation)
print("Minimum text length:", min_length)
print("Maximum text length:", max_length)
print("Median text length:", median_length)
```

```
Average text length: 105.5719696969697
Standard deviation of text length: 37.814197544322
Minimum text length: 3
Maximum text length: 250
Median text length: 104.0
```

Step 2: Data Preprocessing

```
import nltk
from nltk.corpus import stopwords
import string
from sklearn.model_selection import train_test_split
```

```
import string
from sklearn.preprocessing import LabelEncoder
```

Define a set of stop words

```
stop_words = set([
    "i", "me", "my", "myself", "we", "our", "ours", "ourselves",
    "you",
    "your", "yours", "yourself", "yourselves", "he", "him", "his",
    "himself",
    "she", "her", "hers", "herself", "it", "its", "itself", "they",
    "them",
    "their", "theirs", "themselves", "what", "which", "who", "whom",
    "this",
    "that", "these", "those", "am", "is", "are", "was", "were", "be",
    "been",
    "being", "have", "has", "had", "having", "do", "does", "did",
    "doing",
    "a", "an", "the", "and", "but", "if", "or", "because", "as",
    "until",
    "while", "of", "at", "by", "for", "with", "about", "against",
    "between",
    "into", "through", "during", "before", "after", "above", "below",
    "to",
    "from", "up", "down", "in", "out", "on", "off", "over", "under",
    "again",
    "further", "then", "once", "here", "there", "when", "where",
    "why",
    "how", "all", "any", "both", "each", "few", "more", "most",
    "other",
    "some", "such", "no", "nor", "not", "only", "own", "same", "so",
    "than",
    "too", "very", "s", "t", "can", "will", "just", "don", "should",
    "now"
])
```

Convert to lowercase, remove punctuation and remove stopwords

```
def preprocess_text(text):
    if isinstance(text, str): # Ensure input is a string
        # Convert to lowercase
        text = text.lower()
        # Remove punctuation
        text = text.translate(str.maketrans('', '',
string.punctuation))
        # Remove stopwords
        text = ' '.join([word for word in text.split() if word not in
stop_words])
```

```

    return text
    return '' # Return empty string for non-string input

```

Apply preprocessing to the News_headline column

```

df_train['cleaned_headline'] =
df_train['News_headline'].apply(preprocess_text)

```

Convert categorical labels into numerical values

```

label_encoder = LabelEncoder()
df_train['Category'] =
label_encoder.fit_transform(df_train['Category'])

```

Check the cleaned data and label encoding

```

print(df_train[['News_headline', 'cleaned_headline',
'Category']].head())

```

	News_headline \	
0	[Book Extract] From Anushasana Parva, translat...	
1	One laddoo equals to one lakh in your Jan Dhan...	
2	The battle lines have become very clear with R...	
3	How many times should this hypocritical drama ...	
4	Union finance minister Arun Jaitley needs to p...	

	cleaned_headline	Category
0	book extract anushasana parva translated arshi...	0
1	one laddoo equals one lakh jan dhan account ne...	2
2	battle lines become clear russia iran supporti...	3
3	many times hypocritical drama played bother learn	1
4	union finance minister arun jaitley needs pay ...	3

Step 3: Feature Extraction and Model Training

Vectorization

```

from sklearn.feature_extraction.text import TfidfVectorizer

```

TF-IDF Vectorizer

```

vectorizer = TfidfVectorizer(max_features=5000)
X_train_tfidf = vectorizer.fit_transform(df_train['cleaned_headline'])
# Use cleaned_headline

```

Split data into features and target


```
X = X_train_tfidf
y = df_train['Category']
```

Step 4: Model Training

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, f1_score
```

Train on the entire training set

```
model = LogisticRegression(max_iter=200)
model.fit(X, y)
```

```
LogisticRegression(max_iter=200)
```

Make predictions on the training set for evaluation

```
y_pred = model.predict(X)
```

Evaluate the model

```
print(f"Weighted F1 Score: {f1_score(y, y_pred, average='weighted')}")
print(classification_report(y, y_pred))
```

Weighted F1 Score: 0.7974514384981835

	precision	recall	f1-score	support
0	0.87	0.36	0.51	841
1	0.86	0.20	0.33	649
2	0.90	0.24	0.38	941
3	0.82	0.99	0.90	11519
4	0.92	0.55	0.69	898
5	0.96	0.45	0.61	728
accuracy			0.83	15576
macro avg	0.89	0.47	0.57	15576
weighted avg	0.84	0.83	0.80	15576

Step 5: Test Set Predictions

```
print(df_test.columns)
```

```
Index(['ID', 'News_title', 'News_headline'], dtype='object')
```

Apply preprocessing to test data

```
df_test['cleaned_headline'] =  
df_test['News_headline'].apply(preprocess_text)
```

Transform the test data using the same vectorizer

```
X_test_tfidf = vectorizer.transform(df_test['cleaned_headline'])
```

Make predictions on the test set

```
test_predictions = model.predict(X_test_tfidf)
```

DataFrame for submission

```
submission_df = pd.DataFrame({  
    'ID': df_test['ID'], # Include IDs from the test set  
    'Category': test_predictions # Predictions for the categories  
})
```

First few rows of the submission DataFrame

As per the following :

- 0: Arts
- 1: Business
- 2: Humor
- 3: Politics
- 4: Sports
- 5: Tech

```
print(submission_df.head())
```

	ID	Category
0	1	3
1	2	3
2	3	3
3	4	3
4	5	3

```
pd.set_option('display.max_rows', None) # Show all rows  
pd.set_option('display.max_columns', None) # Show all columns  
print(submission_df)
```

	ID	Category
0	1	3
1	2	3
2	3	3
3	4	3

4	5	3
5	6	2
6	7	4
7	8	0
8	9	3
9	10	3
10	11	3
11	12	1
12	13	2
13	14	3
14	15	3
15	16	5
16	17	5
17	18	3
18	19	3
19	20	3
20	21	3
21	22	3
22	23	3
23	24	3
24	25	3
25	26	3
26	27	3
27	28	3
28	29	3
29	30	3
30	31	3
31	32	3
32	33	3
33	34	0
34	35	3
35	36	3
36	37	3
37	38	3
38	39	3
39	40	3
40	41	3
41	42	3
42	43	3
43	44	3
44	45	3
45	46	3
46	47	0
47	48	3
48	49	3
49	50	3
50	51	3
51	52	3
52	53	3

53	54	3
54	55	3
55	56	3
56	57	3
57	58	3
58	59	3
59	60	3
60	61	3
61	62	3
62	63	3
63	64	3
64	65	3
65	66	3
66	67	3
67	68	3
68	69	3
69	70	3
70	71	3
71	72	3
72	73	3
73	74	3
74	75	3
75	76	1
76	77	3
77	78	3
78	79	3
79	80	3
80	81	3
81	82	0
82	83	3
83	84	0
84	85	3
85	86	3
86	87	3
87	88	3
88	89	3
89	90	3
90	91	3
91	92	3
92	93	3
93	94	3
94	95	3
95	96	3
96	97	3
97	98	3
98	99	3
99	100	3
100	101	3
101	102	3

102	103	3
103	104	3
104	105	3
105	106	3
106	107	3
107	108	3
108	109	4
109	110	3
110	111	3
111	112	3
112	113	3
113	114	3
114	115	3
115	116	3
116	117	3
117	118	3
118	119	3
119	120	3
120	121	3
121	122	3
122	123	3
123	124	3
124	125	3
125	126	3
126	127	3
127	128	3
128	129	3
129	130	3
130	131	3
131	132	3
132	133	3
133	134	3
134	135	3
135	136	3
136	137	3
137	138	3
138	139	3
139	140	3
140	141	3
141	142	0
142	143	3
143	144	3
144	145	3
145	146	3
146	147	3
147	148	3
148	149	3
149	150	3
150	151	3

151	152	5
152	153	3
153	154	3
154	155	3
155	156	3
156	157	3
157	158	3
158	159	3
159	160	3
160	161	3
161	162	3
162	163	3
163	164	3
164	165	3
165	166	3
166	167	3
167	168	3
168	169	3
169	170	3
170	171	3
171	172	3
172	173	3
173	174	3
174	175	3
175	176	3
176	177	3
177	178	3
178	179	3
179	180	3
180	181	3
181	182	3
182	183	3
183	184	3
184	185	3
185	186	3
186	187	3
187	188	3
188	189	3
189	190	3
190	191	4
191	192	3
192	193	3
193	194	3
194	195	3
195	196	3
196	197	3
197	198	3
198	199	3
199	200	3

200	201	3
201	202	3
202	203	3
203	204	3
204	205	3
205	206	3
206	207	3
207	208	3
208	209	3
209	210	4
210	211	3
211	212	4
212	213	3
213	214	3
214	215	3
215	216	3
216	217	3
217	218	3
218	219	3
219	220	3
220	221	3
221	222	3
222	223	3
223	224	3
224	225	3
225	226	3
226	227	3
227	228	3
228	229	3
229	230	3
230	231	3
231	232	3
232	233	3
233	234	3
234	235	3
235	236	3
236	237	3
237	238	3
238	239	3
239	240	3
240	241	3
241	242	3
242	243	3
243	244	3
244	245	3
245	246	3
246	247	3
247	248	0
248	249	3

249	250	5
250	251	3
251	252	3
252	253	3
253	254	3
254	255	3
255	256	3
256	257	3
257	258	3
258	259	3
259	260	3
260	261	3
261	262	3
262	263	3
263	264	3
264	265	3
265	266	3
266	267	4
267	268	3
268	269	3
269	270	3
270	271	3
271	272	3
272	273	3
273	274	3
274	275	3
275	276	3
276	277	5
277	278	3
278	279	3
279	280	3
280	281	3
281	282	4
282	283	3
283	284	3
284	285	3
285	286	3
286	287	3
287	288	3
288	289	3
289	290	3
290	291	5
291	292	3
292	293	3
293	294	3
294	295	3
295	296	3
296	297	2
297	298	3

298	299	3
299	300	3
300	301	3
301	302	3
302	303	3
303	304	3
304	305	4
305	306	5
306	307	3
307	308	3
308	309	3
309	310	3
310	311	3
311	312	5
312	313	3
313	314	3
314	315	3
315	316	3
316	317	3
317	318	3
318	319	3
319	320	3
320	321	3
321	322	0
322	323	3
323	324	3
324	325	3
325	326	3
326	327	3
327	328	3
328	329	3
329	330	3
330	331	3
331	332	3
332	333	3
333	334	3
334	335	3
335	336	3
336	337	3
337	338	4
338	339	3
339	340	3
340	341	3
341	342	3
342	343	3
343	344	3
344	345	3
345	346	3
346	347	3

347	348	3
348	349	3
349	350	3
350	351	3
351	352	3
352	353	4
353	354	4
354	355	3
355	356	5
356	357	3
357	358	3
358	359	3
359	360	3
360	361	3
361	362	3
362	363	3
363	364	3
364	365	3
365	366	3
366	367	3
367	368	3
368	369	3
369	370	3
370	371	3
371	372	3
372	373	3
373	374	4
374	375	3
375	376	3
376	377	3
377	378	3
378	379	3
379	380	3
380	381	3
381	382	3
382	383	3
383	384	3
384	385	4
385	386	3
386	387	3
387	388	3
388	389	3
389	390	3
390	391	3
391	392	3
392	393	3
393	394	3
394	395	3
395	396	3

396	397	3
397	398	3
398	399	3
399	400	3
400	401	3
401	402	3
402	403	3
403	404	3
404	405	3
405	406	3
406	407	3
407	408	3
408	409	3
409	410	3
410	411	3
411	412	3
412	413	2
413	414	3
414	415	3
415	416	3
416	417	3
417	418	3
418	419	3
419	420	3
420	421	3
421	422	3
422	423	3
423	424	3
424	425	3
425	426	3
426	427	3
427	428	1
428	429	3
429	430	3
430	431	3
431	432	3
432	433	3
433	434	3
434	435	3
435	436	3
436	437	3
437	438	3
438	439	3
439	440	3
440	441	0
441	442	3
442	443	3
443	444	3
444	445	3

445	446	3
446	447	4
447	448	3
448	449	3
449	450	3
450	451	3
451	452	3
452	453	3
453	454	3
454	455	3
455	456	3
456	457	3
457	458	3
458	459	3
459	460	3
460	461	3
461	462	3
462	463	3
463	464	3
464	465	3
465	466	3
466	467	3
467	468	3
468	469	4
469	470	3
470	471	3
471	472	3
472	473	3
473	474	3
474	475	3
475	476	3
476	477	3
477	478	3
478	479	3
479	480	3
480	481	3
481	482	2
482	483	3
483	484	3
484	485	3
485	486	3
486	487	3
487	488	3
488	489	3
489	490	3
490	491	3
491	492	3
492	493	3
493	494	3
494	495	2

495	496	3
496	497	3
497	498	3
498	499	3
499	500	3
500	501	3
501	502	3
502	503	3
503	504	3
504	505	3
505	506	3
506	507	3
507	508	3
508	509	3
509	510	3
510	511	3
511	512	3
512	513	3
513	514	3
514	515	3
515	516	3
516	517	3
517	518	3
518	519	3
519	520	3
520	521	3
521	522	3
522	523	3
523	524	3
524	525	3
525	526	3
526	527	3
527	528	3
528	529	3
529	530	3
530	531	3
531	532	3
532	533	3
533	534	3
534	535	3
535	536	3
536	537	3
537	538	3
538	539	3
539	540	3
540	541	3
541	542	3
542	543	3
543	544	5

544	545	3
545	546	3
546	547	4
547	548	3
548	549	3
549	550	3
550	551	3
551	552	5
552	553	3
553	554	3
554	555	3
555	556	4
556	557	3
557	558	3
558	559	3
559	560	3
560	561	3
561	562	3
562	563	3
563	564	3
564	565	3
565	566	4
566	567	5
567	568	3
568	569	3
569	570	3
570	571	3
571	572	3
572	573	3
573	574	0
574	575	0
575	576	3
576	577	3
577	578	3
578	579	3
579	580	3
580	581	3
581	582	3
582	583	5
583	584	3
584	585	3
585	586	3
586	587	3
587	588	3
588	589	3
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3408	3409	3
3409	3410	5
3410	3411	5
3411	3412	3
3412	3413	3
3413	3414	3
3414	3415	3
3415	3416	3
3416	3417	3
3417	3418	3
3418	3419	3
3419	3420	3
3420	3421	5
3421	3422	3
3422	3423	3
3423	3424	3
3424	3425	3
3425	3426	3
3426	3427	3
3427	3428	3
3428	3429	3
3429	3430	3
3430	3431	3
3431	3432	3
3432	3433	3
3433	3434	3
3434	3435	3
3435	3436	3
3436	3437	3
3437	3438	3
3438	3439	3
3439	3440	3

3440	3441	3
3441	3442	3
3442	3443	3
3443	3444	3
3444	3445	3
3445	3446	3
3446	3447	3
3447	3448	3
3448	3449	3
3449	3450	3
3450	3451	3
3451	3452	3
3452	3453	3
3453	3454	3
3454	3455	3
3455	3456	3
3456	3457	3
3457	3458	3
3458	3459	3
3459	3460	3
3460	3461	3
3461	3462	3
3462	3463	3
3463	3464	4
3464	3465	3
3465	3466	3
3466	3467	3
3467	3468	3
3468	3469	3
3469	3470	3
3470	3471	3
3471	3472	3
3472	3473	3
3473	3474	3
3474	3475	3
3475	3476	3
3476	3477	3
3477	3478	3
3478	3479	3
3479	3480	3
3480	3481	3
3481	3482	3
3482	3483	3
3483	3484	3

Save the submission DataFrame to a CSV file

```
submission_df.to_csv('my_submission.csv', index=False)
```

Reading back the submission file to verify its contents

```
submission_check = pd.read_csv('my_submission.csv')
```

	ID	Category
0	1	3
1	2	3
2	3	3
3	4	3
4	5	3

Visualizing the Outcome

Count the occurrences of each predicted category

```
predicted_category_counts = submission_df['Category'].value_counts()  
predicted_category_counts
```

```
Category  
3      3232  
4        81  
5        69  
0        53  
1        30  
2        19  
Name: count, dtype: int64
```

Bar plot

```
plt.figure(figsize=(10, 6))  
predicted_category_counts.plot(kind='bar', color='skyblue')  
  
plt.title('Counts of Predicted Categories in Submission', fontsize=16)  
plt.xlabel('Categories', fontsize=14)  
plt.ylabel('Counts', fontsize=14)  
plt.xticks(rotation=0) # Rotates the x-axis labels for better  
readability  
  
(array([0, 1, 2, 3, 4, 5]),  
 [Text(0, 0, '3'),  
   Text(1, 0, '4'),  
   Text(2, 0, '5'),  
   Text(3, 0, '0'),  
   Text(4, 0, '1'),  
   Text(5, 0, '2')])
```

