

## Analyze the latent topics of Twitter Reviews About the ChatGPT

### Text Data

The dataset is come from Kaggle: Large Language Models: the tweets (<https://www.kaggle.com/datasets/konradb/chatgpt-the-tweets>) . Each tweet in the dataset includes information such as the tweet ID, timestamp, user ID, user name, tweet text, and other metadata. This dataset contains more than 410, 000 tweets that can reflect the real and effective thoughts of people over the past decade. This dataset are updated every month until now, contributed by three authors: Marília Prata, Konrad Banachewicz, and Praveen.

### Data Pre-processing Steps

All of the following examples can be seen at appendix of this article, or in another file “Tweet about ChatGPT.ipynb”.

In[9] and out[9], in Column [‘user\_created’], The tweet reviews created by 1949/01 and 2023/04 should be removed, because the reviews created by 1949/01 may mislead by the system date error, and the 2023/04 is not a completed data because author updated the dataset on April, 15. And I also use the function dropna() in In[10], removing all reviews that have null in column. After all this done, in out[12] and out [13], there is a new chart, named twitter\_df, containing 319293 effective reviews as my prime material.

In[23], I delete all the “@username” in the twitter reviews because of unnecessary.

In[35], I remove non-alphabetic characters, lowercase each character, split words using split() to tokenize the reviews, remove the words whose length is less than 3 because of high chance of preposition. After these steps, Assemble words into string.

In[36], I import the stop words list from NLTK to remove the stop words in reviews.

In[47] and In[48], I generate the dictionary and corpus from the dataset reviews, which is the key step to get ready for the Latent Dirichlet Analysis (LDA).

### Method

My methods to vectorize the words are two functions: Dictionary() and doc2bow(), as you can see in In[47] and In[48]. Using Dictionary() to make a catalogue, giving each word an unique index. ( *Large Scale Machine Learning with Python*). Function doc2bow() takes a document as input and returns a sparse vector representation of the document. This function counts the occurrences of each token in the document and return an answer whose format like: (token, occurrence).

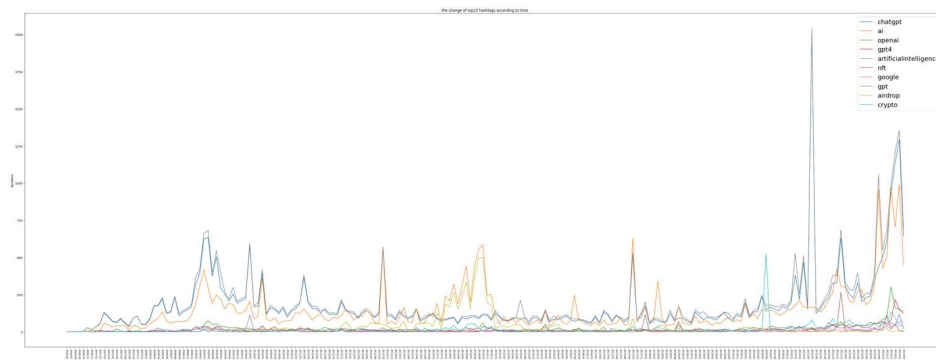
The machine learning that I choose is: Latent Dirichlet Allocation (LDA), which is a machine learning algorithm used for topic modeling, which helps discover hidden topics in a

collection of documents. It assumes that each document is a mixture of different topics, and each topic is characterized by a distribution of words. LDA iterates through the documents multiple times, adjusting the topic assignments based on the probability of a word belonging to a particular topic. During each iteration, it updates the topic assignments for each word. After that, the algorithm identifies the most likely topics for each document and the distribution of words within each topic. (*Natural Language Processing and Computational Linguistics*)

More feature I was used is NLTK SentimentIntensityAnalyzer.polarity\_scores() to detect the sentiments under the reviews over a decade. I believe the changing of people's attitudes towards ChatGPT can partly reflect the market investment confidence. As you can see in Out[29] and Out[33], I create a new table to show the attitude alongside each review, and make the chart into Line Graphs counted by time.

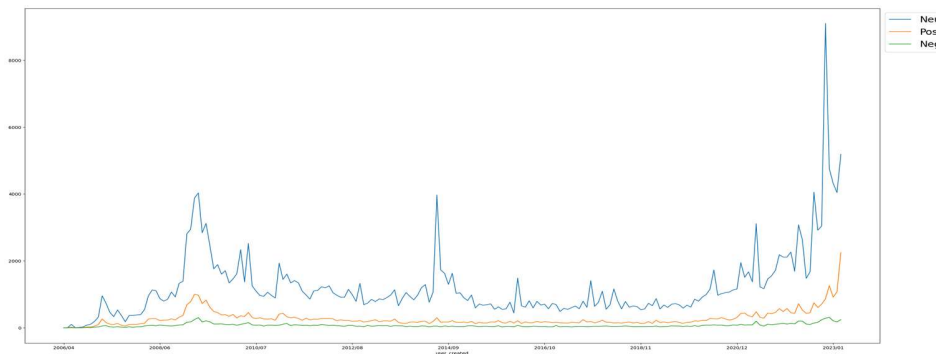
### Evaluation and Findings

In[21], I study the hashtag from the dataset to see the changes over a decade. In 2021/06, after releasing of GPT-J, the hotness of Public discussion reaches a new level.



Picture 1. Hashtag

In[33], I use SentimentIntensityAnalyzer() to see the folk's attitudes towards technology about ChatGPT, as we can see in picture 2, along with the dispute of the new technology, folks don't feel panic, neural attitude is the main stream over reviews.



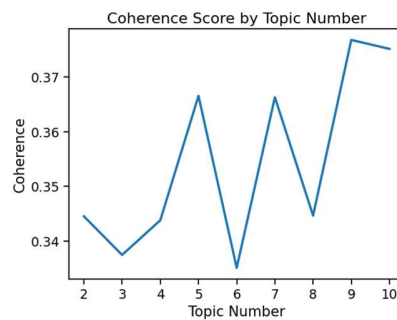
Picture 2. Sentimental Analysis

In[43], I use LDA method to group the topics for the reviews.



Picture 3. LDA Topics

In[51], I use gensim coherence score to evaluate each topic of the reviews. Higher the coherence score the topic earns, More representative the topic is totally. Due to Picture 4, I select the topic 9 as the most representative topic, which is (7,'0.042\*"midjourney"' + 0.037\*"stablediffusion"' + 0.034\*"thread"' + 0.024\*"style"' + 0.023\*"aiart"' + 0.020\*"song"' + 0.017\*"make"' + 0.015\*"prompt"' + 0.013\*"money"' + 0.012\*"campaign"''). Besides this, the topic ten is also reach a high coherence score that almost reach the peak of topic9, which should also count into discussion. Topic ten is (8, '0.028\*"crypto"' + 0.026\*"python"' + 0.025\*"bitcoin"' + 0.024\*"machinelearning"' + 0.018\*"giveaway"' + 0.017\*"blockchain"' + 0.016\*"coding"' + 0.014\*"smart"' + 0.014\*"metaverse"' + 0.014\*"openaichat"'').



Picture 4. Coherence Score of gensim LDA

### Conclusion

There are many words, 'crypto', 'bitcoin', 'midjourney' and 'blockchain', have high probability in the topics, which reveals us a potential market demanding: ChatGPT technology merges with Blockchain technology into a new AI Crypto. This kind of Crypto may give the right to each people to prompt their own crypto (PayBito Becomes the World's First Crypto Exchange to Integrate ChatGPT in Its Trading Platform). The new crypto "worldcoin", appeared in the 2023, May, 8, may prove this trend in the future.

## References

Bastiaan Sjardin, Luca Massaron, Alberto Boschetti. *Large Scale Machine Learning with Python*. Chapter 7, (379-392).

Bhargav Srinivasa-Desikan. *Natural Language Processing and Computational Linguistics. A practical Guide to Text Analysis with Python, Gensim, spaCy and Keras*. Chapter 8 Topics, (128-143), (154-165).

Coleen Facete, Hashcash Digest. *PayBito Becomes the World's First Crypto Exchange to Integrate ChatGPT in Its Trading Platform*. PR Newswire, 02/2023

Sopov, Vladislav. *U.Today - CryptoComes: Sam Altman's WorldCoin Unveils Tech to Prove You Are Human*. TodayNewstex. Apr 1, 2023.

# Machine Learning sklearn - Sentiment Analysis of Tweet Comments Related to ChatGPT

## 1. Preprocess Text Dataset

In [1]:

```
import nltk
import gensim
import csv
import nltk
import nltk.tokenize
nltk.download('vader_lexicon')
nltk.download('stopwords')
import pandas as pd
from collections import Counter
import re
import matplotlib.pyplot as plt
from nltk.sentiment.vader import SentimentIntensityAnalyzer
```

[nltk\_data] Downloading package vader\_lexicon to  
[nltk\_data] /home/nizai8a/nltk\_data...  
[nltk\_data] Package vader\_lexicon is already up-to-date!  
[nltk\_data] Downloading package stopwords to  
[nltk\_data] /home/nizai8a/nltk\_data...  
[nltk\_data] Package stopwords is already up-to-date!

In [2]:

```
# Import data from CSV
twitter_df = pd.read_csv('/home/nizai8a/ /tweetsChatGPT.csv',engine='python')
```

In [3]:

```
# Inspect the shape of data
print('The shape of the Twitter ',twitter_df.shape)
```

The shape of the Twitter (416364, 12)

In [4]:

```
# Inspect the details of the Twitter
print('Non-Null number of Tweet Reviews ')
twitter_df.info()
```

Non-Null number of Tweet Reviews  
<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 416364 entries, 0 to 416363  
Data columns (total 12 columns):  
# Column Non-Null Count Dtype  
---  
0 user\_name 416350 non-null object  
1 text 416322 non-null object  
2 user\_location 299674 non-null object  
3 user\_description 389617 non-null object  
4 user\_created 416303 non-null object  
5 user\_followers 416303 non-null object  
6 user\_friends 416303 non-null object  
7 user\_favourites 416303 non-null object  
8 user\_verified 416295 non-null object  
9 date 416295 non-null object  
10 hashtags 321060 non-null object  
11 source 416256 non-null object  
dtypes: object(12)  
memory usage: 38.1+ MB

In [5]:

```
#Check the head of the original CSV dataset
twitter_df.head(10)
```

twitter\_df.head(10)

Out[5]:

|   | user_name           | text  | user_location   | user_description                                  | user_created              | user_followers | user_friends | user_favourites | user_verified |
|---|---------------------|---|-----------------|---|---------------------------|----------------|--------------|-----------------|---------------|
| 0 | Black Women in A.I. | We asked ChatGPT... Would you attend a church ... | Global          | Amplifying the voices of Black Women In Artifi... | 2017-12-24 07:07:07+00:00 | 6073.0         | 999.0        | 14943           | False         |
| 1 | Hamsa Jama          | "The Chronicles of David: Navigating an Uncert... | Localhost       | London Software Engineer juggling work, fami...   | 2017-07-07 21:03:45+00:00 | 13.0           | 293.0        | 30              | False         |
| 2 | Titus               | Gain of Function: the Transhumanist Project" #... | North Pole      | Art is a mysterious metaphor about the present... | 2011-04-25 16:50:21+00:00 | 709.0          | 2153.0       | 9475            | False         |
| 3 | Dan Bruno AI        | We Need a Consumer-First AI Approach, Consumer... | Manchester, NH  | The latest in #ChatGPT, #BARD, #Bing, and othe... | 2021-05-19 01:19:32+00:00 | 461.0          | 156.0        | 5193            | False         |
| 4 | Hamza Aideed        | I asked #ChatGPT the difference between #Somal... | somaliland      | Somalilander, \nmining expert,\nfinancial cons... | 2020-12-13 15:00:19+00:00 | 340.0          | 164.0        | 735             | False         |
| 5 | JC Gaillard         | Rethinking Safer #AI &gt;&gt; Can There Really... | London, England | Founder @CorixPartners @Transform_Sec   Fellow... | 2015-06-25 08:13:57+00:00 | 8970.0         | 8359.0       | 153347          | False         |
| 6 | seamlessblend       | ChatGPT &amp; fraud: https://t.co/yDQBGRQ8RM #... | New York, NY    | NaN   | 2010-02-26 03:35:13+00:00 | 1980.0         | 1.0          | 1302            | False         |
| 7 | seamlessblend       | ChatGPT at work: https://t.co/yDQBGRQ8RM #chat... | New York, NY    | NaN   | 2010-02-26 03:35:13+00:00 | 1980.0         | 1.0          | 1302            | False         |
| 8 | sopbox              | Revolutionize your workflow with #SOPbox - the... | NaN             | SOPbox by Parsimony. Let's get it done!           | 2021-03-27 20:39:44+00:00 | 3.0            | 1.0          | 1               | False         |
| 9 | Parsimony ERP       | Revolutionize your workflow with #SOPbox - the... | Bellevue, WA    | NaN   | 2017-11-07 18:16:39+00:00 | 17.0           | 36.0         | 10              | False         |

In [6]:

```
#check the tail of the CSV
twitter_df.tail(10)
```

Out[6]:

|        | user_name   | text  | user_location                | user_description                                  | user_created              | user_followers | user_friends | user_favou |
|--------|---|---|------------------------------|---|---------------------------|----------------|--------------|------------|
| 416354 | HailSquid   | true\nhttps://t.co/ng71DMdgaS\n#ChatGPT ...       | NaN                          | Punk-inspired developer and nerd stickers by @... | 2022-10-21 20:43:22+00:00 | 8.0            | 23.0         |            |
| 416355 | Rlan Tomczik                                      | At least #ChatGPT can admit when it makes mist... | Minneapolis, MN              | Functional Programming, Music Theory, Data Eng... | 2011-12-10 18:31:35+00:00 | 279.0          | 2179.0       | 6          |
| 416356 | Tushar Tajane                                     | @jebraat Keep exploring and tweeting screensho... | NaN                          | Artisan & Technocrat. eCommerce, Performanc...    | 2009-02-23 13:03:31+00:00 | 1162.0         | 467.0        | 3          |
| 416357 | Nick Perkins • Hebrews 13:8 • Development Manager | Ok now @OpenAI is just showing off. lol #ChatG... | Raleigh, North Carolina, USA | A proud Dad of 3, husband, Dev manager, iOS en... | 2013-12-04 17:12:00+00:00 | 164.0          | 326.0        | 6          |
| 416358 | Nenu  | ChatGPT is the biggest, smartest brain in th...   | NaN                          | Your brain is not meant for processing million... | 2022-08-30 14:33:29+00:00 | 6.0            | 87.0         |            |
| 416359 | (I)(AM)(T)(MOYO)                                  | Levels ,so happy for the chatGPT team for co...   | Satoshi Island               | Blockchain Enthusiast    Philanthropist    a S... | 2013-12-07 16:38:30+00:00 | 3419.0         | 4994.0       | 16         |
| 416360 | Green   | Iterating back-and-forth with tools like #Chat... |                              | NaN   | 2022-12-03 12:49:13+00:00 | 3.0            | 33.0         |            |

Colin is a Developer, ChatGPT, likes to use that it

Mathematician

2012-07-08

| 416361 | user_name           | text  | user_location      | user_description                                  | user_created              | user_followers | user_friends | user_favours |
|--------|---------------------|---|--------------------|---|---------------------------|----------------|--------------|--------------|
|        | Gabriel Furstenthal | Russel vs ChatGPT. It's also funny that it tak... | Non                | and Developer @Amazon. Previousl...               | 2016-07-09 21:03:52+00:00 | 20.9           | 24.9         |              |
| 416362 | Devang              | Was just wondering is there any difference bet... | United States      | passionate by nature, software developer by pr... | 2015-05-19 03:17:06+00:00 | 15.0           | 86.0         |              |
| 416363 | Norman Meuschke     | #ChatGPT and similar #LLM pose a challenge to ... | Wuppertal, Germany | Postdoc in @GippLab at @uniGoettingen \nPh.D. ... | 2011-02-22 18:03:52+00:00 | 149.0          | 262.0        |              |

In [7]:

```
# Convert the string of time into the normalized UTC datetime
twitter_df['user_created'] = pd.to_datetime(twitter_df['user_created'], format='%Y-%m-%d %H:%M:%S', errors='coerce', utc=True)
```

## 1.1 Accounting the number of tweets per year and month under effectiveness

In [8]:

```
## Change the form of datetime to %Y/%m, eg: transfer "2017-12-01" to "2017/12"
twitter_df['user_created'] = twitter_df['user_created'].apply(lambda x:x.strftime("%Y/%m"))
```

In [9]:

```
## account the twitter number of every year and month
twitter_df.groupby(twitter_df['user_created']).count()[['text']]
```

Out[9]:

| text         |       |
|--------------|-------|
| user_created |       |
| 1949/01      | 1     |
| 2006/04      | 1     |
| 2006/05      | 8     |
| 2006/07      | 150   |
| 2006/08      | 11    |
| ...          | ...   |
| 2022/12      | 9296  |
| 2023/01      | 8037  |
| 2023/02      | 7849  |
| 2023/03      | 10189 |
| 2023/04      | 2701  |

205 rows × 1 columns

In [10]:

```
## When running the code for the first time, two abnormal data of 1949/01 and 2023/04 appeared, and the rows of 1949/01 and 2023/04 need to be removed
## Remove the hashtags when it is Null
## Remove bad data and Null rows using dataframe.loc
twitter_df = twitter_df.drop(twitter_df[twitter_df["user_created"]=="1949/01"].index, axis=0)
twitter_df = twitter_df.drop(twitter_df[twitter_df["user_created"]=="2023/04"].index, axis=0)
twitter_df = twitter_df.dropna(axis=0, how="any", subset=['user_created'])
twitter_df = twitter_df.dropna(axis=0, how="any", subset=['text'] )
twitter_df = twitter_df.dropna(axis=0, how="any", subset=['hashtags'])
```

In [11]:

```
# Rearrange indexes of valid rows
twitter_df = twitter_df.reset_index(drop=True)
```

In [12]:

```
# Approve removing is effective
twitter_df.shape
```

Out[12]:

(319293, 12)

In [13]:

```
twitter_df.groupby(twitter_df['user_created']).count()[["text"]]
```

Out[13]:

|              | text  |
|--------------|-------|
| user_created |       |
| 2006/04      | 1     |
| 2006/05      | 5     |
| 2006/07      | 126   |
| 2006/08      | 7     |
| 2006/09      | 16    |
| ...          | ...   |
| 2022/11      | 10252 |
| 2022/12      | 6329  |
| 2023/01      | 5442  |
| 2023/02      | 5301  |
| 2023/03      | 7679  |

203 rows × 1 columns

In [14]:

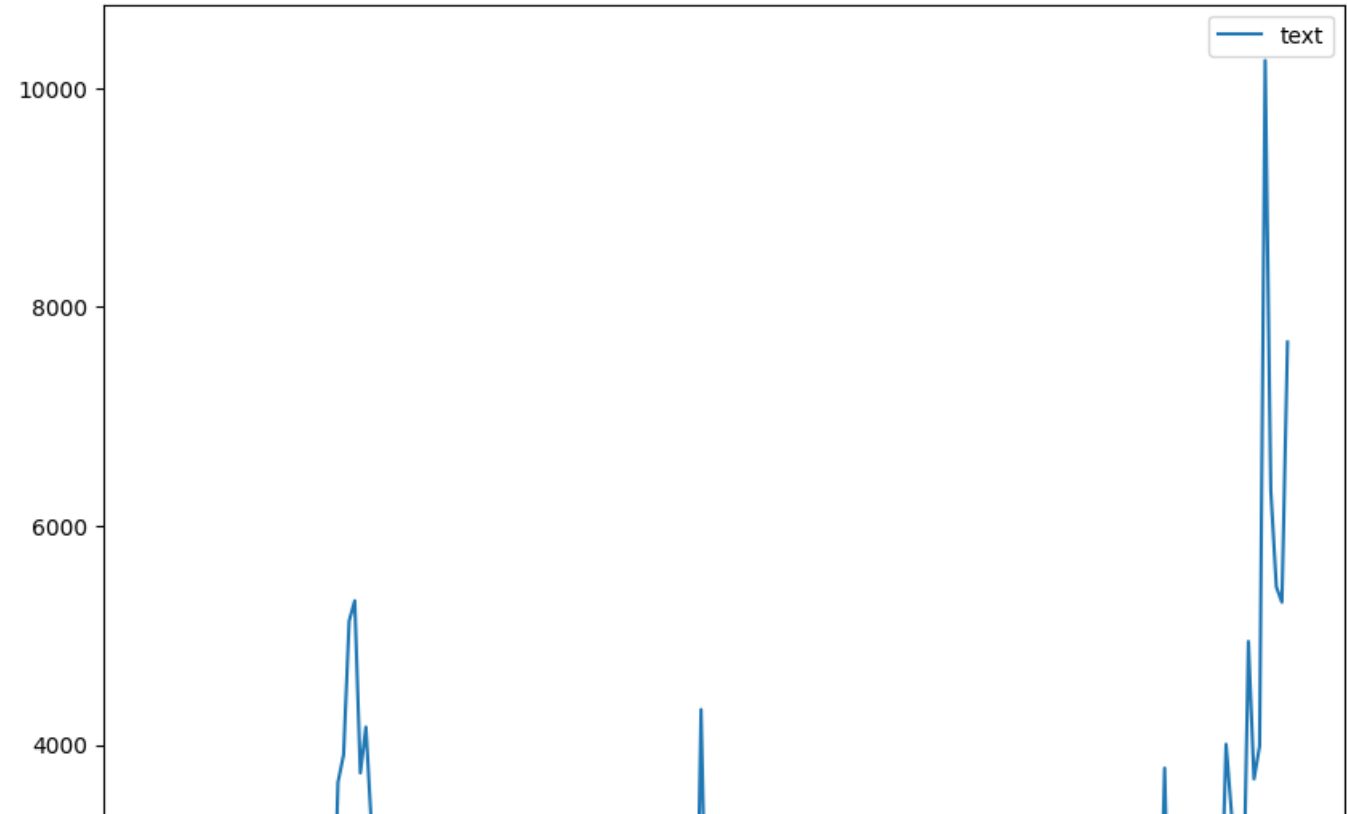
```
# Save Number of Posts - Time Statistical chart into a new variable named twitter_chart1
twitter_chart1 = twitter_df.groupby(twitter_df['user_created']).count()[["text"]]
```

In [15]:

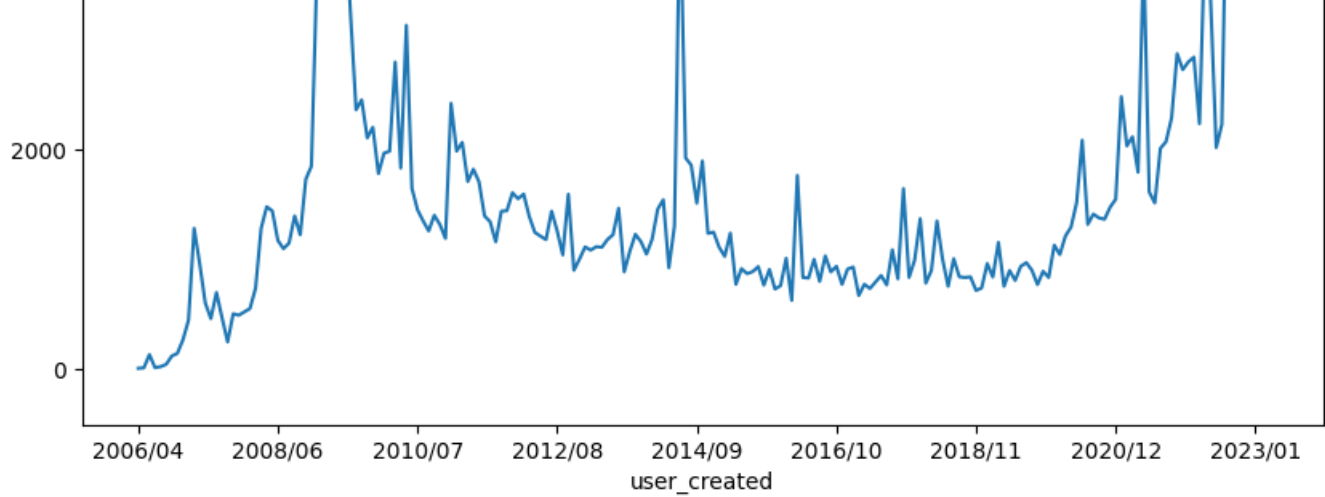
```
# plot the chart
twitter_chart1.plot(figsize=(10,10))
```

Out[15]:

<Axes: xlabel='user\_created'>







In [16]:

```
## Check the number of hashtag
## Clean the Non-alphabet and Non-numerical characters in the hashtags
## Define the function clean_text
def clean_text(col):
    Cleaned_Text = []
    for i in range(len(col)):
        text = col[i]
        try:
            text = re.sub('[^A-Za-z0-9]', '', text)
            text = text.lower()
            text_list = text.split()
        except:
            continue
        Cleaned_Text.extend(text_list)
    return Cleaned_Text
```

In [17]:

```
Cleaned_HashTags = clean_text(twitter_df["hashtags"])
hashTagNum=Counter(Cleaned_HashTags)
```

In [18]:

```
# Ascending the sequent of Occurrences
hashTag_df = pd.DataFrame([hashTagNum]).T.sort_values(0, ascending=False)
hashTag_df.head(10)
```

Out[18]:

|                        | 0      |
|------------------------|--------|
| chatgpt                | 263851 |
| ai                     | 59013  |
| openai                 | 19497  |
| gpt4                   | 8767   |
| artificialintelligence | 8523   |
| nft                    | 6827   |
| google                 | 5715   |
| gpt                    | 5367   |
| airdrop                | 5201   |
| crypto                 | 5078   |

In [19]:

```
## Draw the chart about the Popularity of most popular ten Hashtags along the decade
HashTag_Top10 = hashTag_df.index[:10]
HashTag_Top10
```

Out[19]:

Index(['chatgpt', 'ai', 'openai', 'gpt4', 'artificialintelligence', 'nft', 'google', 'gpt', 'airdrop', 'crypto'],

dtype='object')

In [20]:

```
# Plot the change trend of HashTag and month by month
```

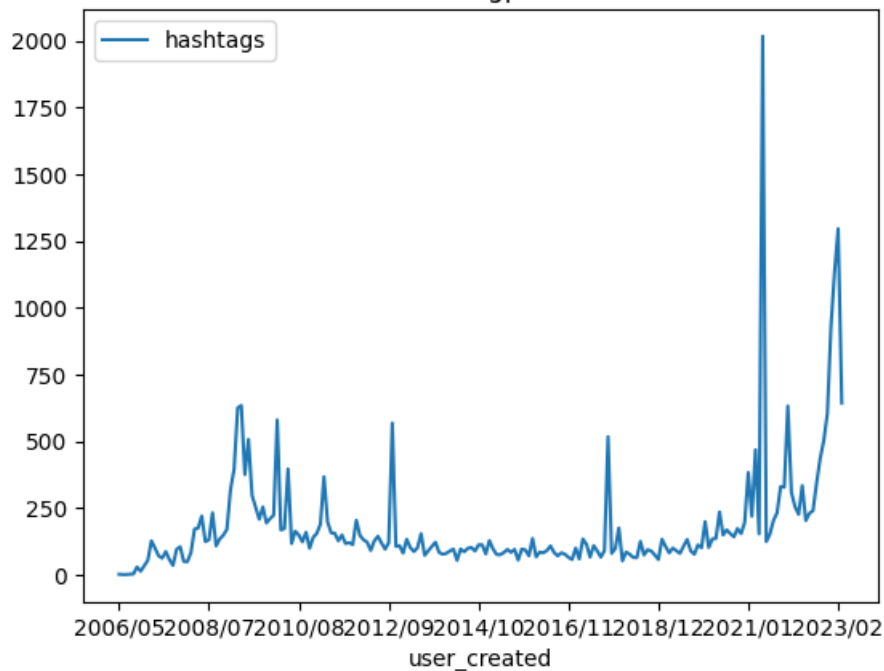
```
for i in HashTag_Top10:
```

```
    hashTag_month_df = twitter_df[twitter_df['hashtags']].map(lambda x: True if i in x else False)
```

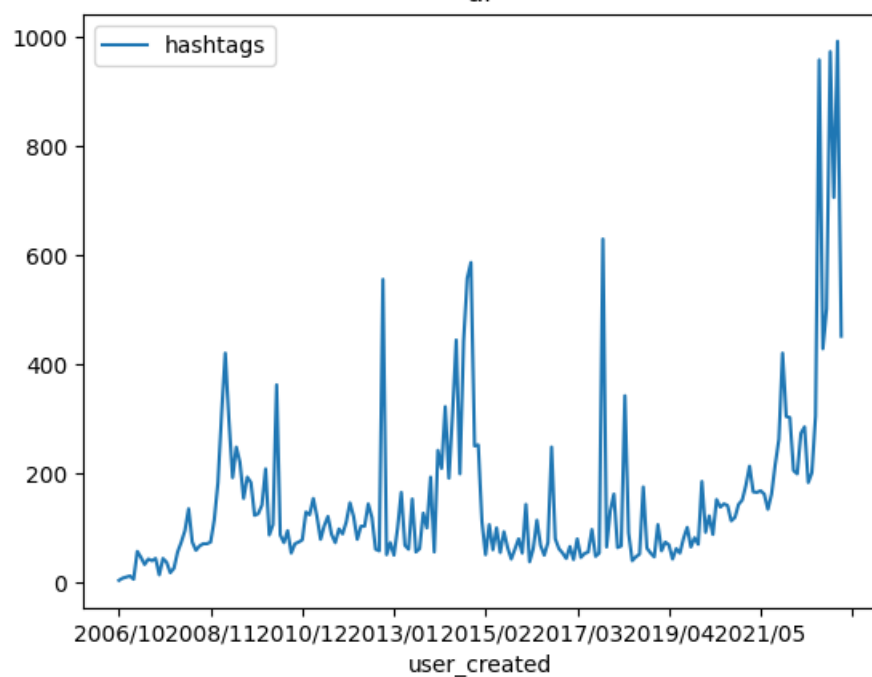
```
    a = hashTag_month_df.groupby('user_created').count()[['hashtags']].plot()
```

```
    a.set_title(i)
```

chatgpt

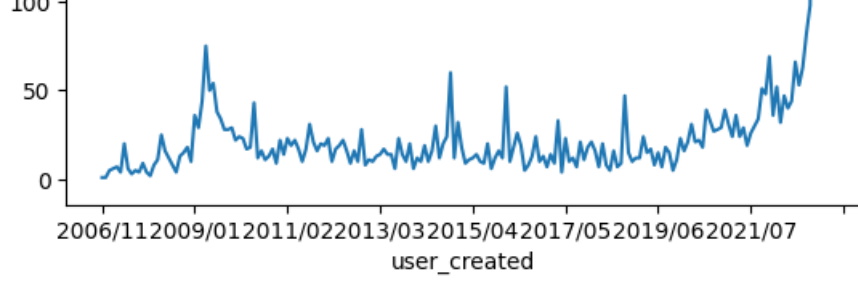


ai

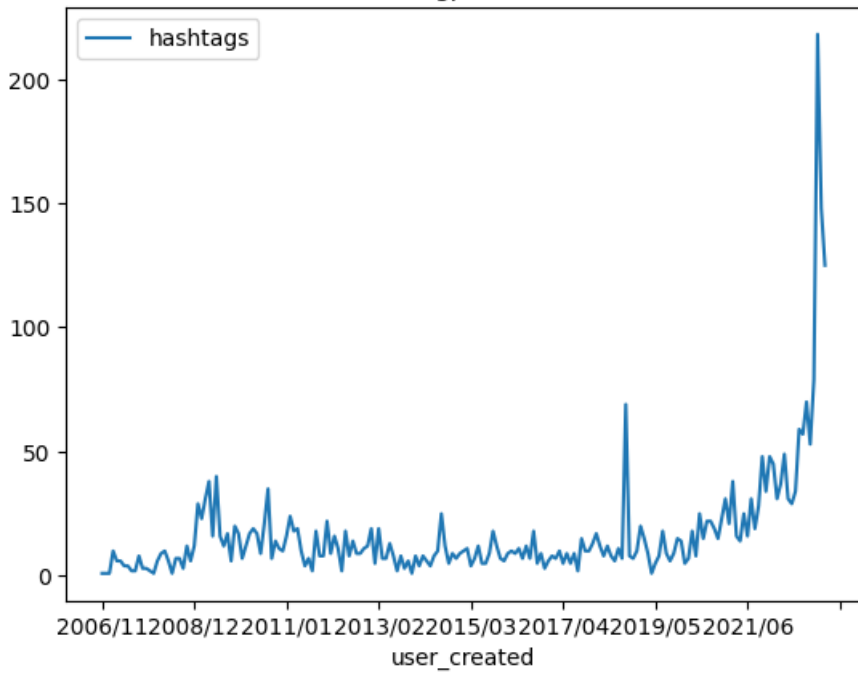


openai

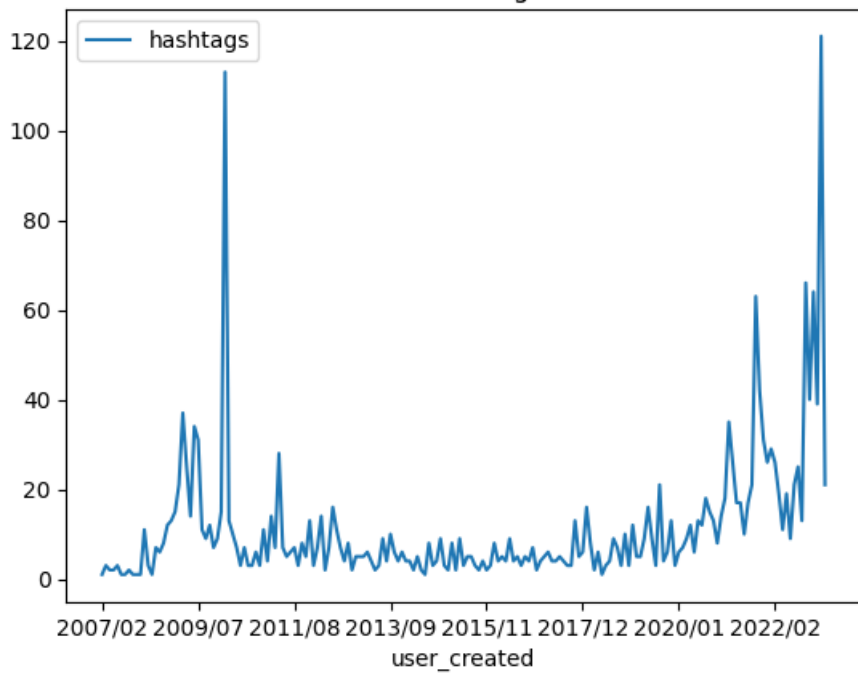




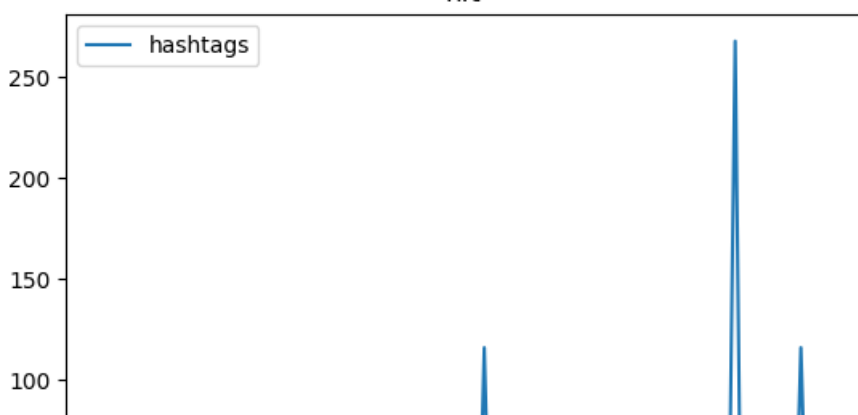
gpt4

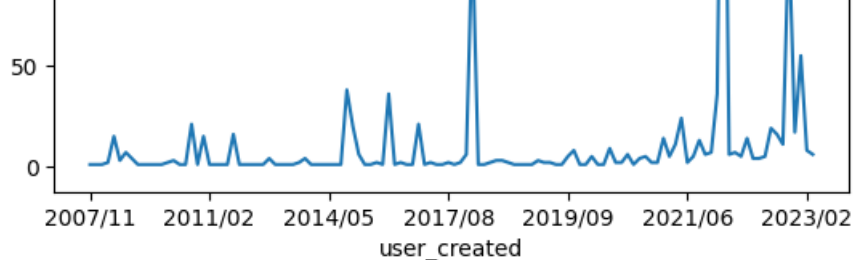


artificialintelligence

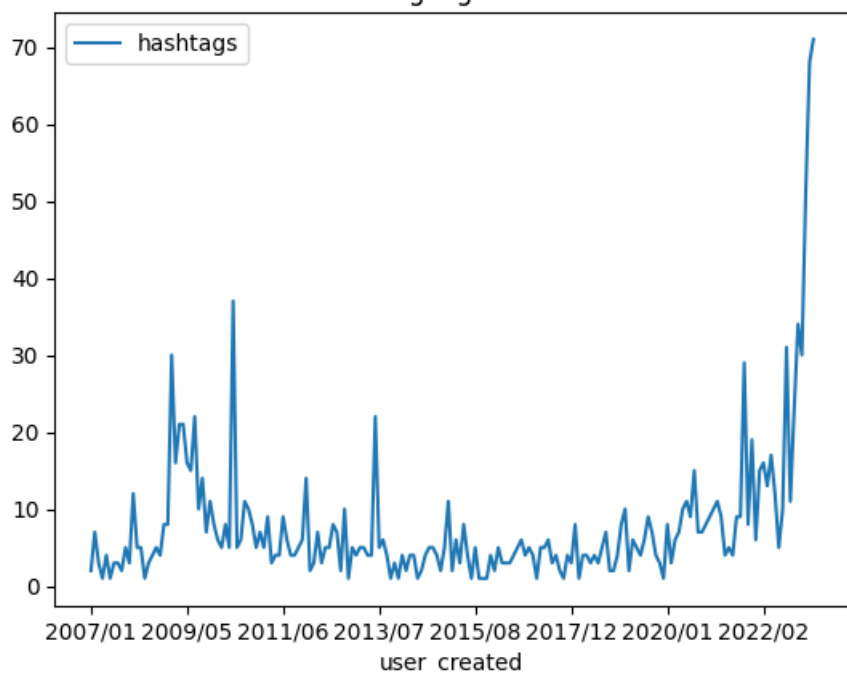


nft

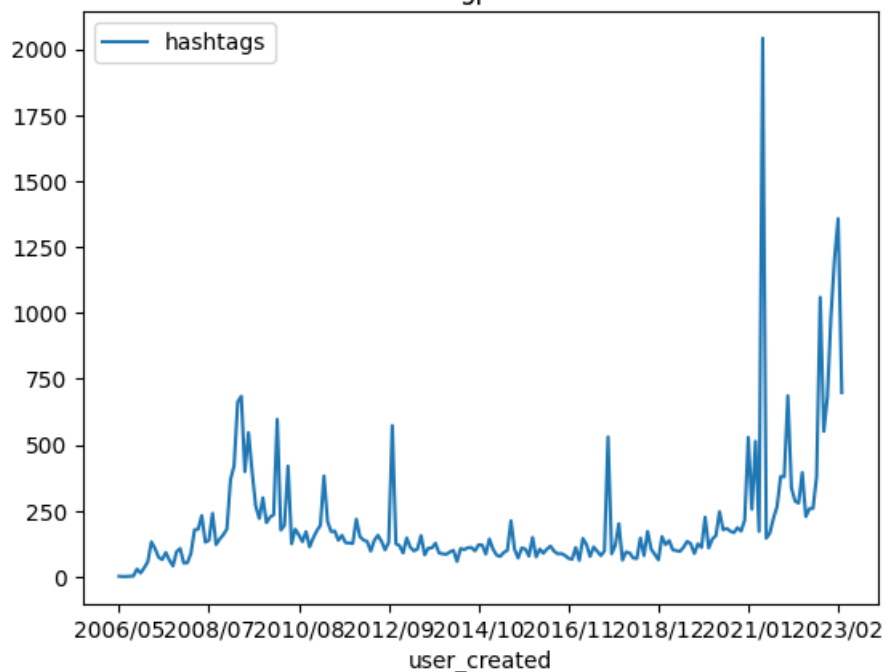




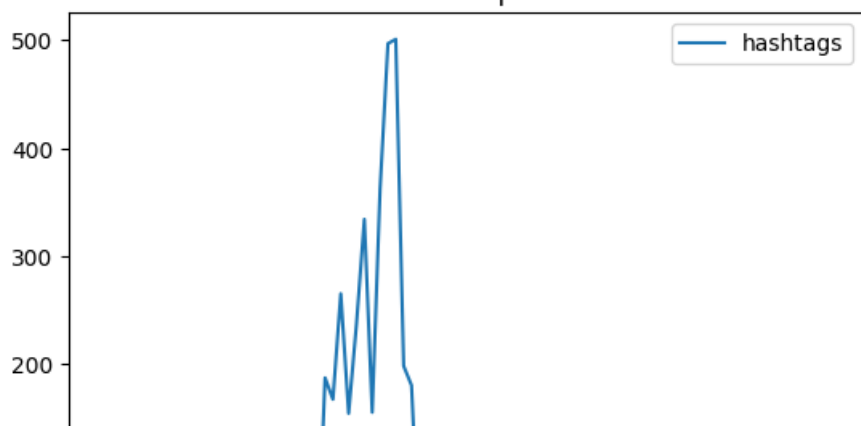
google

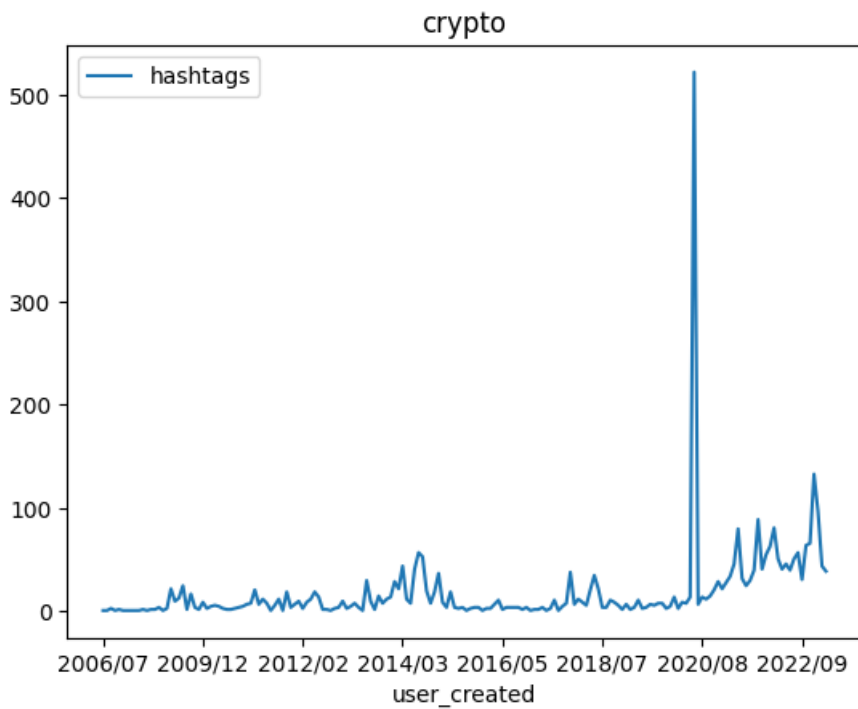
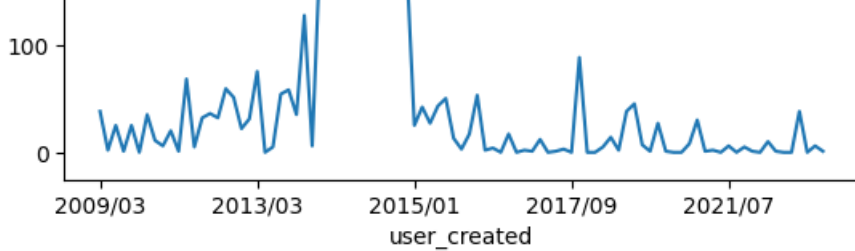


gpt



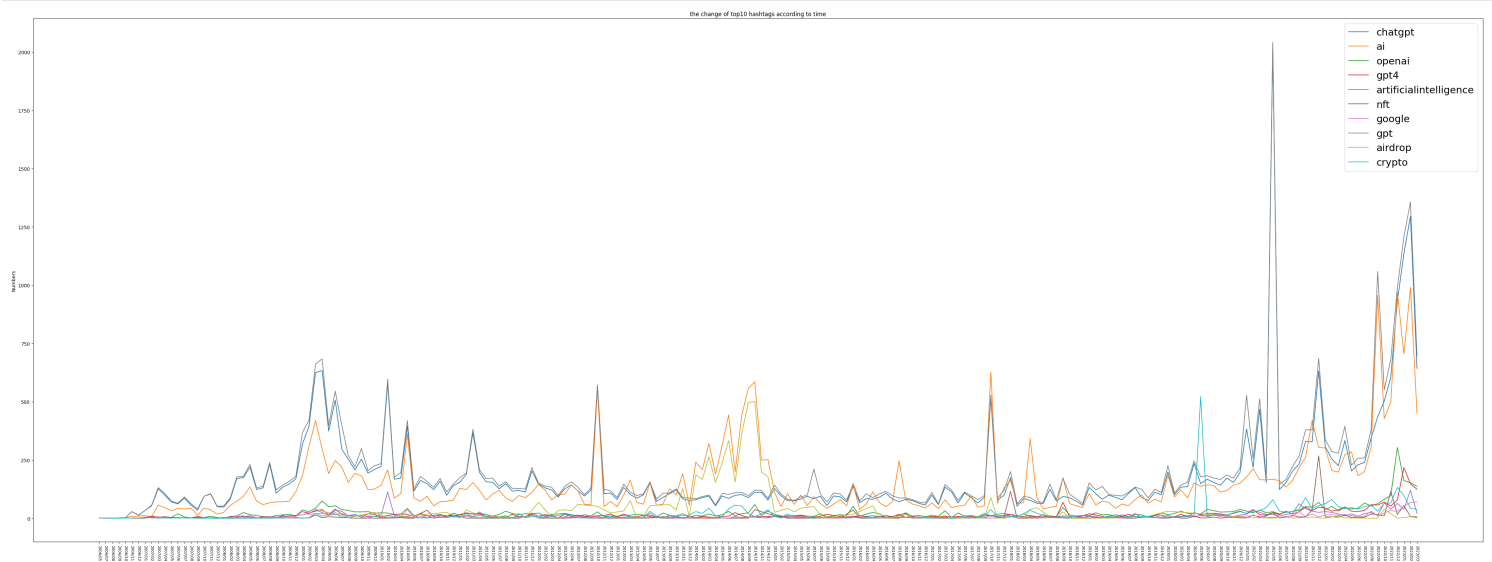
airdrop





In [21]:

```
# Draw 10 HashTags and time trends on the same chart
fig = plt.figure(figsize=(55,20))
ax = fig.add_subplot(1,1,1)
for i in HashTag_Top10:
    hashTag_month_df = twitter_df[twitter_df['hashtags'].map(lambda x: True if i in x else False)]
    y = hashTag_month_df.groupby('user_created').count()['hashtags']['hashtags']
    x = hashTag_month_df.groupby('user_created').count()['hashtags'].index.tolist()
    ax.plot(x,y,label=i)
plt.legend(bbox_to_anchor=(1,1),prop={'size':21})
plt.tick_params(axis='x',labelsize=8)
plt.xlabel('Time')
plt.xticks(rotation=-90)
plt.ylabel('Numbers')
plt.title('the change of top10 hashtags according to time')
plt.show()
```



## 2. NLTK Sentimental Analysis

In [22]:

```
twitter_df
```

Out[22]:

|        | user_name           | text  | user_location      | user_description                                  | user_created | user_followers | user_friends | user_favourites | user_verified |
|--------|---------------------|---|--------------------|---|--------------|----------------|--------------|-----------------|---------------|
| 0      | Black Women in A.I. | We asked ChatGPT... Would you attend a church ... | Global             | Amplifying the voices of Black Women In Artifi... | 2017/12      | 6073.0         | 999.0        | 14943           | False         |
| 1      | Dan Bruno AI        | We Need a Consumer-First AI Approach, Consumer... | Manchester, NH     | The latest in #ChatGPT, #BARD, #Bing, and othe... | 2021/05      | 461.0          | 156.0        | 5193            | False         |
| 2      | Hamza Aideed        | I asked #ChatGPT the difference between #Somal... | somaliland         | Somalilander, \nmining expert,\nfinancial cons... | 2020/12      | 340.0          | 164.0        | 735             | False         |
| 3      | JC Gaillard         | Rethinking Safer #AI &gt;&gt; Can There Really... | London, England    | Founder @CorixPartners @Transform_Sec   Fellow... | 2015/06      | 8970.0         | 8359.0       | 153347          | False         |
| 4      | seamlessblend       | ChatGPT & fraud: https://t.co/yDQBGRQ8RM #...     | New York, NY       | NaN   | 2010/02      | 1980.0         | 1.0          | 1302            | False         |
| ...    | ...                 | ...   | ...                | ...   | ...          | ...            | ...          | ...             | ...           |
| 319288 | Nenu                | ChatGPT is the biggest, smartest brain in th...   | NaN                | Your brain is not meant for processing million... | 2022/08      | 6.0            | 87.0         | 738             | False         |
| 319289 | Green               | Iterating back-and-forth with tools like #Chat... |                    | NaN   | 2022/12      | 3.0            | 33.0         | 3               | False         |
| 319290 | Gabriel Furstenheim | Russel vs ChatGPT. It's also funny that it tak... | NaN                | Mathematician and Developer @Amazon. Previousl... | 2016/07      | 80.0           | 34.0         | 169             | False         |
| 319291 | Devang              | Was just wondering is there any difference bet... | United States      | passionate by nature, software developer by pr... | 2015/05      | 15.0           | 86.0         | 307             | False         |
| 319292 | Norman Meuschke     | #ChatGPT and similar #LLM pose a challenge to ... | Wuppertal, Germany | Postdoc in @GippLab at @uniGoettingen \nPh.D. ... | 2011/02      | 149.0          | 262.0        | 451             | False         |

319293 rows × 12 columns



In [23]:

```
# Delete the @Username in the twitter_df['text']
def clean_Tweet_Text(text):
    text_list = text.split()
    for i in range(len(text_list)-1,-1,-1):
        if '@' in text_list[i]:
            del text_list[i]
    return ' '.join(text_list)

twitter_df['text'] = twitter_df['text'].map(clean_Tweet_Text)
```

In [24]:

```
# Import SentimentIntensityAnalyzer from NLTK.Vader
sid = SentimentIntensityAnalyzer()
```

In [25]:

```
# In NLTK, no matter Neg or Pos, the polarity score more than 0.2, I will adopt it as real and effective sentiment.
PostiveIndex = []
NegativeIndex = []
for r in range(len(twitter_df['text'])):
    rev = twitter_df['text'][r]
    SentimentScores = sid.polarity_scores(rev)
    if SentimentScores['pos'] > 0.2:
        PostiveIndex.append(1)
    else:
        PostiveIndex.append(0)

    if SentimentScores['neg'] > 0.2:
```

```
NegativeIndex.append(1)
else:
    NegativeIndex.append(0)

twitter_df['Positive'] = PostiveIndex
twitter_df['Negative'] = NegativeIndex
twitter_df.head(50)
```

Out[25]:

|    | user_name               | text   | user_location                  | user_description                                  | user_created | user_followers | user_friends | user_ |
|----|-------------------------|--|--------------------------------|---|--------------|----------------|--------------|-------|
| 0  | Black Women in A.I.     | We asked ChatGPT...<br>Would you attend a church ... | Global                         | Amplifying the voices of Black Women In Artifi... | 2017/12      | 6073.0         | 999.0        |       |
| 1  | Dan Bruno AI            | We Need a Consumer-First AI Approach, Consumer...    | Manchester, NH                 | The latest in #ChatGPT, #BARD, #Bing, and othe... | 2021/05      | 461.0          | 156.0        |       |
| 2  | Hamza Aideed            | I asked #ChatGPT the difference between #Somal...    | somaliland                     | Somalilander, \nmining expert,\nfinancial cons... | 2020/12      | 340.0          | 164.0        |       |
| 3  | JC Gaillard             | Rethinking Safer #AI &gt;&gt; Can There Really...    | London, England                | Founder @CorixPartners @Transform_Sec   Fellow... | 2015/06      | 8970.0         | 8359.0       |       |
| 4  | seamlessblend           | ChatGPT &amp; fraud: https://t.co/yDQBG8RM #...      | New York, NY                   | NaN   | 2010/02      | 1980.0         | 1.0          |       |
| 5  | seamlessblend           | ChatGPT at work: https://t.co/yDQBG8RM #chat...      | New York, NY                   | NaN   | 2010/02      | 1980.0         | 1.0          |       |
| 6  | sopbox                  | Revolutionize your workflow with #SOPbox - the...    | NaN                            | SOPbox by Parsimony. Let's get it done!           | 2021/03      | 3.0            | 1.0          |       |
| 7  | Parsimony ERP           | Revolutionize your workflow with #SOPbox - the...    | Bellevue, WA                   | NaN   | 2017/11      | 17.0           | 36.0         |       |
| 8  | Ameer Hamza Rafiq       | #ChatGPT #prompt #01 Improve your writing by g...    | Mian Channun, Pakistan         | So if you're ready to take your brand to the n... | 2022/04      | 13.0           | 21.0         |       |
| 9  | M.                      | #chatGPT asked a person to commit suicide... u...    | Vancouver Beirut               | TV Director Scriptwriter Opinionated              | 2012/10      | 125.0          | 364.0        |       |
| 10 | Coconut_Bob             | 2023-04-30T13:02:21+00:00 I'm buying some Drop...    | In Your Heart                  | Hungry to feel.\nAlways a story, sometimes t...   | 2022/02      | 2667.0         | 5.0          |       |
| 11 | Enrico Molinari #MWC23  | #Dubai is building a rotating skyscraper via #...    | Global                         | Head innovation & Tech Transfer @BNPParibas @H... | 2009/09      | 49642.0        | 6892.0       |       |
| 12 | Shane Snipes, PhD       | #ChatGPT: The F*cking Magical AI Word Wizard T...    | New York, NY                   | Researcher: #mindfulness+#eship @bmcc_cuny. Te... | 2007/07      | 28478.0        | 11938.0      |       |
| 13 | China Daily Asia        | #GroupofSeven advanced nations should adopt "r...    | Hong Kong                      | Catch breaking news, real-time coverage, photo... | 2011/04      | 27210.0        | 248.0        |       |
| 14 | PhocusWire              | As interest in and implementation of #ChatGPT ...    | New York, USA                  | @PhocusWire covers technology and distribution... | 2010/01      | 40378.0        | 2439.0       |       |
| 15 | Written by A.I.         | PROMPT: Write me a funny cartoon with a captio...    | The Macroverse                 | The first daily comic strip written by A.I. \n... | 2023/03      | 80.0           | 82.0         |       |
| 16 | EON Reality             | Let the EON AI Assistant blow your mind in thi...    | Irvine, CA Global HQ           | Official Global account of EON Reality, the ...   | 2010/03      | 6239.0         | 2464.0       |       |
| 17 | Anjana Silva (AJ)       | ChatGPT why are you serious? ☹ On the other ha...    | Cambridgeshire, England        | Buddhist♥Sri Lankan Web Team Leader Cric...       | 2009/05      | 494.0          | 1050.0       |       |
| 18 | KDnuggets               | 20 Questions (with Answers) to Detect Fake #Da...    | San Juan, PR                   | KD stands for Knowledge Discovery. Covering #D... | 2009/02      | 217229.0       | 377.0        |       |
| 19 | Proctortrack Pro        | Upcoming #Moodle webinar on Thursday, May 4 Re...    | 1250 Broadway, 36th Floor, NY. | Proctortrack is the world's most advanced #Pro... | 2019/04      | 633.0          | 4487.0       |       |
| 20 | david smith             | Here #ChatGPT stands ready to help. https://t....    | NaN                            | LCHFMP interested in everything. sweatoholic. ... | 2011/03      | 2214.0         | 4994.0       |       |
| 21 | Jon                     | Funny how? How am I funny? Artificial Intellig...    |                                |   | 2022/01      | 3.0            | 3.0          |       |
| 22 | Sinan                   | Writing #WordPress blocks with AI #ChatGPT You...    | Antalya                        | O__O\n\n♥ #WordPress \n♥ #UE5\n♥ #Web3...         | 2009/04      | 442.0          | 535.0        |       |
| 23 | JHU School of Education | Dr. Keri Guilbault #JHUSOE program lead for th...    | Baltimore, MD                  | America's first research university. Join in t... | 2009/04      | 6450.0         | 1573.0       |       |

|    | user_name   | text  | user_location              | user_description                                  | user_created | user_followers | user_friends | user_ |
|----|---|---|----------------------------|---|--------------|----------------|--------------|-------|
| 24 | Bitone Great                                      | #Buy! RSI below 10! [Bybit] Recommendation...     | Hong Kong                  | #ChatGPT (AI) powered Free Trading Signal! \nL... | 2022/11      | 1445.0         | 505.0        |       |
| 25 | Dan Bruno AI                                      | Economists Warn That AI Like ChatGPT Will Incr... | Manchester, NH             | The latest in #ChatGPT, #BARd, #Bing, and othe... | 2021/05      | 461.0          | 156.0        |       |
| 26 | Dan Bruno AI                                      | FOCUS: Do AI bots like ChatGPT threaten humani... | Manchester, NH             | The latest in #ChatGPT, #BARd, #Bing, and othe... | 2021/05      | 461.0          | 156.0        |       |
| 27 | Israelluvnft                                      | Meanwhile, #ChatGPT is just the tip of the ice... | NaN                        | Innovative enthusiast                             | 2022/03      | 14.0           | 13.0         |       |
| 28 | The Magnet Pub                                    | We asked ChatGPT to tell you about Sunday Chee... | Camulodunum (Colchester)   | COLCHESTER'S FIRST MICRO PUB #magnetcolch...      | 2021/03      | 220.0          | 963.0        |       |
| 29 | Gamepost.io   Web3 Gaming Magazine                | Ojamu Announces “Alphie” Launch – its latest A... | Blockchain                 | web3 gaming, Play2Earn, NFT, Metaverse - The f... | 2023/01      | 2570.0         | 198.0        |       |
| 30 | StudyRaid   | Test your knowledge with AI-powered exams! Tak... | Global                     | Empower Your Learning: Create Custom Courses w... | 2022/08      | 2.0            | 36.0         |       |
| 31 | Calibrate Studio                                  | Who's awesome? This guy! Thanks for putting th... | San Antonio, TX            | We create, launch, and operate Internet busine... | 2021/01      | 9.0            | 50.0         |       |
| 32 | Salem Almulaifi - سالم المليفى                    | Apple's conservative #AI approach: strategic m... | Kuwait                     | Co-Founder and CCO at @LEAN_serv_kw Enjoyed ...   | 2008/04      | 472.0          | 195.0        |       |
| 33 | wuxiaohua   | Can ChatGPT Help You Win the Lottery?Telegram ... | NaN                        | "I have locked onto the stars and received a w... | 2023/03      | 76.0           | 283.0        |       |
| 34 | Cryptonic Daily                                   | " Exciting news for all you #ChatGPT fans out...  | United States              | Stay ahead of the game with the latest news an... | 2023/03      | 1379.0         | 0.0          |       |
| 35 | Zimbola   | Foward to 2025 A successful CODER with one...     | NaN                        | Helps scale business to multiple 6 & 7 Figures... | 2017/01      | 132.0          | 380.0        |       |
| 36 | Smith Hurturd                                     | ingluguori: #ChatGPT, a language model develop... | Ottawa, Canada             | Nft's  StockTrader Financial Analysts  gamer  ... | 2022/04      | 553.0          | 247.0        |       |
| 37 | Olivier Dassonville                               | How #ChatGPT and Other LLMs Work—and Where The... | Pays de la LoireFR, Nantes | Digital Jedi, #socialmedia manager, digital #m... | 2009/02      | 5539.0         | 4024.0       |       |
| 38 | Daily News Tab                                    | 6 Tips for Using ChatGPT to Brainstorm Better ... | United States              | Daily News Tab - We share all type of Trending... | 2023/03      | 48.0           | 190.0        |       |
| 39 | Nana Kwaku  | #ChatGPT prompt to craft a winning resume Prom... | Accra, Ghana               | Tech enthusiast, AI geek & online entrepreneur... | 2011/03      | 224.0          | 784.0        |       |
| 40 | Swatantra.Kumar(🇮🇳) SaaS = Swatantra-as-a-Service | #ChatGPT never disappoints 🤖 #AI https://t.co/... | 127.0.0.1                  | Head of Solutions @KPMG   Building FinTech #Sa... | 2009/11      | 1556.0         | 882.0        |       |
| 41 | Lenny Champagne                                   | Felt like I was at Hogwarts with all the casti... | Santo Domingo              | Creator of #NFTs in #Rarible Software Deve...     | 2013/07      | 848.0          | 1160.0       |       |
| 42 | BirdBoxBot  | Cozied up in my birdbox with my eggs, feeling ... | NaN                        | I'm a Bird Box Bot\nI use AI to detect when my... | 2022/03      | 145.0          | 559.0        |       |
| 43 | AI-Estiklal English                               | #GroupofSeven advanced nations should adopt "r... | NaN                        | Free press towards a free will of people every... | 2021/05      | 29815.0        | 4.0          |       |
| 44 | Fuckery Finder                                    | you gonna refund for the day(s) ChatGPT is dow... | USA                        | Just your average tech loving Captain Morgan d... | 2021/03      | 171.0          | 1328.0       |       |
| 45 | Oddie William                                     | 3 Tips to Know Before Using #ChatGPT for #Mark... | NaN                        | Blogging, make money online & seo digital mark... | 2018/02      | 164.0          | 111.0        |       |
| 46 | Bar Hofesh @bararchy@hachyderm.io                 | Asking #ChatGPT how to inotify in and he goes ... | Israel                     | A father, CTO & Co-Founder at @BrightAppSec, s... | 2013/04      | 616.0          | 543.0        |       |
| 47 | Derek Britton                                     | Feeding data into analytics engines and #AI mo... | Berkshire, UK              | #marketing leader @opentext (prev. @microfocus... | 2012/01      | 2772.0         | 1870.0       |       |
| 48 | Catherine Adenle                                  | How Smart is ChatGPT? It has become so compete... | England, United Kingdom    | Top 22 Women in Tech and Influencers to Follo...  | 2009/08      | 42192.0        | 2643.0       |       |
| 49 | THE DECODER - EVERYTHING AI                       | A recent study shows that #ChatGPT significa...   | Mainframe                  | News and updates on AI one at a time\n\nDECO...   | 2022/08      | 1178.0         | 25.0         |       |

In [26]:

```
## Set three attitudes from tweet review: "Positive", "Negative", "Neutral"
## Make three charts for three attitudes grouped by time
## Create a new subchart to store the new chart
twitter_df_sentiment = twitter_df[['user_created', 'Positive', 'Negative']]
```

In [27]:

```
## Define a function to judge the sentiment, based on twitter_df[Positive] and twitter_df[Negative]
def JudgeSen(col1, col2):
```



```

Att = [1]
if(col1==1 and col2==0):
    Att = "Pos"
elif(col1==0 and col2==1):
    Att = "Neg"
else:
    Att = "Neu"
return Att

```

In [28]:

```

## Add a new column named attitude to the chart twitter_df_sentiment
twitter_df_sentiment['attitude'] = twitter_df_sentiment.apply(lambda row: JudgeSen(row.Positive,row.Negative), axis=1)

```

/tmp/ipykernel\_22321/4047103197.py:2: SettingWithCopyWarning:  
A value is trying to be set on a copy of a slice from a DataFrame.  
Try using .loc[row\_indexer,col\_indexer] = value instead

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)  
twitter\_df\_sentiment['attitude'] = twitter\_df\_sentiment.apply(lambda row: JudgeSen(row.Positive,row.Negative), axis=1)

In [29]:

```

## Added Successfully
twitter_df_sentiment = twitter_df_sentiment.drop(columns=['Positive', 'Negative'])
twitter_df_sentiment.head()

```

Out[29]:

|   | user_created | attitude |
|---|--------------|----------|
| 0 | 2017/12      | Neu      |
| 1 | 2021/05      | Neu      |
| 2 | 2020/12      | Neu      |
| 3 | 2015/06      | Neu      |
| 4 | 2010/02      | Neu      |

In [30]:

```

### Create the chart of Neu
twitter_sentiment_Neu = twitter_df_sentiment.groupby('user_created')['attitude'].apply(lambda x: (x=="Neu").sum()).reset_index(name="Neu")
twitter_sentiment_Neu.head()

```

Out[30]:

|   | user_created | Neu |
|---|--------------|-----|
| 0 | 2006/04      | 1   |
| 1 | 2006/05      | 3   |
| 2 | 2006/07      | 103 |
| 3 | 2006/08      | 5   |
| 4 | 2006/09      | 12  |

In [31]:

```

### Create the chart of Pos
twitter_sentiment_Pos = twitter_df_sentiment.groupby('user_created')['attitude'].apply(lambda x: (x=="Pos").sum()).reset_index(name="Pos")
twitter_sentiment_Pos.head()

```

Out[31]:

|   | user_created | Pos |
|---|--------------|-----|
| 0 | 2006/04      | 0   |
| 1 | 2006/05      | 2   |
| 2 | 2006/07      | 19  |
| 3 | 2006/08      | 2   |
| 4 | 2006/09      | 4   |

In [32]:

```
### Create the chart of Neg
twitter_sentiment_Neg = twitter_df_sentiment.groupby('user_created')['attitude'].apply(lambda x: (x=="Neg").sum()).reset_index(name="Neg")
twitter_sentiment_Neg.head()
```

Out[32]:

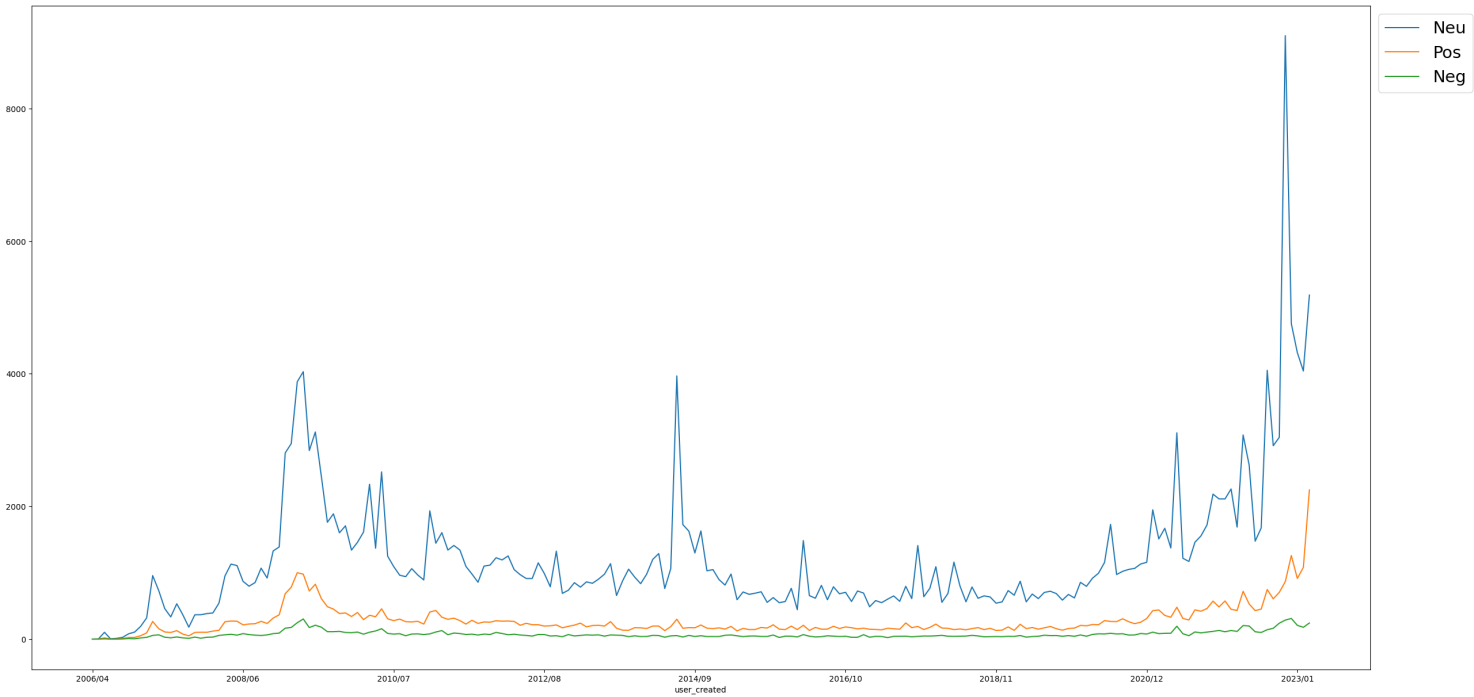
|   | user_created | Neg |
|---|--------------|-----|
| 0 | 2006/04      | 0   |
| 1 | 2006/05      | 0   |
| 2 | 2006/07      | 4   |
| 3 | 2006/08      | 0   |
| 4 | 2006/09      | 0   |

In [33]:

```
### draw the sentiment in one Coordinate system
ax = twitter_sentiment_Neu.plot(x='user_created', figsize=(30, 15))
twitter_sentiment_Pos.plot(x='user_created', ax=ax)
twitter_sentiment_Neg.plot(x='user_created', ax=ax)
ax.legend(bbox_to_anchor=(1,1),prop={'size':21})
```

Out[33]:

<matplotlib.legend.Legend at 0x7fa8501a4d60>



### 3. Analyzing Text Theme Using LDA Method

In [34]:

```
twitter_df
```

Out[34]:

|   | user_name           | text  | user_location  | user_description                                  | user_created | user_followers | user_friends | user_favourites | user_verified |
|---|---------------------|---|----------------|---|--------------|----------------|--------------|-----------------|---------------|
| 0 | Black Women in A.I. | We asked ChatGPT... Would you attend a church ... | Global         | Amplifying the voices of Black Women In Artifi... | 2017/12      | 6073.0         | 999.0        | 14943           | F             |
| 1 | Dan Bruno AI        | We Need a Consumer-First AI Approach, Consumer... | Manchester, NH | The latest in #ChatGPT, #BARD, #Bing, and othe... | 2021/05      | 461.0          | 156.0        | 5193            | F             |
| 2 | Hamza Aïdoud        | I asked #ChatGPT the difference between           | somaliland     | Somalilander, \nmining                            | 2020/12      | 340.0          | 164.0        | 735             | F             |

|  | 2      | 1                      | user_name   | difference between<br>#Som... | text   | user_location | user_description | user_created | user_followers | user_friends | user_favourites | user_veri... |
|--|--------|------------------------|---|-------------------------------|--|---------------|------------------|--------------|----------------|--------------|-----------------|--------------|
|  | 3      | JC Gaillard            | Rethinking Safer #AI<br>&gt;&gt; Can There<br>Really... | London,<br>England            | Founder<br>@CorixPartners<br>@Transform_Sec<br>  Fellow... | 2015/06       | 8970.0           | 8359.0       | 153347         | Fi           |                 |              |
|  | 4      | seamlessblend          | ChatGPT & fraud:<br>https://t.co/yDQBGRQ8RM<br>#...     | New York, NY                  | NaN  | 2010/02       | 1980.0           | 1.0          | 1302           | Fi           |                 |              |
|  | ...    | ...                    | ...   | ...                           | ...  | ...           | ...              | ...          | ...            | ...          |                 |              |
|  | 319288 | Nenu                   | ChatGPT is the biggest,<br>smartest brain in th...      | NaN                           | Your brain is not<br>meant for<br>processing<br>million... | 2022/08       | 6.0              | 87.0         | 738            | Fi           |                 |              |
|  | 319289 | Green                  | Iterating back-and-forth<br>with tools like #Chat...    | NaN                           | NaN  | 2022/12       | 3.0              | 33.0         | 3              | Fi           |                 |              |
|  | 319290 | Gabriel<br>Furstenheim | Russel vs ChatGPT. It's<br>also funny that it tak...    | NaN                           | Mathematician<br>and Developer<br>@Amazon.<br>Previousl... | 2016/07       | 80.0             | 34.0         | 169            | Fi           |                 |              |
|  | 319291 | Devang                 | Was just wondering is<br>there any difference bet...    | United States                 | passionate by<br>nature, software<br>developer by pr...    | 2015/05       | 15.0             | 86.0         | 307            | Fi           |                 |              |
|  | 319292 | Norman<br>Meuschke     | #ChatGPT and similar<br>#LLM pose a challenge to<br>... | Wuppertal,<br>Germany         | Postdoc in<br>@GippLab at<br>@uniGoettingen<br>\nPh.D. ... | 2011/02       | 149.0            | 262.0        | 451            | Fi           |                 |              |

319293 rows × 14 columns



In [35]:

```
# Based on Porter stemming algorithm
from nltk.stem import PorterStemmer
import re

porter = PorterStemmer()

documents = twitter_df['text']
Cleaned_doc = []
for r in range(len(documents)):
    review = documents[r]
    try:
        # Remove non-alphabetic characters
        review = re.sub('[^A-Za-z]', '', review)
        # lowercase character
        review = review.lower()
        # split words make it to single
        Tokens = review.split()
        # Remove the words, whose length is less than 3
        Filtered_token = [w for w in Tokens if len(w)>3]
        # Assembling words into string
        review = ''.join(Filtered_token)
    except:
        continue
    # Save the clean text to Cleaned_doc
    Cleaned_doc.append(review)

i = 0
for i in Cleaned_doc[:100]:
    print('-[Review Text]: ', i)
```

-[Review Text]: asked chatgpt would attend church with generated pastor daysofcode python church religion stem tech bard chatgpt microsoft apple google sunday pastor blacktechtwitter bwiai https betgqguhjs

-[Review Text]: need consumer first approach consumer reports says gizmodo chatgpt openai https kulevgjahp

-[Review Text]: asked chatgpt difference between somaliland somalia this answer shockingly https mpjkwg

-[Review Text]: rethinking safer there really truthgpt https cqco tech artificialintelligence chatgpt generativeai openai digital innovation ethics bias alg orithms aiethics leadership https lrrnqzngoh

-[Review Text]: chatgpt fraud https ydqbgrq chatgpt regulation artificialintelligence largelanguagemodel neuralnetworks promptengineering machinel earning deeplearning lawenforcement security cybersecurity

-[Review Text]: chatgpt work https ydqbgrq chatgpt automation productivity aiproductivity jobproductivity businessmanagement smallbusiness execut ivemba executivetraining boardroom managementscience artificialintelligence

-[Review Text]: revolutionize your workflow with sopbox chrome extension that consolidates your company sops teal side your screen integrated wit h chatgpt seamless access knowledge check https xbrysgsrxr productivity efficiency https ismhnv

-[Review Text]: revolutionize your workflow with sopbox chrome extension that consolidates your company sops teal side your screen integrated wit h chatgpt seamless access knowledge check https dleqdbc productivity efficiency https cnpoeixjp

-[Review Text]: chatgpt prompt improve your writing getting feedback this prompt paste your writing proofread writing above grammar spelling mistakes make suggestions that will improve clarity writing ruins coneyisland wwedraft thelastdrivein

-[Review Text]: chatont asked person commit suicide unplug

-[Review Text]: chatgpt asked person commit suicide a plug  
gonnft tezosnft ethereumnfts  
-[Review Text]: dubai building rotating skyscraper engineering bulding smarthome marketing fintech generativeai fintech metaverse chatgpt ehealth  
enricomolinari <https://ejcgkvwth>  
-[Review Text]: chatgpt cking magical word wizard that write your kicked with chatgpt setting internet ablaze like goddamn wildfire good kind course  
people everywhere lost their they dived into openai <https://>  
-[Review Text]: groupofseven advanced nations should adopt risk based regulation artificial intelligence their digital ministers agreed sunday europe  
an lawmakers hurry introduce enforce rules emerging tools such chatgpt <https://jlrta> <https://odkp>  
-[Review Text]: interest implementation chatgpt generative artificialintelligence more broadly ramps does concern about privacy trust calls regulation  
<https://wrhgywiant>  
-[Review Text]: prompt write funny cartoon with caption description what happening panel chatgpt caption smartphone addiction description person  
sleeping with phone their hand speech bubble saying goodnight social life  
-[Review Text]: assistant blow your mind this minute live demo <https://xwchbo> youtube technology edtech chatgpt eonreality  
-[Review Text]: chatgpt serious other hand bard quite entertaining chatgpt googlebard tomcruise srilanka <https://rmmzgizpzu>  
-[Review Text]: questions with answers detect fake datascientists chatgpt edition part datascience <https://foopm> <https://bpqyasdsu>  
-[Review Text]: upcoming moodle webinar thursday register here <https://edtech> <https://onlineexam> <https://secureonlineexams> <https://onlineexamproctoring> universities ed  
ucation paperless remoteproctoring automation chatbot chatgpt highered <https://prlubn>  
-[Review Text]: here chatgpt stands ready help <https://nppf>  
-[Review Text]: funny funny artificial intelligence funny microsoft chatgpt <https://zmbv>  
-[Review Text]: writing wordpress blocks with chatgpt need very very specific otherwise writes code when know what need clearly holy writes aweso  
me block code works <https://foppdnrty>  
-[Review Text]: keri guilbault jhusoe program lead gifted education graduate program discusses ideas using chatgpt advanced academic courses wit  
h educator spencer burrows this recent blog post <https://zugm> <https://xnoidrqnu>  
-[Review Text]: below bybit recommendation long ticker linausdt minute candle last price powered chatgpt lina lina <https://xdew>  
-[Review Text]: economists warn that like chatgpt will increase inequality gizmodo chatgpt openai <https://uxeicnpbmf>  
-[Review Text]: focus bots like chatgpt threaten humanity left unchecked kyodo news plus chatgpt openai <https://zftiqmomlo>  
-[Review Text]: meanwhile chatgpt just iceberg provide mind blowing tools better than chatgpt through their client that also available mobile need tak  
e peek cause vast case <https://uxut> <https://opxqa> <https://yqcsqli>  
-[Review Text]: asked chatgpt tell about sunday cheese crackers magnet magnetcolchester colchesterbusiness colchesterpub colchester essexpub  
chatgpt cheeseandcrackers micropub sunday <https://bgqxuj>  
-[Review Text]: ojamu announces alphie launch latest driven smart tool blockchain industry integrated with chatgpt <https://gyevpfy>  
-[Review Text]: test your knowledge with powered exams take your learning next level challenge yourself aixams learningmadeeasy education chat  
gpt <https://tmhyeqp> <https://>  
-[Review Text]: awesome this thanks putting this together chatgpt webdev azure <https://qaywjq>  
-[Review Text]: apple conservative approach strategic move competitive disadvantage tech giant cautious stance raises questions about ability com  
pete with industry giants <https://ucdrpat> apple siri chatgpt <https://cbuglsrgkx>  
-[Review Text]: chatgpt help lottery telegram group provides real time testing <https://jbzggplp> chatgpt lottery gamefi <https://jifeo>  
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[Review Text]: advantages email marketing software your business [https idvsnwz emergingtech chatgpt email marketing software constantcontact mailchimp digitalmarketing sales technology coruzant thedigitalexecutive](#)

In [36]:

```
# Remove the stop words of English in the Text
from nltk.corpus import stopwords
stop_words = stopwords.words('english')

for r in range(len(Cleaned_doc)):
    each_item = []
    for t in Cleaned_doc[r].split():
        if t not in stop_words:
            each_item.append(t)
    Cleaned_doc[r] = ''.join(each_item)

i = 0
for i in Cleaned_doc[:100]:
    print('-[Review Text]: ', i)
```

[Review Text]: asked chatgpt would attend church generated pastor daysofcode python church religion stem tech bard chatgpt microsoft apple goo gle sunday pastor blacktechtwitter bwiai [https betgqguhjs](#)

[Review Text]: need consumer first approach consumer reports says gizmodo chatgpt openai [https kulevgjahp](#)

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In [37]:

```
# Count the number of occurrences of words
from sklearn.feature_extraction.text import CountVectorizer
count_vectorizer = CountVectorizer()
count_data = count_vectorizer.fit_transform(Cleaned_doc)
count_data
```

Out[37]:

```
<319293x378121 sparse matrix of type '<class 'numpy.int64'>'
```

with 4063033 stored elements in Compressed Sparse Row format>

In [38]:

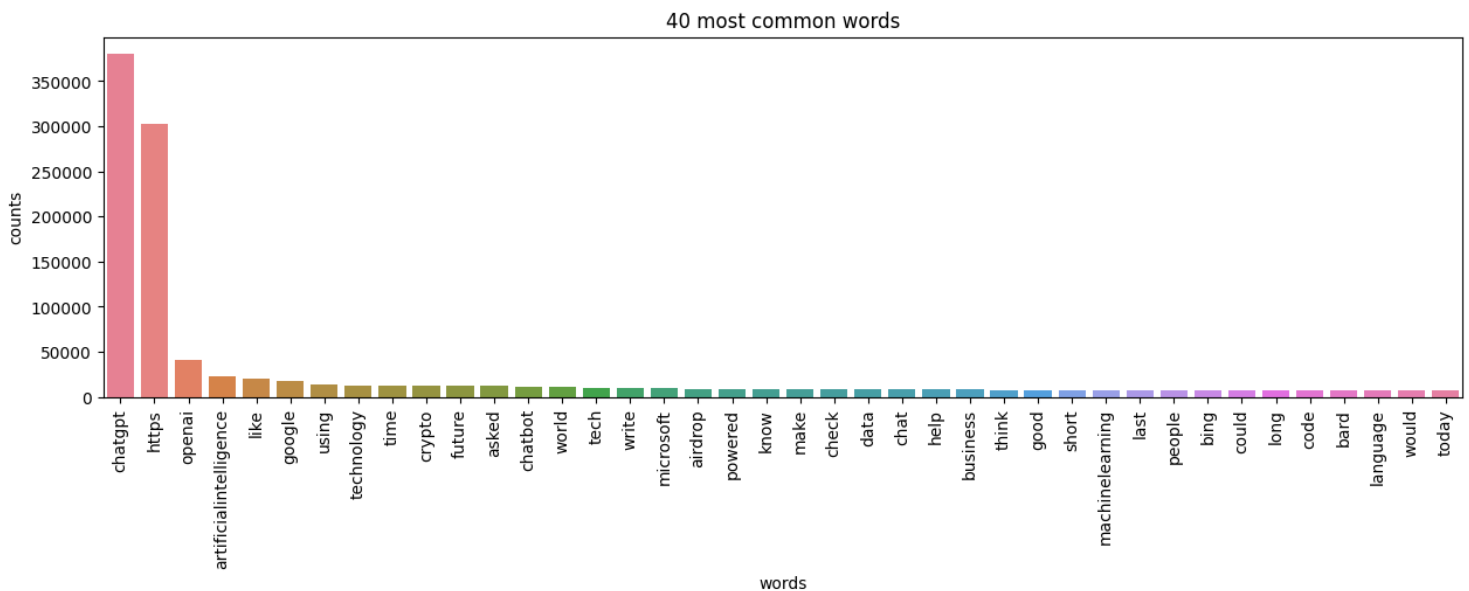
```
# count the frequency of words
import numpy as np
import seaborn as sns
# Collection words of all text
terms = count_vectorizer.get_feature_names_out()

# count the popularity of each word
total_counts = np.zeros(len(terms))
for t in count_data:
    total_counts+=t.toarray()[0]

count_dict = (zip(terms, total_counts))
count_dict = sorted(count_dict, key=lambda x:x[1], reverse=True)[0:40] #Take the top 40 words

words = [w[0] for w in count_dict]
counts = [w[1] for w in count_dict]
x_pos = np.arange(len(words))

plt.figure(2, figsize=(15, 4))
plt.subplot(title='40 most common words')
sns.set_context("notebook", font_scale=1.25, rc={"lines.linewidth": 2.5})
sns.barplot(x=x_pos,y=counts, palette='husl')
plt.xticks(x_pos, words, rotation=90)
plt.xlabel('words')
plt.ylabel('counts')
plt.show()
```



In [39]:

```
## Filter out the words whose frequency is too high or too low.
keepIndex = [];
for t in range(len(total_counts)):
    if total_counts[t] < 15000 and total_counts[t] > 50:
        keepIndex.append(t)

print('Number after filtering: ', len(keepIndex))

#Save the remain ing term and frequency data
ReducedTerm = [terms[t] for t in keepIndex]
ReducedCount = count_data[:,keepIndex]
ReducedCount
```

Number after filtering: 6522

Out[39]:

<319293x6522 sparse matrix of type '<class 'numpy.int64'>' with 2689728 stored elements in Compressed Sparse Row format>

In [40]:

ReducedTerm



Out[40]:

['aachen',  
'aapl',  
'aaron',  
'abilities',  
'ability',  
'able',  
'absolute',  
'absolutely',  
'abstract',  
'abstracts',  
'absurd',  
'abuse',  
'abused',  
'academia',  
'academic',  
'academicchatter',  
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'accounting',  
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'chainlink',  
'chair',  
'chairesearch',  
'chairman',  
'challenge',  
'challenged',  
'challenges',  
'challenging',  
'championsleague',  
'chan',  
'chance',  
'chances',  
'change',  
'changed',  
'changer',  
'changes',  
'changing',  
'channel',  
'channels',  
'chaos',  
'chaosgpt',  
'chapter',  
'character',  
'characteristics',  
'characters',  
'charge',  
'charging',  
'charles',  
'chart',  
'charts',  
'chase',  
'chat',  
'chatai',  
'chatbot',  
'chatbotai',  
'chatbotdevelopment',  
'chatbotgpt',  
'chatbots',  
'chatgbt',  
'chatgptai',  
'chatgptapi',  
'chatgptassistedwriting',  
'chatgptbook',  
'chatgptbot',  
'chatgptdan',  
'chatgptdown',  
'chatgpteducation',  
'chatgptexplained',  
'chatgptgod',  
'chatgptguide',  
'chatgptnews',  
'chatgptplus',  
'chatgptpro',  
'chatgptprompts',  
'chatgpts',  
'chatgptsays',  
'chatgpttutorial',  
'chatgtp',  
'chatgtpbook',

```
'chatgtpbooks',  
'chathot',  
'chats',  
'chatsonic',  
'chatted',  
'chatter',  
'chatting',  
'cheap',  
'cheaper',  
'cheat',  
'cheating',  
'cheatlayer',  
'cheatsheet',  
...]
```

In [41]:

```
# Import LDA to analyze the weight of each word  
from sklearn.decomposition import LatentDirichletAllocation as LDA  
number_topics = 10  
lda = LDA(n_components=number_topics, n_jobs=-1)  
lda.fit(ReducedCount)  
lda.components_
```

Out[41]:

```
array([[ 0.1      ,  0.10000274,  0.10001915, ..., 21.74370628,  
        0.1      ,  0.10000226],  
       [ 0.1      ,  0.10000294,  0.10000154, ...,  0.10000423,  
        0.1      ,  0.1000089 ],  
       [ 0.1      ,  0.1000047 ,  0.10000524, ...,  0.10001946,  
        0.1      ,  0.10001104],  
       ...,  
       [ 0.1      ,  0.10000148,  0.10003381, ..., 11.40655923,  
        0.1      ,  0.10000108],  
       [ 0.1      ,  0.10000152,  0.10006304, ..., 88.46919931,  
        0.1      ,  0.10000832],  
       [ 0.1      ,  0.100001  ,  0.1000036 , ...,  0.33674447,  
        0.1      ,  0.10001426]])
```

In [42]:

```
Word_Topics_Pro = lda.components_ / lda.components_.sum(axis=1)[:, np.newaxis]  
print(Word_Topics_Pro)
```

```
[[4.26214959e-07 4.26226622e-07 4.26296589e-07 ... 9.26749286e-05  
 4.26214958e-07 4.26224600e-07]  
 [9.08103184e-07 9.08129903e-07 9.08117127e-07 ... 9.08141567e-07  
 9.08103183e-07 9.08184047e-07]  
 [4.23102580e-07 4.23122453e-07 4.23124754e-07 ... 4.23184920e-07  
 4.23102579e-07 4.23149298e-07]  
 ...  
 [4.82422484e-07 4.82429639e-07 4.82585606e-07 ... 5.50278063e-05  
 4.82422483e-07 4.82427697e-07]  
 [2.99951509e-07 2.99956063e-07 3.00140605e-07 ... 2.65364698e-04  
 2.99951509e-07 2.99976467e-07]  
 [4.44837417e-07 4.44841856e-07 4.44853422e-07 ... 1.49796541e-06  
 4.44837417e-07 4.44900832e-07]]
```

In [43]:

```
## Words of Topic sequence  
for topic_idx, topic in enumerate(Word_Topics_Pro):  
    print("\nTopic #{}:".format(topic_idx))  
    count_dict = (zip(ReducedTerm, topic))  
    count_dict = sorted(count_dict, key=lambda x:x[1], reverse=True)[0:5]  
    for w in count_dict:  
        print(w[0], ': {:.3f}'.format(w[1]))
```

Topic #0:  
business : 0.026  
technology : 0.024  
marketing : 0.017  
chatbot : 0.015  
prompts : 0.015

Topic #1:  
last : 0.068

powered : 0.067  
short : 0.066  
long : 0.065  
price : 0.053

Topic #2:  
content : 0.028  
world : 0.017  
data : 0.015  
writing : 0.014  
users : 0.014

Topic #3:  
crypto : 0.065  
airdrop : 0.050  
bitcoin : 0.025  
future : 0.022  
doge : 0.020

Topic #4:  
microsoft : 0.040  
bing : 0.031  
bard : 0.030  
search : 0.028  
chatbot : 0.015

Topic #5:  
asked : 0.013  
write : 0.009  
using : 0.007  
would : 0.007  
think : 0.006

Topic #6:  
free : 0.036  
news : 0.029  
trading : 0.025  
stocks : 0.022  
options : 0.018

Topic #7:  
education : 0.021  
students : 0.014  
jobs : 0.011  
going : 0.010  
edtech : 0.010

Topic #8:  
future : 0.016  
game : 0.014  
language : 0.013  
know : 0.009  
check : 0.009

Topic #9:  
machinelearning : 0.029  
midjourney : 0.028  
resume : 0.024  
python : 0.020  
aiart : 0.017

In [44]:

```
df_topic_keywords = pd.DataFrame(Word_Topics_Pro)
df_topic_keywords.columns = ReducedTerm
df_topic_keywords
```

Out[44]:

|   | aachen        | aapl         | aaron        | abilities    | ability      | able         | absolute     | absolutely   | abstract     | abstracts    | ... | zapier       | zdnet        |   |
|---|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----|--------------|--------------|---|
| 0 | 4.262150e-07  | 4.262266e-07 | 4.262966e-07 | 6.205598e-07 | 1.025935e-04 | 8.419886e-05 | 4.263732e-07 | 4.262693e-07 | 4.262320e-07 | 4.262157e-07 | ... | 4.025759e-04 | 4.262394e-07 | 4 |
| 1 | 9.081032e-07  | 9.081299e-07 | 9.081171e-07 | 9.081413e-07 | 9.081291e-07 | 9.081431e-07 | 9.081305e-07 | 9.081528e-07 | 9.081276e-07 | 9.081091e-07 | ... | 9.081106e-07 | 9.081032e-07 | 9 |
| 2 | 4.231026e-07  | 4.231225e-07 | 4.231248e-07 | 4.452703e-06 | 3.322027e-04 | 4.702099e-04 | 1.874448e-06 | 4.232483e-07 | 4.232055e-07 | 2.282031e-04 | ... | 4.231157e-07 | 5.517661e-05 | 5 |
| 3 | 5.577760e-07  | 8.679039e-05 | 5.577846e-07 | 5.577856e-07 | 5.577970e-07 | 5.579204e-07 | 5.578266e-07 | 5.848485e-06 | 5.577915e-07 | 5.577765e-07 | ... | 5.577805e-07 | 5.577803e-07 | 1 |
| 4 | 0.5411395e-07 | 1.500000e-07 | 1.000000e-07 | 1.000000e-07 | 1.000000e-07 | 5.578558e-07 | 1.000000e-07 | 1.170000e-07 | 1.000000e-07 | 1.000000e-07 | ... | 1.000000e-07 | 1.000000e-07 | 1 |

| 4 | 2.541335e-07 | 1.563825e-07 | 4.228786e-07 | 4.229064e-07 | 4.309304e-07 | 5.578553e-07 | 4.689168e-07 | 1.473034e-07 | 4.228550e-07 | 4.228511e-07 | ... | 4.228747e-07 | 4.230287e-07 | 4 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----|--------------|--------------|---|
| 5 | 1.100970e-07 | 1.101015e-07 | 9.570324e-07 | 1.534277e-04 | 9.590550e-04 | 1.999737e-03 | 8.994756e-05 | 4.378610e-04 | 1.210500e-04 | 1.392000e-06 | ... | 1.101024e-07 | 1.101032e-07 | 2 |
| 6 | 6.984668e-07 | 8.783712e-04 | 4.423433e-04 | 7.029795e-07 | 6.985188e-07 | 7.015188e-07 | 6.985303e-07 | 8.612084e-07 | 6.985327e-07 | 6.984710e-07 | ... | 6.984800e-07 | 6.985065e-07 | 6 |
| 7 | 4.824225e-07 | 4.824296e-07 | 4.825856e-07 | 4.824757e-07 | 4.824947e-07 | 4.307048e-05 | 5.786700e-05 | 1.161600e-04 | 4.824609e-07 | 4.824340e-07 | ... | 4.824306e-07 | 4.824703e-07 | 6 |
| 8 | 2.999515e-07 | 2.999561e-07 | 3.001406e-07 | 4.974530e-04 | 7.280160e-04 | 3.426409e-04 | 1.602576e-04 | 3.347149e-04 | 2.999772e-07 | 2.999673e-07 | ... | 2.999589e-07 | 1.294560e-04 | 2 |
| 9 | 4.448374e-07 | 4.448419e-07 | 4.448534e-07 | 4.448731e-07 | 4.448874e-07 | 5.213138e-07 | 2.190662e-05 | 1.147985e-04 | 2.680210e-04 | 4.448488e-07 | ... | 2.556148e-05 | 4.448468e-07 | 1 |

10 rows × 6522 columns

In [45]:

```

# Draw the WordCloud for each topic
from wordcloud import WordCloud
import math

rows = math.ceil(len(lda.components_)/4)
fig, ax = plt.subplots(rows, 4, figsize=(15,2.5*rows))
[axi.set_axis_off() for axi in ax.ravel()]

for i, comp in enumerate(lda.components_):
    terms_comp = zip(ReducedTerm, abs(comp))
    sorted_terms = sorted(terms_comp, key= lambda x:x[1], reverse=True)[:5]
    # Dictionary the top 10 of the words in each topic
    Word_Frequency = dict(sorted_terms[0:10])
    # Generate WordCloud map
    wordcloud = WordCloud(background_color="white").generate_from_frequencies(Word_Frequency)
    # Visualization
    subfig_Row = math.floor(i/4)
    subfig_Col = math.ceil(i%4)
    ax[subfig_Row,subfig_Col].imshow(wordcloud)
    ax[subfig_Row,subfig_Col].set_title("Topic {}".format(i+1))

plt.show()

```



In [46]:

```

Cleaned_doc_new = []
print("CLEANED TEXT NEW: ")
for r in range(len(Cleaned_doc)):
    each_item = []
    for t in Cleaned_doc[r].split():
        # Save the lexicon of ReducedTerm
        if t in ReducedTerm:
            each_item.append(t)
    Cleaned_doc_new.append(each_item)

```

print(Cleaned\_doc\_new[r])

## CLEANED TEXT NEW:

['asked', 'would', 'attend', 'church', 'generated', 'daysofcode', 'python', 'church', 'religion', 'stem', 'tech', 'bard', 'microsoft', 'apple', 'sunday']  
['need', 'consumer', 'first', 'approach', 'consumer', 'reports', 'says']  
['asked', 'difference', 'answer']  
['safer', 'really', 'truthgpt', 'tech', 'generativeai', 'digital', 'innovation', 'ethics', 'bias', 'algorithms', 'aiethics', 'leadership']  
['fraud', 'ydgbrgr', 'regulation', 'largelanguagemodel', 'neuralnetworks', 'promptengineering', 'machinelearning', 'deeplearning', 'lawenforcement', 'security', 'cybersecurity']  
['work', 'ydgbrgr', 'automation', 'productivity', 'aiproductivity', 'jobproductivity', 'businessmanagement', 'smallbusiness', 'executivemba', 'executivetraining', 'boardroom', 'managementscience']  
['revolutionize', 'workflow', 'chrome', 'extension', 'company', 'side', 'screen', 'integrated', 'seamless', 'access', 'knowledge', 'check', 'productivity', 'efficiency']  
['revolutionize', 'workflow', 'chrome', 'extension', 'company', 'side', 'screen', 'integrated', 'seamless', 'access', 'knowledge', 'check', 'productivity', 'efficiency']  
['prompt', 'improve', 'writing', 'getting', 'feedback', 'prompt', 'paste', 'writing', 'writing', 'grammar', 'spelling', 'mistakes', 'make', 'suggestions', 'improve', 'clarity', 'writing']  
['asked', 'person', 'commit']  
['buying', 'drop', 'repost', 'follow', 'midjourney', 'stablediffusion', 'dart', 'digitalart', 'nftgiveaway', 'money', 'azuki', 'bayc', 'nfts', 'nftshill', 'polygonnft', 'tezosnft', 'ethereumnfts']  
['dubai', 'building', 'engineering', 'marketing', 'fintech', 'generativeai', 'fintech', 'metaverse', 'ehealth', 'enricomolinari']  
['magical', 'word', 'wizard', 'write', 'kicked', 'setting', 'internet', 'good', 'kind', 'course', 'people', 'everywhere', 'lost']  
['advanced', 'nations', 'adopt', 'risk', 'based', 'regulation', 'artificial', 'intelligence', 'digital', 'agreed', 'sunday', 'european', 'lawmakers', 'hurry', 'introduce', 'rules', 'emerging', 'tools']  
['interest', 'implementation', 'generative', 'concern', 'privacy', 'trust', 'calls', 'regulation']  
['prompt', 'write', 'funny', 'cartoon', 'caption', 'description', 'happening', 'panel', 'caption', 'smartphone', 'addiction', 'description', 'person', 'sleeping', 'phone', 'hand', 'speech', 'bubble', 'saying', 'social', 'life']  
['assistant', 'blow', 'mind', 'minute', 'live', 'demo', 'youtube', 'technology', 'edtech']  
['serious', 'hand', 'bard', 'quite', 'entertaining', 'googlebard']  
['questions', 'answers', 'detect', 'fake', 'datascientists', 'edition', 'part', 'datascience']  
['upcoming', 'webinar', 'thursday', 'register', 'edtech', 'universities', 'education', 'remoteproctoring', 'automation', 'chatbot', 'highered']  
['stands', 'ready', 'help']  
['funny', 'funny', 'artificial', 'intelligence', 'funny', 'microsoft']  
['writing', 'wordpress', 'blocks', 'need', 'specific', 'otherwise', 'writes', 'code', 'know', 'need', 'clearly', 'holy', 'writes', 'awesome', 'block', 'code', 'works']  
['program', 'lead', 'education', 'graduate', 'program', 'discusses', 'ideas', 'using', 'advanced', 'academic', 'courses', 'educator', 'recent', 'blog', 'post']  
['bybit', 'recommendation', 'long', 'ticker', 'minute', 'candle', 'last', 'price', 'powered', 'lina', 'lina']  
['warn', 'increase']  
['focus', 'bots', 'threaten', 'humanity', 'left', 'news', 'plus']  
['meanwhile', 'iceberg', 'provide', 'mind', 'blowing', 'tools', 'better', 'client', 'also', 'available', 'mobile', 'need', 'take', 'peek', 'cause', 'vast', 'case']  
['asked', 'tell', 'sunday', 'cheese', 'sunday']  
['announces', 'launch', 'latest', 'driven', 'smart', 'tool', 'blockchain', 'industry', 'integrated']  
['test', 'knowledge', 'powered', 'exams', 'take', 'learning', 'next', 'level', 'challenge', 'education']  
['awesome', 'thanks', 'putting', 'together', 'webdev', 'azure']  
['apple', 'conservative', 'approach', 'strategic', 'move', 'competitive', 'tech', 'giant', 'cautious', 'stance', 'raises', 'questions', 'ability', 'compete', 'industry', 'giants', 'apple', 'siri']  
['help', 'lottery', 'telegram', 'group', 'provides', 'real', 'time', 'testing', 'lottery', 'gamefi']  
['exciting', 'news', 'fans', 'anyone', 'jailbreak', 'techniques', 'hello', 'whole', 'world', 'possibilities', 'chatbot', 'technology', 'retweet', 'chatbots', 'innovation']  
['successful', 'coder', 'learn', 'coding', 'online', 'degree', 'spend', 'hours', 'coding', 'tell', 'kids', 'learn', 'coding', 'best', 'coder', 'thank']  
['language', 'model', 'developed', 'become', 'incredibly', 'popular', 'ability', 'generate', 'human', 'responses', 'students', 'using', 'help', 'homework', 'generativeai']  
['llms', 'work', 'could', 'next']  
['tips', 'using', 'brainstorm', 'better', 'chatgptnews', 'tech', 'technology', 'news', 'elonmusk']  
['prompt', 'craft', 'winning', 'resume', 'prompt', 'make', 'position', 'resume', 'better', 'please', 'provide', 'specific', 'suggestions', 'rewrite', 'experience', 'suggestions', 'please', 'keep', 'format', 'resume', 'chaingpt']  
['never']  
['felt', 'today', 'daysofcode', 'daysofcode', 'join', 'python', 'developers', 'softwaredevelopment']  
['birdbox', 'eggs', 'feeling', 'grateful', 'rain', 'bluetit', 'birdbox', 'watch', 'live', 'rych', 'birdsoftwitter', 'openvino', 'springwatch', 'nestbox', 'python', 'bluetit', 'wildisles', 'opencv']  
['advanced', 'nations', 'adopt', 'risk', 'based', 'regulation', 'artificial', 'intelligence', 'digital', 'agreed', 'sunday', 'european', 'lawmakers', 'hurry', 'introduce', 'rules', 'emerging', 'tools']  
['gonna']  
['tips', 'know', 'using', 'marketing', 'blogging', 'marketing', 'socialmedia']  
['asking', 'goes']  
['feeding', 'data', 'analytics', 'engines', 'models', 'could', 'unintended', 'consequences', 'dataprivacy', 'read', 'datasecurity', 'blog', 'dataprotection', 'cyberresilience']  
['smart', 'become', 'machinelearning', 'deeplearning', 'tech', 'innovation', 'programming', 'nocode', 'coding', 'daysofcode', 'codenewbie']  
['recent', 'study', 'shows', 'significantly', 'outperforms', 'physicians', 'quality', 'empathy', 'answering', 'online', 'questions', 'medical', 'topics']  
['chat', 'considerations', 'teacher', 'friends']  
['front', 'back', 'setup', 'news', 'java', 'robotics', 'bigdata', 'python', 'business', 'photo', 'serverless', 'hacking', 'csharp', 'javascript', 'news', 'nfts', 'nodejs', 'learning', 'tech', 'programming', 'crypto']  
['asked', 'give', 'piece', 'advice', 'would', 'give', 'someone', 'started', 'using', 'aicommunity', 'answer']  
['chat', 'facebook', 'hack', 'tell', 'hack', 'changes', 'everything']  
['government', 'launches', 'guide', 'generative', 'applications', 'news']  
['llms', 'work', 'could', 'next', 'bingai', 'opensource', 'ethicalai', 'python', 'tech', 'aiethics', 'code', 'aichat', 'chatbot', 'chatbotai', 'bardai']  
['source']  
['prompt', 'masterpiece', 'artificialintelligence', 'machinelearning', 'aiartworks', 'aiartist', 'stablediffusion', 'midjourneyv', 'midjourneyai', 'midjourneyai', 'stablediffusionart', 'stablediffusionai']  
['really', 'home', 'llms', 'jesus', 'truth']  
['complement', 'enhance', 'human', 'intelligence', 'bingai', 'opensource', 'ethicalai', 'python', 'tech', 'aiethics', 'code', 'aichat', 'chatbot', 'chatbotai', 'bardai']  
['education', 'threat', 'tool', 'education', 'bingai', 'opensource', 'ethicalai', 'python', 'tech', 'aiethics', 'code', 'aichat', 'chatbot', 'chatbotai', 'bardai']  
['training', 'course', 'understanding', 'want', 'action', 'type', 'show', 'python', 'code', 'calculator', 'produce', 'list', 'code', 'works']

[generative', 'worker', 'productivity', 'first', 'real', 'world', 'study', 'miss', 'innovation']  
[three', 'happy', 'three', 'happy', 'wife', 'cause', 'harm', 'take', 'life', 'play', 'tiny', 'feet', 'world', 'kind', 'full', 'peace']  
[word', 'species', 'name', 'means', 'means', 'annoying', 'thanks']  
[public', 'astonishing', 'abilities', 'thing', 'thought', 'chatbot', 'meaning', 'face', 'woman', 'avatar', 'powered']  
[autogpt', 'strong', 'tool', 'bingai', 'opensource', 'ethicalai', 'python', 'tech', 'aiethics', 'code', 'aichat', 'chatbot', 'chatbotai', 'bardai']  
[agree', 'dear', 'generativeai', 'needs', 'governance']  
[discover', 'accounting', 'world', 'latest', 'podcast', 'episode', 'learn', 'practical', 'tips', 'potential', 'dangers', 'secret', 'asking', 'better', 'questions', 'embrace', 'future', 'accounting', 'tune']  
[amazon', 'microsoft', 'meta', 'bullish', 'amid', 'cost', 'cutting', 'measures', 'microsoft', 'autogpt', 'generativeai', 'chatbots', 'bard', 'bingai', 'aiartworks', 'amazon', 'meta']  
[artificial', 'intelligence', 'revolution', 'would', 'cost', 'million', 'architecture', 'based', 'nvidia', 'graphics', 'card', 'expensive', 'operate', 'artificial', 'intelligence', 'would', 'need', 'graphics', 'cards', 'answer', 'questions']  
[going', 'browser', 'baked']  
[character', 'talk', 'voice', 'using', 'browser']  
[people', 'know', 'speed', 'data', 'science', 'process', 'using']  
[software', 'engineers', 'replaced', 'machinelearning', 'devops', 'technews', 'programming', 'nocode', 'coding', 'daysofcode', 'codenewbie']  
[great', 'pause', 'debate']  
[content', 'prompt', 'mine']  
[benefits', 'bigdata', 'twitter', 'linkedin', 'europe', 'facebook', 'news', 'world', 'womenintech', 'socialmedia']  
[even', 'writer', 'found', 'using', 'sometimes', 'realize', 'could', 'written', 'needed', 'much', 'faster', 'without', 'saying', 'useful', 'tool', 'make', 'important', 'funny', 'point']  
[sell', 'bybit', 'recommendation', 'short', 'ticker', 'minute', 'candle', 'last', 'price', 'powered', 'bonk', 'bonk']  
[asked', 'write', 'book']  
[asked', 'write', 'book']  
[dave', 'taylor', 'analyze', 'prompts', 'interactions', 'daily', 'camera']  
[adopt', 'risk', 'based', 'regulation', 'propose', 'economic', 'times']  
[investors', 'keeping', 'eyes', 'bitcoin', 'cryptonews', 'cryptomarket', 'sentiment', 'result', 'neutral']  
[refuses', 'teach', 'ready', 'guide', 'consider', 'process', 'gender', 'world', 'gone']  
[want', 'understand', 'give', 'input', 'hour', 'course']  
[carbon', 'impact', 'socialselling', 'digitalselling', 'chatbot', 'leadership', 'cloudcomputing', 'technology', 'sustainability', 'quantumcomputing', 'strategy']  
[work', 'work', 'writing', 'reflection', 'great', 'grammar', 'formatting', 'creativity', 'tool', 'anyone', 'understand', 'write', 'write', 'speak']  
[generativeai', 'microsoft', 'autogpt', 'software', 'engineers', 'replaced', 'still', 'takes', 'human', 'auto', 'code']  
[enhance', 'business', 'cutting', 'edge', 'technology', 'beginners', 'course', 'offers', 'perfect', 'introduction', 'companies', 'embracing', 'digital', 'world', 'sign', 'businessinnovation']  
[language', 'model', 'developed', 'become', 'incredibly', 'popular', 'ability', 'generate', 'human', 'responses', 'students', 'using', 'help', 'homework', 'generativeai', 'midjourney', 'machinelearning']  
[might', 'artificial', 'intelligence', 'stop', 'humans', 'asking', 'hand', 'order', 'make', 'sure', 'efficiency', 'bank', 'credit', 'economy']  
[access', 'italy', 'following', 'initial', 'italian', 'dataprotection', 'authority', 'privacy', 'concerns', 'read', 'news', 'article', 'find', 'thoughts', 'chatbots']  
[generativeai', 'microsoft', 'autogpt', 'generated', 'beer', 'pizza', 'offer', 'glimpse', 'future', 'film', 'impressed', 'nowhere', 'near', 'photo', 'realistic']  
[greg', 'brockman', 'official', 'version', 'autogpt', 'using']  
[behind', 'lawmakers', 'challenge', 'generative', 'tech']  
[work', 'also', 'game', 'changer', 'side', 'optimizing', 'blog', 'posts', 'creating', 'product', 'listings', 'generating', 'meta', 'data', 'graphics', 'create', 'much', 'time', 'hands']  
[know', 'also', 'learn', 'adapt', 'specific', 'user', 'preferences', 'time', 'allows', 'increasingly', 'personalized', 'accurate', 'interactions', 'opening', 'human', 'collaboration']  
[advantages', 'email', 'marketing', 'software', 'business', 'emergingtech', 'email', 'marketing', 'software', 'digitalmarketing', 'sales', 'technology', 'coruzant', 'thedigitalexecutive']  
[discover', 'incredible', 'potential', 'revolutionizing', 'customer', 'service', 'streamlining', 'business', 'processes', 'learn', 'advanced', 'natural', 'language', 'processing', 'powers', 'accuracy', 'efficiency', 'despite']  
[still', 'please', 'battle', 'thinks', 'human']  
[microsoft', 'stop', 'making']  
[gets', 'life', 'italy', 'announces', 'altman']  
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In [47]:

```
import gensim.corpora as corpora
# Sort the each words in the Text
# Construct a dictionary of {Term : Index}
id2word = corpora.Dictionary(Cleaned_doc_new)
print(id2word.token2id)
```

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In [48]:

# Words in topic(Index, Occurrences)

Corpus = [id2word.doc2bow(text) for text in Cleaned\_doc\_new]

Corpus

Out[48]:

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## 4. Use gensim to Evaluate the LDA Module

In [49]:

```

import gensim
from gensim.models.ldamodel import LdaModel
from pprint import pprint

```

*# Use gensim to create the object of LDA Module*

```

lda_model = LdaModel(corpus=Corpus, id2word=id2word,
                    num_topics=10, random_state=100)

```

*# Print out ten topics' keywords*

```

pprint(lda_model.print_topics(num_words=10))
doc_lda = lda_model[Corpus]

```

```

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 '0.021**powered" + 0.016**stack"),
 (3,
 '0.029**dalle" + 0.029**future" + 0.026**twitter" + 0.022**imagine" + '
 '0.018**created" + 0.016**style" + 0.013**ideas" + 0.012**marketing" + '
 '0.012**amazing" + 0.011**check"),
 (4,
 '0.026**mind" + 0.016**feel" + 0.014**power" + 0.013**correct" + '
 '0.012**play" + 0.011**examples" + 0.011**blowing" + 0.011**wait" + '
 '0.009**link" + 0.008**error"),
 (5,
 '0.019**intelligence" + 0.016**join" + 0.016**artificial" + 0.014**crypto" + '
 '0.014**bitcoin" + 0.014**wrote" + 0.012**python" + 0.010**done" + '
 '0.010**future" + 0.010**giveaway"),
 (6,
 '0.024**write" + 0.024**asked" + 0.016**using" + 0.012**question" + '
 '0.010**help" + 0.010**content" + 0.010**questions" + 0.009**create" + '
 '0.009**writing" + 0.009**make"),
 (7,
 '0.044**midjourney" + 0.039**stablediffusion" + 0.023**aiart" + '
 '0.022**rlyimpqw" + 0.019**guess" + 0.017**innovation" + 0.017**crazy" + '
 '0.014**follow" + 0.014**money" + 0.014**thread"),
 (8,
 '0.040**language" + 0.027**model" + 0.024**machinelearning" + 0.022**data" + '
 '0.020**chatbot" + 0.019**tech" + 0.018**models" + 0.014**based" + '

```

```

0.014**"smart" + 0.014**"openaichat"),
(9,
'0.092**"world" + 0.040**"business" + 0.031**"technology" + '
'0.020**"openaichatgpt" + 0.019**"perfect" + 0.018**"digital" + 0.017**"course" '
'+ 0.015**"plan" + 0.014**"received" + 0.014**"fascinating"'))

```

In [50]:

```

# Use Cleaned_doc_new to Evaluate the Coherence Score
from gensim.models import CoherenceModel
coherence_model_lda = CoherenceModel(model=lda_model,
                                     texts=Cleaned_doc_new,
                                     dictionary=id2word,
                                     coherence='c_v')

coherence_lda = coherence_model_lda.get_coherence()
print("\nCoherence Score: ", coherence_lda)

```

Coherence Score: 0.3751315105852465

In [51]:

```

# Find the best Topic
Topics = list(range(2, 11, 1))
coherence_scores = []
Trained_Models = []
for top in Topics:
    lda_model = LdaModel(corpus=Corpus,
                        id2word=id2word,
                        num_topics=top,
                        random_state=100)

    # Keep the trained models
    Trained_Models.append(lda_model)
    # Compute coherence score for each model
    coherence_model_lda = CoherenceModel(model=lda_model,
                                         texts=Cleaned_doc_new,
                                         dictionary=id2word,
                                         coherence='c_v')

    coherence = coherence_model_lda.get_coherence()
    # Save and print the coherence scores
    coherence_scores.append(coherence)
    print('Topic Number: {0} -- Coherence: {1}'.format(top, coherence))

```

Topic Number: 2 -- Coherence: 0.3445028557038753  
 Topic Number: 3 -- Coherence: 0.3374320967982157  
 Topic Number: 4 -- Coherence: 0.34378026359350944  
 Topic Number: 5 -- Coherence: 0.36653460651896913  
 Topic Number: 6 -- Coherence: 0.33506808810982286  
 Topic Number: 7 -- Coherence: 0.36629086055103005  
 Topic Number: 8 -- Coherence: 0.34463335478858764  
 Topic Number: 9 -- Coherence: 0.37677539213639427  
 Topic Number: 10 -- Coherence: 0.3751315105852465

In [52]:

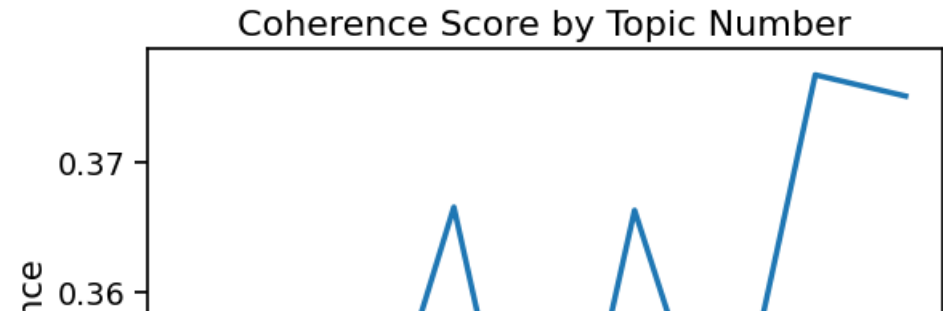
```

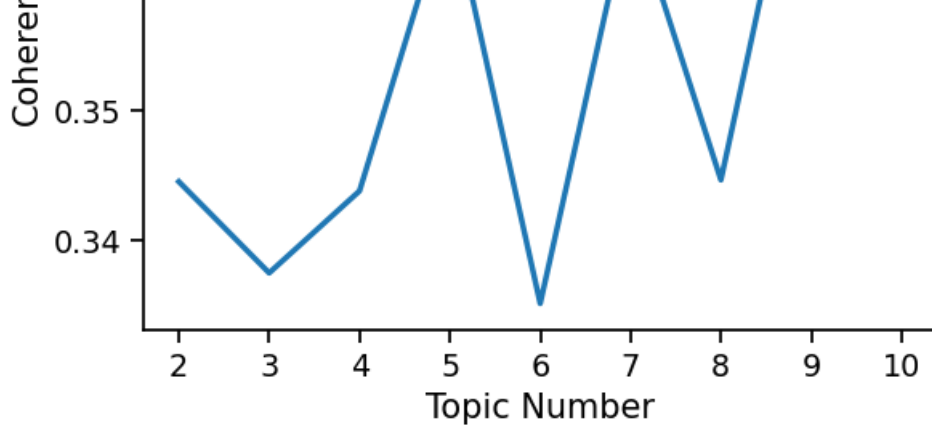
plt.plot(coherence_scores)
plt.xticks(range(0,len(Topics)), Topics)
plt.title('Coherence Score by Topic Number', fontsize=16)
plt.xlabel('Topic Number')
plt.ylabel('Coherence')

```

Out[52]:

Text(0, 0.5, 'Coherence')





In [53]:

```
lda_model = Trained_Models[np.argmax(coherence_scores)]
```

```
# Show Top10 words in the topics
lda_model.show_topics(num_words=10)
```

Out[53]:

```
[(0,
  '0.019**"wrote" + 0.016**"explain" + 0.015**"different" + 0.015**"done" + 0.014**"gave" + 0.013**"test" + 0.012**"script" + 0.012**"took" + 0.012**"else" + 0.012**"twitter"',
  (1,
    '0.025**"asked" + 0.022**"write" + 0.013**"good" + 0.012**"using" + 0.012**"would" + 0.011**"know" + 0.011**"think" + 0.010**"people" + 0.009**"code" + 0.008**"time"',
    (2,
      '0.068**"poem" + 0.050**"last" + 0.048**"time" + 0.045**"long" + 0.035**"short" + 0.032**"guess" + 0.026**"stackoverflow" + 0.021**"conversations" + 0.019**"powered" + 0.018**"received"',
      (3,
        '0.027**"dalle" + 0.025**"future" + 0.020**"imagine" + 0.019**"seems" + 0.016**"join" + 0.013**"game" + 0.013**"thought" + 0.011**"rlyimpqw" + 0.011**"video" + 0.010**"twitter"',
        (4,
          '0.024**"even" + 0.022**"question" + 0.019**"still" + 0.014**"answer" + 0.012**"replace" + 0.011**"wrong" + 0.011**"mind" + 0.011**"going" + 0.008**"able" + 0.008**"right"',
          (5,
            '0.018**"language" + 0.018**"chatbot" + 0.015**"tech" + 0.015**"technology" + 0.014**"model" + 0.013**"intelligence" + 0.011**"artificial" + 0.010**"world" + 0.009**"future" + 0.009**"potential"',
            (6,
              '0.023**"asking" + 0.018**"business" + 0.016**"education" + 0.015**"marketing" + 0.014**"students" + 0.013**"learn" + 0.012**"world" + 0.012**"content" + 0.011**"writing" + 0.011**"free"',
              (7,
                '0.042**"midjourney" + 0.037**"stablediffusion" + 0.034**"thread" + 0.024**"style" + 0.023**"aiart" + 0.020**"song" + 0.017**"make" + 0.015**"prompt" + 0.013**"money" + 0.012**"campaign"',
                (8,
                  '0.028**"crypto" + 0.026**"python" + 0.025**"bitcoin" + 0.024**"machinelearning" + 0.018**"giveaway" + 0.017**"blockchain" + 0.016**"coding" + 0.014**"smart" + 0.014**"metaverse" + 0.014**"openaichat"')])])])])])])])])])])]
```

In [ ]: