Automatic Twitter Event Summarization: Making Sense of War in Ukraine

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DATA 690: Introduction to Natural Language Processing

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Install Necessary Libraries

```
!pip install -q bertopic
!pip install -q python-louvain
!pip install -q -U sentence-transformers
!pip install -q transformers
!pip install -q rouge
!pip install -q emoji
!pip install -q pandarallel
!pip install -q sumy
!pip install -q textrank4zh
!pip install -q textstat
```

```
import pandas as pd
pd.set_option('display.max_rows', 500)
pd.set_option('display.max_columns', 500)
import re
import numpy as np
import nltk
import matplotlib.pyplot as plt
import spacy
from nltk.tokenize import word_tokenize
from nltk.corpus import stopwords
nltk.download('stopwords')
nltk.download('punkt')
from datetime import datetime, timedelta
import ast

# ner
from spacy import displacy
import emoji
import string
```

```python
# topic modeling
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.decomposition import NMF
from bertopic import BERTopic

# clustering
from sklearn.metrics.pairwise import linear_kernel
from tqdm.notebook import tnrange
import networkx as nx
import community.community_louvain as community_louvain
from sentence_transformers import SentenceTransformer, util
import umap
import hdbscan
from bertopic import BERTopic
from gensim.summarization import keywords
from wordcloud import WordCloud

# sentiment analysis
from nltk.sentiment.vader import SentimentIntensityAnalyzer
from nltk.stem import SnowballStemmer
from nltk.sentiment.vader import SentimentIntensityAnalyzer
from sklearn.feature_extraction.text import CountVectorizer
from textblob import TextBlob as tb
nltk.download('vader_lexicon')
from pandarallel import pandarallel

# summarization
from transformers import pipeline
from rouge import Rouge
from statistics import mean
import seaborn as sns
import math
from collections import Counter
from nltk.probability import FreqDist
from sentence_transformers.util import cos_sim as cos_sim_
import transformers
from transformers import BartTokenizer, BartForConditionalGeneration
import textwrap
from gensim.summarization import summarize
from spacy.lang.en.stop_words import STOP_WORDS
from sumy.parsers.plaintext import PlaintextParser
from sumy.nlp.tokenizers import Tokenizer
from sumy.summarizers.lex_rank import LexRankSummarizer
from sumy.summarizers.text_rank import TextRankSummarizer
from sumy.summarizers.lsa import LsaSummarizer
from string import punctuation
from heapq import nlargest
import sys
from textrank4zh import TextRank4Sentence
import textstat

# settings
```

```
# settings
from warnings import simplefilter
simplefilter(action='ignore', category=FutureWarning)
simplefilter(action="ignore", category=DeprecationWarning)
import multiprocessing
# check number of cores available
print('\nNUMBER OF CPU CORES:', multiprocessing.cpu_count())
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package vader_lexicon to /root/nltk_data...
[nltk_data]   Package vader_lexicon is already up-to-date!

NUMBER OF CPU CORES: 4
```

Data Preparation

IMPORTANT:

1) The filepath may need to be changed to point to the location of the datafile.

2) The lineterminator='\n' parameter is necessary to ensure Pandas reads the file correctly.

```
# mount google drive
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call dri
```

```
# load original data file for custom preprocessing in NER and Sentiment Analysis
tweets_original = pd.read_csv('/content/drive/MyDrive/Ukraine_war.csv')
```

```
# load cleaned data
tweets = pd.read_csv('/content/drive/MyDrive/ukraine_war_clean_.csv', lineterminator='
```

```
# view original file
tweets_original.head()
```

	_type	url	date
0	snscrape.modules.twitter.Tweet	https://twitter.com/ksenijapavlovic/status/150...	2022-03-05 23:59:58+00:00
1	snscrape.modules.twitter.Tweet	https://twitter.com/ty_phoon31/status/15002598...	2022-03-05 23:59:58+00:00
2	snscrape.modules.twitter.Tweet	https://twitter.com/ann_peace22/status/1500259...	2022-03-05 23:59:54+00:00
3	snscrape.modules.twitter.Tweet	https://twitter.com/GardensR4Health/status/150...	2022-03-05 23:59:52+00:00

```
# view cleaned data
tweets.head()
```

	content	date	content_clean	tokenized	tokens_no_stopwor
0	There was an anti war protest for #Ukraine as ...	2022-03-05 23:59:58+00:00	there was an anti war protest for ukraine as w...	['there', 'was', 'an', 'anti', 'war', 'protest...	['anti', 'war', 'prote 'ukraine', 'well'
1	https://t.co/Z1pURKlNHu NATO followed USA into...	2022-03-05 23:59:58+00:00	nato followed usa into afghanistan forgotten a...	['nato', 'followed', 'usa', 'into', 'afghanist...	['nato', 'followed', 'us 'afghanistan', 'f
2	@mfa_russia @RusEmbUSA @RussiaUN @MFA_Ukraine ...	2022-03-05 23:59:54+00:00	it s not russophobia we just hate putin and al...	['it', 's', 'not', 'russophobia', 'we', 'just'...	['russophobia', 'ha 'putin', 'enablers',
3	@nytimes This war could have been avoided by e...	2022-03-05 23:59:52+00:00	this war could have been avoided by ensuring t...	['this', 'war', 'could', 'have', 'been', 'avoi...	['war', 'could', 'avoide 'ensuring', 'puti
4	@ggreenwald Remember the biggest mistake made ...	2022-03-05 23:59:52+00:00	remember the biggest mistake made by those who...	['remember', 'the', 'biggest', 'mistake', 'mad...	['remember', 'bigge 'mistake', 'made', 's

```
# convert to datetime object
tweets.date = pd.to_datetime(tweets.date)
```

```
tweets.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199480 entries, 0 to 199479
Data columns (total 8 columns):
 #   Column                    Non-Null Count   Dtype
---  ------                    --------------   -----
 0   content                   199480 non-null  object
 1   date                      199480 non-null  datetime64[ns, UTC]
 2   content_clean             199480 non-null  object
 3   tokenized                 199480 non-null  object
 4   tokens_no_stopwords       199480 non-null  object
 5   token_sents_no_stops      199480 non-null  object
 6   lemmatized_no_stops       199480 non-null  object
 7   lemmatized_sent_no_stops  199480 non-null  object
dtypes: datetime64[ns, UTC](1), object(7)
memory usage: 12.2+ MB
```

▾ Group Tweets by Time

```
# get range of dates in corpus
last_date = tweets.date.max().date() + timedelta(days=1)
first_date = tweets.date.min().date()
date_range = pd.date_range(start=first_date, end=last_date)
date_range
```

```
DatetimeIndex(['2021-12-31', '2022-01-01', '2022-01-02', '2022-01-03',
               '2022-01-04', '2022-01-05', '2022-01-06', '2022-01-07',
               '2022-01-08', '2022-01-09', '2022-01-10', '2022-01-11',
               '2022-01-12', '2022-01-13', '2022-01-14', '2022-01-15',
               '2022-01-16', '2022-01-17', '2022-01-18', '2022-01-19',
               '2022-01-20', '2022-01-21', '2022-01-22', '2022-01-23',
               '2022-01-24', '2022-01-25', '2022-01-26', '2022-01-27',
               '2022-01-28', '2022-01-29', '2022-01-30', '2022-01-31',
               '2022-02-01', '2022-02-02', '2022-02-03', '2022-02-04',
               '2022-02-05', '2022-02-06', '2022-02-07', '2022-02-08',
               '2022-02-09', '2022-02-10', '2022-02-11', '2022-02-12',
               '2022-02-13', '2022-02-14', '2022-02-15', '2022-02-16',
               '2022-02-17', '2022-02-18', '2022-02-19', '2022-02-20',
               '2022-02-21', '2022-02-22', '2022-02-23', '2022-02-24',
               '2022-02-25', '2022-02-26', '2022-02-27', '2022-02-28',
               '2022-03-01', '2022-03-02', '2022-03-03', '2022-03-04',
               '2022-03-05', '2022-03-06'],
              dtype='datetime64[ns]', freq='D')
```

```
# function to group tweets by selected time interval
def tweets_by_time_interval(data=None, interval=2, just_groups=False):
    """
  Parameters:
    data: dataframe (tweets)
    interval: int (number of days in each time interval)
    just_groups: bool (return only the groupings of dates)
```

```
  Returns:
    date_groups: list
    tweets_date: dataframe
  """
  selected_interval = interval
  date_groups = list(zip(*(iter(date_range),) * selected_interval))
  if just_groups:
    return date_groups
  tweets_date = []
  for i in date_groups:
    start = str(i[0].to_pydatetime())
    end = str(i[-1].to_pydatetime() + timedelta(days=1))
    tweets_date.append(data.loc[(data.date > start) & (data.date <= end)])
  return tweets_date


# define function to remove emojis
def remove_emoji(string):
    return emoji.get_emoji_regexp().sub(u'', string)
```

Part 1. Sub-event and Main Idea Detection

1.1. Named Entity Recognition

```
# load the model
NER = spacy.load("en_core_web_sm")


# get data
tweets_ = tweets.copy()
# convert to datetime object
tweets_.date = pd.to_datetime(tweets_['date']).dt.date
# select relevant columns
tweets_ = tweets_[['date', 'token_sents_no_stops']]


tweets_.head()
```

	date	token_sents_no_stops	
0	2022-03-05	anti war protest ukraine well getting headline	

```
combined_df = tweets_.groupby('date', as_index=False)['token_sents_no_stops'].apply('
```

```
combined_df.head()
```

	date	token_sents_no_stops	
0	2021-12-31	us want russia ukraine fight proxy war supply ...	
1	2022-01-01	purpose whitewashing russian bellicose stance ...	
2	2022-01-02	hilarious kremlin propaganda bullshit could st...	
3	2022-01-03	imagine putin xi mullahs simultaneously making...	
4	2022-01-04	avert war west welcome ukraine reformed russia...	

```
# define function for NER
def get_NER(raw_text, len_):
  text1= NER(raw_text)
  for word in text1.ents[:len_]:
    print(word.text,word.label_)


# output sample NER
raw_text = combined_df['token_sents_no_stops'].values[0]
get_NER(raw_text, 25)
```

```
us GPE
russia GPE
ukraine GPE
ukraine GPE
russia GPE
vietnam GPE
afghanistan GPE
russian NORP
russia nato ORG
eastern europe LOC
russia GPE
russia GPE
russia GPE
first.putin GPE
ukraine GPE
russia GPE
ukraine GPE
russia GPE
vietnam GPE
afghanistan GPE
european NORP
ukraine GPE
russia GPE
```

```
    new year EVENT
    ukraine GPE
```

```python
# visualize NER
text1= NER(raw_text)
displacy.render(text1,style="ent",jupyter=True)
```

led jew **NORP** kyiv guess even north korea **GPE** venezuela **GPE** syria **GPE** fooled putin **PERSON** propaganda.putin afford financially intervention syria **GPE** would able afford ukraine **GPE** country weakened pandemic would position wage war russia **GPE** would end like japan **GPE** wwii.well sanctions preferable war retribution aggression ukraine.russia invaded crimea eastern **ORG** ukraine **GPE** placed war time footing typical russian **NORP** aggression.say **ORG** ukraine act w us eu support theoretical offensive would harm kyiv ties west amp risky point **PRODUCT** appears assumptions ideas behind russia **GPE** war footing exactly able coexist one **CARDINAL** another.last years kiev **GPE** drafting fight ukraine **GPE** war donbass.cia start another war ukraine **GPE** trending.bad year **DATE** decline freedom without fundamental change biden administration see changing worst risk truly disastrous attacks ukraine **GPE** taiwan **GPE** major war middle east **LOC** would take.greatly doubt putin **PERSON** would ever fire icbms matter badly things went ukraine putin **PERSON** mobster suicidal however use biological chemical weapons eventually also tactical nukes ukraine **GPE** war turns.diplomatic talks hostile nuclear power make remotely close equals us gdp times size russia **GPE** putin threatens war ukraine biden help stabilize situation bravo toddler tantrum needs attention.one brave woman stands moscow **GPE** holding sign saying war ukraine.without us **GPE** fascist europe **LOC** would either competing russia **GPE** eastern europe cold war type thing even nato **ORG** russia **GPE** ukraine **GPE** would anchor euroasianism russia **GPE** would central authority dont rly see options.true rope dope fashion putin **PERSON** setup biden fall guy phone calling biden refuse outrageous demands pretext invasion ukraine **GPE** maybe new years eve **EVENT** surprise attack stay alert ready go war.hopes begin war ukraine.aww poor teddy bear war hopes dashed russia **GPE** hails biden putin **PERSON** call good basis dial ukraine **GPE** tensions.russian war agitation putin **PERSON** russia **GPE** aggressors nato **ORG** ukraine **GPE** eu **ORG** usa.interesting developments east europe **LOC** ukraine must true sense conform regional strategy stop agitating war neighbours please foreign interests american **NORP** must respect far territories conform needs priorities interests.worth time scroll went invading ukraine nuclear war well escalated quickly.biden **NORP** putin **PERSON** call really avert war ukraine via.putin trying distract corruption authoritarianism memorial threatening war threatens international security putin **PERSON** threatens ukraine **GPE** greater instability russia **GPE** deserves better putin.must also remember russia **GPE** putin **PERSON** started war ukraine **GPE**

lost gdp.ukrainians consider russia **GPE** unfriendly hostile state due russia **GPE** aggression e war donbas annexation crimea ukraine **GPE** lost billion.soviet union **ORG** backed cuba **GPE** cuba **GPE** long long way ussr **GPE** near usa **GPE** similarly ukraine near russia **GPE** far usa **ORG** position means lot war.wow fact russia **GPE** found whatever want amp joey answer **PRODUCT** soon israeli iran war **EVENT** begins january **DATE** caused biden abandoning allies russia **GPE** move ukraine **GPE** followed china **GPE** taking taiwan.moscow old arbat war ukraine.ukraine yet part eu **ORG** blaming eu **ORG** f war yugoslavia **GPE** countries eu **ORG** time quoting nazi **NORP** anthem eu **ORG** über alles know offensive get historic facts right posting.spy dumb bears omicron end pfizer oral pill soon endemic russia **GPE** ukraine **GPE** bullish sorry war bullish.peace yugoslavia **GPE** example ukraine **GPE** austerity fiscsal responsibility democracy grece vote oxi means rule banks oh yes lets drink fortress europe **LOC** continuous war workers countries eu **ORG** uber alles cheers.basically ukraine **GPE** lost media war west helped lot funding protecting fake anticorruption activists close none quality control grants spending achieved results.reminder russia **GPE** already invaded ukraine **GPE** whether military crimea puppets continues wage war ukraine.really sick compare holodomor ukraine **GPE** relief efforts made bengal famine colonial administration **ORG** damndest help despite refugee crises caused war amp japanese **NORP** invasion sick anti english **LANGUAGE** racist.solicitude united nations **ORG** crystal pallace offer párts disagreement beligerancy ukraine **GPE** crisis un **ORG** mediation among parts peace resolution avoiding nuclear war europe **LOC** thanks reading.russia red line moscow **PRODUCT** allow ukraine **GPE** join nato **ORG** world war iii **EVEN** hangs balance com russias red line moscow **GPE** wont allow ukraine **GPE** join nato **ORG** wwiii html.war profiteers chompin bit putin **PERSON** move ukraine **GPE** putin bidens **PERSON** cronies make millions **CARDINAL** war dead.desperate bid avert war biden putin **PERSON** showdown today **DATE** ukraine **GPE** hangs balance.better ground war air war like nato serbia **ORG** countries also ukraine **GPE** ex soviet **NORP** country america **GPE** always get wars country get involved america **GPE** attack vietnam **GPE** serbia **GPE** many countries.newyear almost upon us look bacl guiding hand linking downing flight mh invasion crimea bloody donbas war eastern ukraine **GPE** donbass.multi front war know china **GPE** attack taiwan **GPE** amp russia **GPE** attack ukraine.breakingnews pres biden amp russia **GPE** putin holding second **ORDINAL** video conference

rising tensions ukraine exiger matt hayden **PERSON** tells cheddar russia **GPE** cyber war west longer term risk gisermangroup get noticed.breakingnews pres biden amp russia **GPE** putin holding second **ORDINAL** video conference rising tensions ukraine exiger matt haden **PERSON** tells cheddar russia **GPE** cyber war west longer term risk gisermangroup get noticed.ukraine going nuclear akin nato **ORG** us using nukes russia **GPE** crossing russia **GPE** redline triggering nuke war imho wont happen.thanks us **GPE** ukraine **GPE** historically part russia **GPE** led coup president professional comedian **PERSON** current parliament **ORG** honoring nazi **NORP** war heroes wtg vicky newland.aware probably nato **ORG** guarantee war europe **LOC** schools buildings eastern **ORG** ukraine **GPE** damaged russian **NORP** invading proxy forces russiaoutofukraine.russians supports putin war **PERSON** ukraine **GPE** west culture everyday russian **NORP** society thing know would revolution dignity style uprising years ago **DATE** nope.russia **GPE** knows war conquering furthermore see ukraine **GPE** country breakaway state upset poison us **GPE** commit genocide eliminate nation keep trying.russians **NORP** pretend ruthenians **NORP** without ukraine **GPE** time war history.putin says russia **GPE** want war ukraine **ORG** urges west meet **LOC** demands quickly nbc **ORG** news.guess probably one **CARDINAL** reason washington **GPE** need reinforce eastern flank send hardware decide event skirmish small wide scale war breaks europe **LOC** starting ukraine.ukraine service personnel kia year **ORG** russia **GPE** ongoing war ukraine puts names faces report.yes would im polish **NORP** im highly interested topic military polish **NORP** armed forces currently suffitient means wage war force avaiable send ukraine **GPE** like european country.clinton **ORG** signed treaty come defense regardless war coming covid next story crisis kremlin **ORG** making biden putin **PERSON** speak amid tensions ukraine.time new year **EVENT** biden escalates military standoff ukraine **GPE** looks like may get another war decades.terrorism israeliterrorism forcible evictions amp demolition homes indigenous people order steal land amp give recently arrived settlers russia **GPE** ukraine europe amp usa constitute war crimes israeliwarcrimes israeliwarcrimes.reporting ab putin **PERSON** biden call long repeat idea war looming amp russia **ORG** feels provoked ukraine **GPE** defensive decisions play putin **PERSON** imperial agenda war broke ukrainians right decide fate.attention paid risks military posturing amp show force russia **GPE** amp armscontrol stabilize situation strategic ambiguity risk war russia **GPE** ukraine.remember north south

korea **GPE** almost glimpse war new year **EVENT** russia **GPE** ukraine turn anyone omicron spread stat ukrainian **NORP** border among hundred thousand **CARDINAL** russian **NORP** troops crazy world huh.china must collapse one **CARDINAL** two **CARDINAL** collapse sure unlikely china **GPE** ukraine **GPE** smells kosovo **GPE** us **GPE** engineered kosovo **GPE** war organize capital flight europe **LOC** weaken euro europe **LOC** normally unite prevent war europe **LOC** costs.guess possibly starting nuclear war ukraine **GPE** good thing.also ukraine **GPE** join nato **ORG** conflict russia nato **ORG** rule unstable country conflict accede ukraine **GPE** joined nato **ORG** would war russia **GPE** article.full scale russian **NORP** invasion unoccupied ukraine **GPE** would far largest boldest riskiest military operation moscow **GPE** launched since inva **ORG** sion afghanistan **GPE** crimea donbas ukraine **ORG** europe **LOC** russia **GPE** war.seen numerous interviews ordinary ukrainians enlisted fight guerilla war putin **PERSON** forces invade war would last years years **DATE** ukraine **GPE** ready give sovereignty putin **PERSON** warped nostalgia.would world economy even notice russia **GPE** war ukraine.fact russia **GPE** waged war chechnya georgia **ORG** ukraine syria post **ORG** soviet **NORP** period forgotten.episode panellists guest discuss risk war ukraine **GPE** uk **GPE** carrier strike group announcement terrorist groups iraq.aggression russia **GPE** russia **GPE** annexed crimea funding civil war ukraine considered aggression nato **ORG** move east want ukraine **GPE** wants join nato **ORG** choice sovereign state.separating ukraine **GPE** area influence soviet union **GPE** stupid separating virginia **GPE** rest united states george f kennan **PERSON** father doctrine containing soviet **NORP** expansion cold war.favor us **GPE** inserting war russia **GPE** ukraine.us position must war dangerous unpredictable fight also tell putin ukraine **PERSON** automatically admitted nato **ORG** invades.looks like ukraine **GPE** baltics even eu **ORG** us nato hard time finding peace neutrality peaceful co existence independent states without existence soviet union **GPE** peace guarding capacities alternative peace neutrality join war.biden rings putin **PERSON** say sanctions russia **GPE** could launched russia **GPE** starts war ukraine **GPE** putin threatens ukraine **GPE** must allowed join nato **ORG** ever via boris johnson **PERSON** backboris johnson eu labour **PERSON** starmer.terse white house **ORG** statement said made clear united states **GPE** allies partners respond decisively russia **GPE** invades ukraine putin **PERSON** calculates political meaningful response get war.told new putin **PERSON** soldiers come ukraine **GPE**

really war.must say may follow tweeters necessary agree curious see makes tick however agree remainatiks

brussels **GPE** going lead us third world war **EVENT** want add ukraine **GPE** eu **ORG** fold

CARDINAL cost.putin standard imperialist comparing hitler ignorant charge mil people big country certain

interests case breaking ukraine **GPE** land grab would evil taking land mexico **GPE** war.vladimir

putin **PERSON** invades ukraine **GPE** declaration war nato respond **EVENT** talk nato **ORG**

needs act event seen weak putin **PERSON** even consider poland **GPE** target.hope god wrong putin

PERSON ordering troops ukraine **GPE** border china **GPE** threatening taiwan **GPE** odds

involved front war wounded biden.interesting family history grandparents fleeing ukraine **GPE** war mam

family name descending polish **NORP** royalty honestly remember shit many people involved.backstop

case russians **NORP** cant sustain offensive turn parts ukraine **GPE** passport protectorate justify

endless war brilliant leaders handle last wars highly doubt.putin told invasion ukraine **GPE** war without

end drip drip **GPE** drip body bags.unify ru military donbass ukraine **ORG** poor moscow **GPE** rule

cccp **ORG** mostly kremlin **ORG** loyalists since shed poverty industrial center occupied seaports

threatened fdi trade kept away war escalation risks.nato waging undeclared war kurdish **NORP** nation

appease erdogan rising tensions west russia **GPE** possible invasion ukraine **GPE** turkey

geographic location **ORG** makes even valuable warmongers west kurds.nuclear war unlikely stage us

GPE knows pretty well continue troll russia **GPE** indefinitely russia **GPE** knows well ukraine nato

ORG matter time us **GPE** drop idea.russia **GPE** invade ukraine **GPE** likely proxy war via

wagner group east.nothing written coup etat february kiev **GPE** democratically elected president fine

elections according osse ukraine **GPE** replace minsk ii **PERSON** agreement civil war people eastern

ukraine.us wants start war russian **NORP** border like russia **GPE** vs ukraine **GPE** russia **GPE**

tells us **GPE** strike ukraine **GPE** us dawned would able stay safe overseas fright come.would

nuclear war ukraine **GPE** ukraine **GPE** proxy front nuclear war years ago one.dec russia **GPE**

orcs eastern **ORG** ukraine **GPE** kept europe **LOC** year war going daytime quiet hey know

putin **PERSON** like peace ukrainian **NORP** military report overnight mortar shelling amp artillery

thankfully hit donbas **GPE** donbass.german green death cult squared russia **GPE** let go war

ukraine **GPE** food let way less energy fundamentally bad.likely negotiations fail military experts say

something important big war local wars happen direct war hardly possible nato **ORG** border russia

GPE crucial means war ukraine.could given putin billions **PERSON** allowing pipeline would fund putins war machine ukraine.maybe ukraine **PERSON** tell russia **GPE** empire war sanctions solve everything.kremlin aide ushakov biden **PERSON** says several times nuclear war putin responds biden west imposes destructive sanctions escalation ukraine **GPE** complete shutdown relations russia **GPE** u.moscow buildup troops near ukraine **GPE** borders bellicose rhetoric raised prospect **ORG** major conventional war europe **LOC** phone call today joe biden vladimir putin **PERSON** underscores dangers kremlin **ORG** manufactured crisis.one call scholz change berlin **GPE** gas policy would lead withdrawal donbass merkel steinmeier maaß scholz **PERSON** also responsible russia **GPE** war ukraine **GPE** everyone knows one **CARDINAL** wants say loud.consequences cold war future must integration full membership russia **GPE** ukraine **GPE** eu.based report lack nato **ORG** amp us **GPE** assurances means way russia **GPE** guarantee safety invade destabilise ukraine **GPE** cold war supposed see end nato **ORG** expansion yet crept russian **NORP** borders false pretences.weird many people call civil war internal matter ukraine **GPE** happen russian **NORP** citizens.serbia outside ukrainian **GPE** embassy protesters chanting crimea russia **GPE** kosovo serbia **GPE** crimea donbas ukraine europe **ORG** russia **GPE** war.constructive relationship war criminals lied amp invaded yugoslavia **GPE** afghanistan **GPE** iraq **GPE** libya **GPE** syria **GPE** amp ukraine.least someone mentioning terminal destination logic train russia **GPE** invades ukraine **GPE** unrestricted war spills russia nato **ORG** member countries russia **GPE** begins lose russia **GPE** escalates de escalate escalates icbms.us russian **NORP** leaders repeated red lines **ORG** ukraine **GPE** ahead new year **EVENT** talks designed prevent new war europe **LOC** unitedstates russia **GPE** ukraine.worst case scenario would involve de facto russian **NORP** control territory east dnipro river **LOC** still opportunity ukraine **GPE** acquire long range weapons systems including reach russia **GPE** war continue expand.uatv launched campaign aimed reach audience russia **GPE** warn russians **NORP** participation war ukraine russians **NORP** let zhirinovsky **PERSON** go trench stay home.article **PERSON** says us **PERSON** said use force ukraine **GPE** idea us **GPE** risk war russia **GPE** straw man argument war risk exaggerated make de fuse outcome look like gain somehow comparable nixon **PERSON** geopolitical win.notion putin **PERSON** could economically politically afford go war ukraine **GPE** baffling would likely result downfall anything else.biden putin **PERSON** dey threaten

eachother shey war happen like ukraine **GPE** situation.december simon wiesenthal **PERSON** born

buczacz ukraine **GPE** holocaust survivor dedicated life tracking nazi **NORP** war criminals co founded

jewish **NORP** historical documentation centre linz austria gather evidence war trials.n n acting tough

russia **GPE** right middle trying talk sense people avoid suffering might come nuclear war end n b c ukrain

taiwan n.b eastern european **NORP** countries biden administration said concede either demands usa

nato **ORG** really hold cards russia **GPE** decides invade ukraine **GPE** keep nato **ORG** away

borders going go war.yet russians **NORP** want much chance getting without major war even west **LOC**

capitulate unlikely ukraine **GPE** certainly pr point **ORG** scored kremlin change.us **PERSON**

russian **NORP** leaders repeated red lines **ORG** ukraine **GPE** ahead new year **EVENT** talks

designed prevent new war europe.rhetoric surrounding putin **PERSON** vs biden ukraine **GPE** debate

close immitation cold war years **DATE** would much better realized open democracy threat russia **GPE**

let reinstate gorbachev perestroika **PERSON** glasnost.bet everything know conflicts plus everything know

russian **NORP** aggression poland **GPE** hungary **GPE** afghanistan **GPE** hell half **CARDINAL**

world cold war ukraine could written post note.war regardless reason us sending special forces soldiers

taiwan **GPE** train locals thing missile systems ukraine **GPE** last time soviets **NORP** something

similar cuba **GPE** almost nuclear war.biden led us **GPE** policy ukraine **GPE** maybe weight

russia **GPE** consider withdraw forces mercenaries occupied regions recognise independent sovereign

existence ukraine **GPE** prevent global war ukrainecrisis ukrainewar.think war china **GPE** certainly

still possible hell even war russia **GPE** appears possible regards ukraine.ukraine matters handled

discussed american **NORP** looking conflict war.careful wording choose rebel groups russian **NORP**

special forces operatives like girkin strelkov **PERSON** fomented conflict drew first **ORDINAL** blood

kickstarted russian **NORP** war ukraine.varnished covered thick layer russian **NORP** propaganda

attempting distort facts misinform us **GPE** actual origins russian **NORP** war eastern regions

ukraine **GPE** also people tend forget time passes yet evidence always.rtoday **GPE** prospect war

russia **GPE** ukraine **GPE** comes behind ian maxwell refusal accept verdict properly constituted

court.putin warns **ORG** biden sever ties imposes new sanctions via sleepy creep jack **PERSON** mothe

russia **GPE** runs ukraine **GPE** war quick russia **GPE** side one.golan crimea two **CARDINAL**

different scenarios soviets **NORP** gifted crimea ukraine **GPE** durning ussr **GPE** era goodwill

gesture zionists **NORP** illegally occupied golan **GPE** heights syria **GPE** war trophy someone

powerful may k ck arses amp golan **ORG** back.assume refer ukraine **GPE** say localized nuclear

event also assume refer limited nuclear war case risks uncontrolled large scale nuclear escalation high see

either party would choose option.forget strelkov aka girkin **PERSON** also fought transnistria took part

russian **NORP** occupation ukraine **GPE** crimea useful russian **NORP** fsb asset drew first

ORDINAL blood donbas kickstarted war eastern ukraine.sinister **EVENT** usa russia **ORG** getting

closer war day ukraine **GPE** uk **GPE** dragged deal fallout case could well glowing green fallout

better buckle bumpy ride ahead.see **ORG** put treading toward war threatening ukraine **GPE** wonder

full wits russian **NORP** culture science wonderful russians **NORP** known personally good people

mean trust put oligarchic mob.nope usa committed numerous war crimes hate freedom locking julian

NORP assange exposed war crimes usa hurling planet towards ww war mongering trying take ukraine

GPE russia **GPE** backyard demonic evil.russia **ORG** already annexed crimea seizing military force

ukraine **GPE** russia **GPE** props war donbas.agree given call today talks next week **DATE** things

seem easing right canadian **NORP** us uk **GPE** latvian **NORP** troops ukraine **GPE** training

troops likely another unofficially easily fog war mishap iran **GPE** russia **GPE** shot passenger planes

long ago.us **PRODUCT** propaganda putin **PERSON** trying invade troops border country cause

ukraine **GPE** plus even russia **GPE** western countries pushed proportion cause ones wanting

war.ukraine rupture relations time war putin **PERSON** warns biden complete rupture relations sanctions

proceed.freedomofthepress crisis since took office promise democracy prevailed never materialised starving

children killed yemen **GPE** us bombs ukraine **GPE** threat war theres nothing feel proud freeassange

nomorewars yemencantwait.domestically russians **NORP** lots ukrainians **NORP** see ukraine **GPE**

part russia **GPE** historically us trying get way reunification solidify domestic political support war bad

idea.talk warnings ahead january **DATE** meetings crimea donbas ukraine **GPE** europe russia **GPE**

war.russia going war ukraine **GPE** putin **PERSON** bluffing wants concessions west radicalize **LOC**

population russia.mean going war biden tells putin us respond **PERSON** decisively russia **GPE**

invades ukraine **GPE** smartnews.indeed nonsense russia **GPE** threatened russia **GPE** wages

active war russian **NORP** occupied parts ukraine **GPE** since rampant russian **NORP** assets

appease russia **GPE** justify russian **NORP** aggression apologetic rhetoric russia.ukrainian **NORP**

prisoners celebrating xmas new year **EVENT** magadan rf stalin era cap dokulakization amp world war ii

prisoners celebrating xmas   new year **EVENT**   magadan n stalin era esp dekulakization amp   world war ii

EVENT   many   ukrainians **NORP**   deported gulag kulaks others members   ukraine **GPE**   intelligentsia

yet others former upa partisans.comments posted   chinese **NORP**   already   american **NORP**   military

personnel   ukraine **GPE**   russia **GPE**   military   syria **GPE**   military usa gets military confrontation

russia america **LOC**   fighting war alone friendly want get nukes   russia.russia **ORG**   violated

internationally recognized borders arbitrarily redrew state border lines   russia **GPE**   aggressive state

destabilizes neighbors various means outright wages war appeasing   russia **GPE**   complicit war russia

wages ukraine.survival mechanism psychotic   russian **NORP**   regime   russia **GPE**   invaded occupied

ukraine **GPE**   crimea   peninsula eastern **PERSON**   regions   ukraine **GPE**   russia **GPE**

continuously wages war   ukraine **GPE**   ukrainian **NORP**   territory since.daily reminder

russiainvadedukraine amp illegally occupying crimea   putin **PERSON**   ukraine way get waging war donbas

amp sending weapons armour disguised humanitarian convoys ukrainewillresist orcs send back

mordor.tom russians **NORP**   invaded occupied parts   ukraine **GPE**   matter kind justification   russians

NORP   used   russia **GPE**   waging war ukraine years yet always   russia **GPE**   threatened apologism

russia **GPE**   appalling.brilliant way cause war   putin **PERSON**   actually wanted invade   ukraine **GPE**

would done   weeks ago **DATE**   highly visible troops bargaining chips intended force negotiation   nato

ORG   eastern europe.see military guys thread   america appetite war **EVENT**   middle east **LOC**

everyone knows   putin **PERSON**   certainly knows going take   ukraine **GPE**   lets see part old   ussr

GPE   wants next.needs accept   ukraine **GPE**   countries free rebuild lost empires endless war historical

era authority.us embassy   ukraine **GPE**   literally saying ur ur war breaks ur.say fuck   russia **GPE**   fuck

putin **PERSON**   president   biden **PERSON**   needs send small military force small war large enough tell

queen   putin **PERSON**   invades attacks   ukraine **GPE**   attacking   us nato **ORG**   freeze   russian

LANGUAGE   accounts.believe biden enter new war go head amp put world front new fact   ukraine **GPE**

russian.russia   us nato **ORG**   ukraine **GPE**   russia **GPE**   ambassador accuses   u nato **ORG**

remaking   cold war **EVENT**   amid rising tensions ukraine.want people shipped   ukraine **GPE**   told take

post since damn determined get   us **GPE**   war russia.america lose   russia **GPE**   invades   ukraine

GPE   ukraine **GPE**   really foundation stone greater   russia **GPE**   perhaps   putin **PERSON**   sees

well   gateway mediterranean world **ORG**   sadly   world war **EVENT**   starts.order known liar   michael

PERSON   name least   one **CARDINAL**   battle   ukrainian **NORP**   army   russian **NORP**   troops war

PERSON name least one CARDINAL battle ukrainian NORP army russian NORP troops war

territory ukraine thousands CARDINAL russians NORP occupying ukraine GPE government

ukraine GPE declared war russia.putin trying separate us nato ORG allies holding separate meetings

putin PERSON plays hands stupid give ukraine GPE additional arms including stinger missiles threat

heavy casualties deter putin PERSON biden making war likely.worth war ukraine like strong talk.beyond

war ukraine serve purpose hand puting ass.thing war ukraine GPE going serve get whole lot people

killed good reason.think russian NORP pres putin PERSON order military invade ukraine GPE

threat economic sanctions russia GPE enough prevent war taking place putin PERSON get another

us GPE pres say believe anything says like fmr pres trump.wish ORG third ORDINAL includes

talks european NORP security architecture esa russia GPE stops war ukraine GPE aggressive

actions neighbors georgia moldova belarus.supporting ORG unconstitutional coup united states GPE

thereby caused civil war donbas russia GPE accepted crimea composition war ukraine would even

fiercer.us president joe biden PERSON talked russian NORP counterpart putin PERSON phone

lasted min PERSON president biden highlighted nuclear war must started conversation businesslike

meaningful important.dutch spanish NORP war lastet years DATE ukraine GPE need long

conquer putin PERSON old surrounded enemies ruined economy sitting table lukashenko PERSON

hugging mate know time.nbcnews sébastien roblin PERSON whatever strategy employed war scale

violence would ricochet much widely geographically contained conflict eastern ukraine.ukraine territory

dispute west ukraine ORG western leaning east ukraine ORG sort simmering civil war putin want

ukraine GPE joining nation main reason wants attack ukraine.time stfu keystone never started scared

grounds putin PERSON release hold ukraine GPE going war way would like.link al varying degrees

PERSON russia GPE although process acquired momentum initial subversive war west drove ukraine

towards nato ORG need went nuts.hmmm apple ORG oranges crimea bloodless ukraine GPE

bloody soviet NORP regime fall bcs coffins arriving afghan NORP war everyone russia GPE

know inc putin cant afford bloody war.sébastien roblin whatever strategy employed war scale violence would

ricochet much widely geographically contained conflict eastern ukraine.enter war ukraine GPE matter

russia GPE acting world police need fix first ORDINAL aspire helping country.hunt isis war chest us

russia exchange ORG warnings ukraine uk ORG covid cases hit new high tesla recalls half million

CARDINAL cars bunnysec putin PERSON needs understand lot people willing face nuclear war

CARDINAL cars.bunnysec putin **PERSON** needs understand lot people willing face nuclear war

ukraine.spy ukraine invasion bulls love ze war drums algos war pandemics negative oil fear parade.trump

daddy vlady gain invading ukraine **GPE** economy crushing sanctions entire eu **ORG** shunning amp

potential war would cripple ru **PERSON** economy already shi er understanding position nato.biden

NORP putin **PERSON** call complete disaster heard putin **PERSON** planning invade ukraine **GPE**

biden backing want war russia **GPE** would awful us really weak biden putin **PERSON** knows xi

ukraine **PERSON** run taiwan.biden said respond decisively russia **GPE** invades ukraine **GPE** putin

heard u allies nothing russia **GPE** invasion ukraine **GPE** consequences war crimes already

committed.union soviet **NORP** socialist republics became first **ORDINAL** marxist **NORP** country

world otd revolution amp **EVENT** grueling civil war ended russian **NORP** empire initially ussr **GPE**

comprised federation russia **GPE** belorussia ukraine **GPE** amp transcaucasian **NORP**

federation.russian **NORP** invasion anything last thing whole world needs shit kicked virus two years

DATE putin **PERSON** goes markets crash biden needs say look f idiot **NORP** leave ukraine **GPE**

alone war.part ref **PERSON** large scale war played russia **GPE** china **GPE** may use generation v

weapons collapse alike ceo wrote taiwan **GPE** conclusion europe **LOC** usa training ukraine supply

weapons providing nato **ORG** membership till time ripe.minsk trilateral agreement far ideal ukraine

GPE essentially froze current frontline ru ua war **GPE** locked russia **GPE** military advancements

withing ukraine **GPE** therefore minsk trilateral agreement harming russia **GPE** facilitating ukraine.u

agressor supplying weapons ukraine keepen **ORG** greedy war machine business know politicians pocket

better something late.tensions ukraine **GPE** mean russia **GPE** war partial occupation ukraine

resulted ukrainian **NORP** deaths yes tensions western **NORP** mouthpiece kremlin propaganda

PERSON must lowering.times playing neoconservative political games could end life earth **LOC** young

children jack **PERSON** want future stepan bandera **ORG** followers ukraine **GPE** worth risking

nuclear war russia.us goes war russia **GPE** ukraine **GPE** truly apex **LOC** reboots.china

demands u end hostile military operations near borders notice parallels ukraine **GPE** taiwan **GPE**

confrontations russia **GPE** china **GPE** demanding us nato war alliance pull back forces stop

encroachments coincidence.spy tell one **CARDINAL** reason market go covid cases hospitalizations

russia **GPE** ukraine **GPE** war many.russia **GPE** china **GPE** winning china **GPE** arrests

hong kong **GPE** pro democracy groups military flights taiwan **GPE** usa china **GPE** silence covid

hong kong **GPE** pro democracy groups military flights taiwan **GPE** usa china **GPE** silence covid

origins russia **GPE** demands concession nato **ORG** ukraine embarrassed afghanistan **GPE**

militarizing civil war.members congress **ORG** want finance war ukraine **GPE** even inflammatory

given austerity taxpayers experiencing tax dollars squandered everything things would improve quality

life.tether time bomb amp p target w blackswan **PERSON** sq bull vs short mc visa nfts temper genomics

space c **ORG** categorized cold media gov institutions trust falls war risk china **GPE** taiwan **GPE**

russia **GPE** ukraine university suffer vs internet education.pray prevent us **GPE** attempts ignite war

impoverished ukraine **GPE** latest proxy.may putin contemplating starting war ukraine **GPE**

authoritarians love start wars distract domestic failures.let clear aggressor situation nato **ORG** us would

get involved shooting war russia **GPE** provoked action invasion ukraine **GPE** think far point putin

PERSON certainly playing dangerous game.new post russia **GPE** go war ukraine published news

ORG information uk.biden **PRODUCT** amp putin second **ORDINAL** phone talk year **DATE**

agreed one **CARDINAL** thing start nuclear war ukraine **GPE** issue putin **PERSON** said usa **ORG**

must guarantee ukraine **GPE** never part nato **ORG** biden said accept ultimatum amp warned

economic sanctions.putin start war turkey shot two **CARDINAL** military planes war ukraine **GPE** us

GPE media poking bear.considering security threat united states **GPE** even news russia **GPE**

going invade b ukraine **GPE** part nato **ORG** c learn lesson war mongering oif.want war russia **GPE**

ukraine americans **NORP** standby innocents oppressed need start calling something else.biden saw

week ago **DATE** us would go war ukraine **GPE** wants talk tough moron sitting washington **GPE**

putin **PERSON** knows would scared us ally cheesy lying sac sh joe **PERSON** helm.actually good thing

poso us weapons ukraine **GPE** would increase risk nuclear war russia **GPE** assured us would

assume missile attack russia **GPE** would bring full scale nuclear hit us **GPE** mainland.war biden

putin exchange warnings phone call amid rising ukraine tensions guardian.brandon **PRODUCT** defend

southern border go war defending ukraine **GPE** border huh.watch **ORG** attack dec poland **ORG**

lithuania back ukraine **GPE** war russia **GPE** near donbas **GPE** youtube.providing arms cold war

habit hard break ukraine.afghanistan civil war somewhat meme **ORG** tier syria **GPE** libya **GPE**

yugoslavia **GPE** ukraine **GPE** better analogies ukraine **GPE** libya **GPE** rebels lost without

foreign backing syria **GPE** rpg artillery war.mental gymnastics people go ignore biden role supporting

using neo nazi **NORP** militants topple ukraine **GPE** democratically elected president igniting civil war

using nec **nazi** **NORP** militants topple ukraine **GPE** democratically elected president igniting civil war

russia **GPE** border.clear definitely want war russia **GPE** ukraine **GPE** brandon worst negotiator

history negotiators keep single promise.russia currently invading ukraine **GPE** crimea eastern **ORG**

regions war stopped quit caring.could putin **PERSON** plan start war ukraine **GPE** create us **GPE**

internal crisis time use american **NORP** brainwashed operatives start civil war first **ORDINAL** killing

key elected officials finally use us **GPE** congressmen try overturn democracy.really pains pray nato u

de **ORG** escalate bully putin **PERSON** invading ukraine **GPE** fighting earth destruction fellow

humans ukrainians set sights new year new **EVENT** war.yeltsin give ossetians **NORP** abkhazians

russian **NORP** passports going war georgia stationing north k troops permanently territories yeltsin

PERSON recognized ukraine **GPE** borders including crimea yeltsin **PERSON** ended first chechen

war reasonable terms.going continue monitor closely movement build russian **NORP** forces ukraine

GPE border prepare whatever decision ultimately made russian **NORP** president russia nato **ORG**

us war.us **GPE** wage war ukraine brigades europe **LOC** send ships black sea combat would sunk

landbased anti ship missiles benefit us uk **GPE** needs negotiate.us citizens support war **EVENT**

ukraine.stop end shut war police court jail world police jail court wrong crime work people go jail gun war

court police wrong biden tredeu lopez canada **ORG** america mexico **GPE** must end stop war

afghanistan **GPE** russia **GPE** india **GPE** ukraine **GPE** pearce.ukraine invasion would biggest

mistake putin **PERSON** presidency russian **NORP** people want war want president putin **PERSON**

address problems russia.putin biden talk tonight **TIME** awaken amp others imminent danger extinction

war living replay cuban **NORP** missile crisis time set nato **ORG** amp usa russia **GPE** allow

nato **ORG** nuclear weapons ukraine.american **NORP** people become desensitized war event another

world war happen **EVENT** us destroy within ukraine **GPE** reached cuban **NORP** missile crisis

levels people even realize.good read statement experts former senior officials offering ideas deter moscow

GPE escalating current war aggression ukraine **GPE** discourage moscow **GPE** future

provocations.yes trump blocked platform putin **PERSON** trump ukraine **GPE** pee tape go war protect

trump.timely video view biden putin **PERSON** ukraine **GPE** crisis victor davis **PERSON** hanson

border war europe **LOC** led wwii via.manufactured crime ukraine **GPE** blame biden cause lose

election weaponized deadly virus cover war crime chaos facilitate destruction knew trump would lose final

stages insurrection kicked imo.tree provinces taken rf russia **GPE** wants zaporozhe **GPE** well k army

stages insurrection kicked limotrso provinces taken r. russia **GPE** wants zaporozhe **GPE** weiik army

mounted ukrainian **NORP** border mobilization ukraine **GPE** started troops deployed state war martial

legislation passed ukrainian **NORP** government waiting russo german **NORP** gobli gook **PERSON**

talk.know watch documentory ukraine middle civil war.idk jim **PERSON** say putin **PERSON** threatening

war ukraine **GPE** order fuck elections putin **PERSON** starts war ukraine **GPE** amp engage leave

dems **NORP** approval ratings.united states russia **GPE** discuss nuclear war must avoided ukraine

GPE idea nuclear war even brought indicated least one side seeing potential military conflict.going lead

winter war **EVENT** ukraine.cut putin **PERSON** friends completely admit ukraine nato **ORG** today

DATE charge putin war crimes invades.putin **GPE** admitting plan invade ukraine **GPE** somehow

imagines cold war ii **EVENT** threat rather obvious necessary result action.putin admitting plans invade

ukraine **GPE** really think new cold war threat rather obvious necessary result action.unqualified narcissist

band fools gon na **ORG** get us **GPE** war breaking biden putin **PERSON** trade threats call amid

rising russia **GPE** ukraine tensions reports say.better escalation war best putin jot **PERSON** scare

west pitin **GPE** havr better nuck better big land cnn **ORG** biden pushes putin ukraine de escalation

PERSON second **ORDINAL** call month via.stop talking bollox ukraine **GPE** divided thats theres civil

war moment lost senses.war best let see win guardian biden putin exchange warnings phone call amid rising

ukraine **GPE** tensions via.think difference ukraine **GPE** west probably embarrassed easier look nkr

war **PERSON** business less fundamentally humiliating.bigger dangerous war inevitable ukraine **GPE**

must backdown late political solution way forward.may **ORG** appears may another war europe **LOC**

putin making threats invade ukraine **GPE** appears happy right self determination.trump armed ukraine

american **NORP** anti tank weapons fight war.inter going war ukraine **GPE** antagonizing russians

NORP losing hand.insistence ordering europe **LOC** rules provokes russian **NORP** nationalism

makes war ukraine **GPE** politically useful putin **PERSON** regardless outcome.crimea war england

amp russia **GPE** england amp ukraine **GPE** ukraine **GPE** belongs russia.going make sentencing

make expect war break world somewhere potentially ukraine.people ukraine **GPE** want defend russia

GPE aggression russia **GPE** stays within borders war simple.stories bottom left ring truth imo know

mds r nothin licensed prescription writers stephen cohen **PERSON** yrs ago passing n interviews asked

consequences ukraine **GPE** joining nato **ORG** said nuclear war period.russian **NORP** federation

deterred invading ukraine **GPE** already years months days ago **DATE** aggressor state defeated

deterred invading ukraine ai 2 already years months days ago war2 aggressor state defeated

united **ORG** efforts world democracies stop talking dictator putin **PERSON** get done end war.may go

war russia **GPE** invades ukraine **GPE** want married finest man girls ever seen lord saviour

returns.ukraine kill every last mf **PERSON** crosses border russia **GPE** provoking war.people

PERSON ukraine **GPE** want fight russia **GPE** go ahead ukraine **GPE** amp russia **GPE** us

GPE options us go war russia **GPE** protect ukraine **GPE** would insane.democratic ukraine **GPE**

much america **GPE** vital interest mean engage shooting war russia widen invasion **ORG** ukraine

GPE things go back normal.good see call separatists criminals referred annexation crimea occupation

russia **GPE** invaded ukraine **GPE** killing date ukrainians **NORP** war churchill made grave error

ceding poland **GPE** stalin cede donbas putinsplan.u leadership needed urge nato **ORG** immediately

accept ukraine north atlantic treaty **ORG** organization attack one **CARDINAL** country attack countries

putin **PERSON** attacked ukraine **GPE** would war european **NORP** countries canada **GPE**

u.politicians obey constitution must removed election removed force way things going may end like ukraine

GPE war.war ukraine **GPE** looks like shaping largest land war europe since ww.civil **FAC** war

ukraine **GPE** russian **NORP** invasion amp destabilization.deployment ahead russian **NORP**

ukraine **GPE** war.putin orders russian **NORP** soldiers go ukraine **GPE** escalation war end war

bring peace.wonder things russian **NORP** population thinking possible war ukraine putin **PERSON**

trying distract attention corona crisis hits russia **GPE** pretty hard third **ORDINAL** winter **DATE** war

smart.dear americans **NORP** prepared give life ukraine **GPE** taiwan **GPE** israel **GPE** well

get ready media government sure pushing war except grenada **GPE** pop since ww reasons turn lies

stupid.borders sovereign talking capitulation avoid aggression russia **GPE** wants annexe georgia **GPE**

ukraine recommendation hey guys let fight russia **GPE** wants country reason go war.putin want war

ukraine want nato **ORG** want rt biden putin **PERSON** talk nearly hour **TIME** alarm rises

ukraine.think putin **PERSON** much pride ego stand result terrible war going happen ukraine.one

interesting aspects whole ukraine **GPE** situation watching u western russia watching community

essentially descend rhetorical civil war whether russia **GPE** may seriously invade part contrived

diplomatic plot.hillary support every turn nato **ORG** expansion including even ukraine **GPE** amp

georgia **GPE** common sense trip wire violated post cold war settlement europe **LOC** amp led russia

GPE violent counter reactions.save ukraine **GPE** un **ORG** must back n meet putin **PERSON**

demands country would want engage war   russia **GPE**   sake another country careful us may want war

happen benefits good stirring shit everywhere.sleepy   joe **PERSON**   called   putin **PERSON**   returning call

putin **PERSON**   told   sleepy joe **PERSON**   defend   ukraine **GPE**   nuclear war crowning sleepy   joe

PERSON   president   roosevelt.since **PERSON**   us **GPE**   engineered coup   ukraine **GPE**   us foreign

policy elite gunning war lose may end world neocons bent starting another disaster ukraine.started ww

trending starting strong possible war   russia **GPE**   ukraine **GPE**   got   ta love earth **LOC**   days.would

want   war america war stupid **EVENT**   say leave   ukraine **GPE**   taiwan **GPE**   alone live nice life

people want war ones never goto one politicians   putin xi **PERSON**   jinping biden cowards war

terrible.policy vis vis soviet union cold war definitely diplomatic solutions current standoff   russia **GPE**

entail taking account   russia **GPE**   interests greatly helping   ukraine **GPE**   progress maximum

potential.ukraine dream team face former   kgb **ORG**   exec putin probably better dreaming waging war

nyt.breaking president biden president   putin **PERSON**   talk phone distinguished group experts former

senior officials issue statement urging decisive action face looming   kremlin **ORG**   threat escalate war

ukraine.putin called   sleepy joe **PERSON**   chew   sleepy joe **PERSON**   conceded defend   ukraine **GPE**

▾ 1.2. Topic Modeling

▾ 1.2.1. Non-negative Matrix Factorization (NMF)

```
# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 2)
date_groups = tweets_by_time_interval(tweets, 2, True)

for i,group in enumerate(tweets_date):
  print(f'DATES: {date_groups[i][0].date()} - {date_groups[i][-1].date()}')
  # vectorize
  vect = TfidfVectorizer(max_features=2000, min_df=1)
  X = vect.fit_transform(group.lemmatized_sent_no_stops)
  # get dictionary
  idx_to_word = np.array(vect.get_feature_names_out())

  # nmf
  nmf = NMF(n_components=5, solver="mu")
  W = nmf.fit_transform(X)
  H = nmf.components_
```

```python
# print topics
for i, topic in enumerate(H):
  # terms in each topic are in descending order of importance/contribution to that t
  print(f'Topic {i+1}: {",".join([str(x) for x in idx_to_word [topic.argsort()[:-10:
  total = topic.sum()
print('\n')
```

```
    DATES: 2022-01-16 - 2022-01-17
    Topic 1: ukraine,russia,war,russian,putin,start,invade,need,one
    Topic 2: cyberattack,behind,hybrid,claim,russia,move,news,website,deface
    Topic 3: nato,prevent,chief,russia,cbc,news,join,member,usa
    Topic 4: europe,putin,drumbeat,sound,threat,border,profound,peace,present
    Topic 5: trench,forever,ukraine,war,verini,james,via,paolo,pellegrin


    DATES: 2022-01-18 - 2022-01-19
    Topic 1: russia,ukraine,war,europe,invade,us,attack,could,think
    Topic 2: troop,send,russian,belarus,invasion,military,fear,border,amid
    Topic 3: biden,putin,think,president,trump,war,full,blow,joe
    Topic 4: nato,join,member,membership,expansion,nuclear,need,avoid,part
    Topic 5: world,start,people,war,ukraine,country,like,need,one


    DATES: 2022-01-20 - 2022-01-21
    Topic 1: russia,ukraine,war,invade,us,europe,china,talk,usa
    Topic 2: biden,putin,president,joe,move,full,think,trump,vladimir
    Topic 3: russian,border,troop,invasion,people,military,ukrainian,force,europe
    Topic 4: start,world,war,ukraine,one,like,iii,people,invade
    Topic 5: nato,join,member,putin,country,part,membership,world,nuclear


    DATES: 2022-01-22 - 2022-01-23
    Topic 1: russia,war,ukraine,world,start,invade,think,like,country
    Topic 2: biden,trump,joe,ukraine,war,hunter,border,family,putin
    Topic 3: us,embassy,fear,evacuation,staff,request,amid,order,evacuate
    Topic 4: putin,russian,troop,invasion,germany,europe,border,west,ukrainian
    Topic 5: nato,join,member,russia,eu,part,lead,membership,usa


    DATES: 2022-01-24 - 2022-01-25
    Topic 1: russia,war,ukraine,invade,world,think,people,one,like
    Topic 2: biden,joe,hunter,trump,president,protect,putin,family,administration
    Topic 3: nato,putin,russian,join,member,country,europe,invasion,border
    Topic 4: troop,send,border,put,us,alert,deploy,american,fight
    Topic 5: start,putin,world,invade,try,iii,strong,whether,trump


    DATES: 2022-01-26 - 2022-01-27
    Topic 1: russia,war,ukraine,invade,start,world,think,china,us
    Topic 2: putin,people,like,world,need,one,think,make,russian
    Topic 3: nato,country,join,member,europe,usa,eu,expansion,attack
    Topic 4: biden,joe,hunter,president,administration,son,dirt,trump,push
    Topic 5: border,troop,russian,send,invasion,ukraine,us,military,protect
```

```
DATES: 2022-01-28 - 2022-01-29
Topic 1: ukraine,war,russia,nato,like,world,country,people,us
Topic 2: biden,president,zelensky,need,panic,joe,almost,million,hype
Topic 3: start,mount,russia,tensions,war,warn,try,news,moscow
Topic 4: russian,troop,border,invasion,warn,moscow,cold,since,top
Topic 5: putin,johnson,boris,vladimir,visit,call,invade,region,think
```

```python
# view numerical contribution of top terms to a subset of topics -- for last date rang
for topic, words in enumerate(H):
  total = words.sum()
  largest = words.argsort()[::-1]
  print(f'\nTopic {topic}')
  for i in range(3):
    print(idx_to_word[largest[i]], round(words[largest[i]], 4))
```

```
Topic 0
ukraine 1.688
war 1.6567
russia 0.8059

Topic 1
putin 1.9358
declaration 0.8537
sanction 0.6269

Topic 2
russia 1.6386
via 0.9209
news 0.6746

Topic 3
nato 2.1587
fly 0.3447
zone 0.3167

Topic 4
world 1.8656
war 0.2275
via 0.2001
```

1.2.2. BERTopic

1.2.2.1. BERTopic Word Scores

```python
# most salient words/terms in each topic
```

```python
def get_BERTopic_word_scores(data, date_group_, group_num):
    """
    Parameters:
      data: dataframe
      date_group_: list (time intervals)
      group_num: int (selected period of x days)

    Returns:
      topic_modeling.visualize_barchart()
    """
    group = group_num
    print(f'DATES: {date_group_[group][0].date()} - {date_group_[group][-1].date()}')
    sentence_vects = list(data[group]['lemmatized_sent_no_stops'])
    topic_modeling = BERTopic(n_gram_range=(1,3), min_topic_size=40)
    topics, probs = topic_modeling.fit_transform(sentence_vects)
    return(topic_modeling.visualize_barchart())

# Generate data with specified number of days in each interval
# TOPICS ACROSS ENTIRE DATASET
tweets_date = tweets_by_time_interval(tweets, 65)
date_groups = tweets_by_time_interval(tweets, 65, True)
get_BERTopic_word_scores(tweets_date, date_groups, 0)
```

```
DATES: 2021-12-31 - 2022-03-05
```

Downloading: 100%	1.18k/1.18k [00:00<00:00, 41.3kB/s]
Downloading: 100%	190/190 [00:00<00:00, 7.79kB/s]
Downloading: 100%	10.2k/10.2k [00:00<00:00, 419kB/s]
Downloading: 100%	612/612 [00:00<00:00, 25.1kB/s]
Downloading: 100%	116/116 [00:00<00:00, 4.89kB/s]
Downloading: 100%	39.3k/39.3k [00:00<00:00, 467kB/s]
Downloading: 100%	349/349 [00:00<00:00, 14.8kB/s]
Downloading: 100%	90.9M/90.9M [00:01<00:00, 61.5MB/s]
Downloading: 100%	53.0/53.0 [00:00<00:00, 2.25kB/s]
Downloading: 100%	112/112 [00:00<00:00, 4.07kB/s]
Downloading: 100%	466k/466k [00:00<00:00, 577kB/s]
Downloading: 100%	350/350 [00:00<00:00, 14.6kB/s]
Downloading: 100%	13.2k/13.2k [00:00<00:00, 524kB/s]
Downloading: 100%	232k/232k [00:00<00:00, 658kB/s]

```
/usr/local/lib/python3.7/dist-packages/numba/np/ufunc/parallel.py:363: NumbaWarn
```

```python
# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 7)
date_groups = tweets_by_time_interval(tweets, 7, True)
# Topic word scores for a sample subset of data
get_BERTopic_word_scores(tweets_date, date_groups, 5)
```

```
DATES: 2022-02-04 - 2022-02-10
```

Topic Word Scores
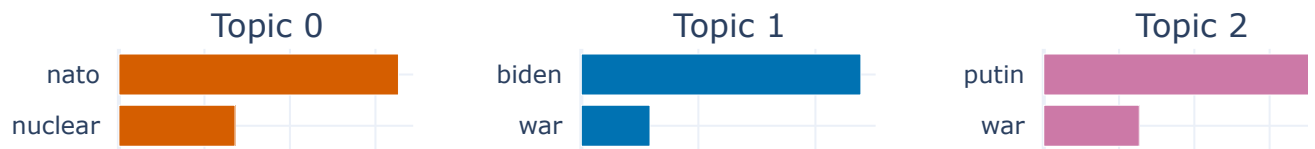

```
# Topic word scores for a sample subset of data
get_BERTopic_word_scores(tweets_date, date_groups, 7)
```

```
DATES: 2022-02-18 - 2022-02-24
```

Topic Word Scores
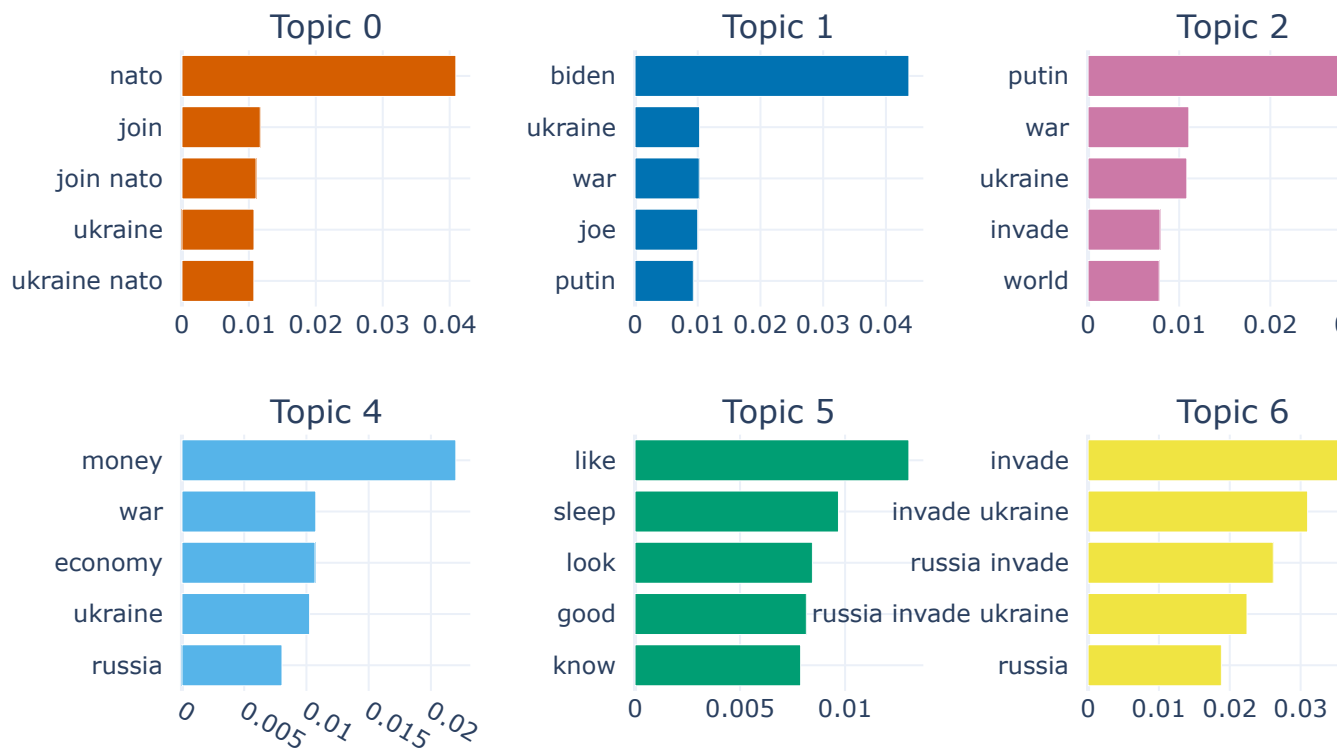

```
# Topic word scores for a sample subset of data
get_BERTopic_word_scores(tweets_date, date_groups, -1)
```

```
DATES: 2022-02-25 - 2022-03-03
```

Topic Word Scores
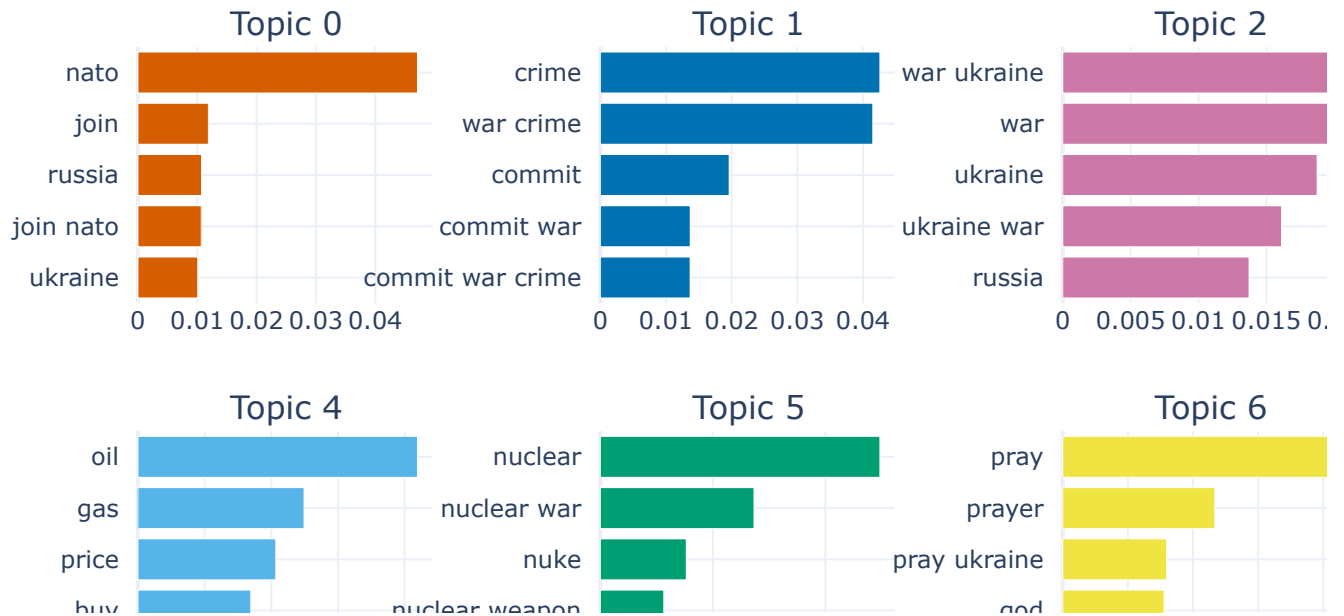
1.2.2.2. BERTopic Intertopic Distance Figure

```python
# intertopic distance

def get_BERTopic_dist(data, date_group_, group):
    """
    Parameters:
      data: dataframe
      date_group_: list (time intervals)
      group: int (selected period of x days)

    Returns:
      topic_modeling.visualize_topics()
    """
    date_group_ix = group
    sentence_vects = list(data[date_group_ix]['lemmatized_sent_no_stops'])
    topic_modeling = BERTopic(n_gram_range=(1,3), min_topic_size=70)
    topics, probs = topic_modeling.fit_transform(sentence_vects)
    print(f'{date_group_[date_group_ix][0].date()} - {date_group_[date_group_ix][-1].dat
    return topic_modeling.visualize_topics()


# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 3)
date_groups = tweets_by_time_interval(tweets, 3, True)
get_BERTopic_dist(tweets_date, date_groups, 20)
```

```
    2022-03-01 - 2022-03-03
```

Intertopic Distance Map

D2

D1

Topic 1

○

▼ 1.2.2.3. BERTopic Hierarchical Clustering

```
# visualize the hierarchy of related topics

def get_BERTopic_hierarch(data, date_group_, group):
  """
  Parameters:
    data: dataframe
    date_group_: list (time intervals)
    group: int (selected period of x days)

  Returns:
    topic_modeling.visualize_hierarchy()
  """
  date_group_ix = group
```

```
    sentence_vects = list(data[date_group_ix]['lemmatized_sent_no_stops'])
    topic_modeling = BERTopic(n_gram_range=(1,3), min_topic_size=70)
    topics, probs = topic_modeling.fit_transform(sentence_vects)
    print(f'{date_group_[date_group_ix][0].date()} - {date_group_[date_group_ix][-1].dat
    return topic_modeling.visualize_hierarchy(orientation='left')


# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 5)
date_groups = tweets_by_time_interval(tweets, 5, True)
get_BERTopic_hierarch(tweets_date, date_groups, 4)
```

    2022-01-20 - 2022-01-24

Hierarchical Clustering
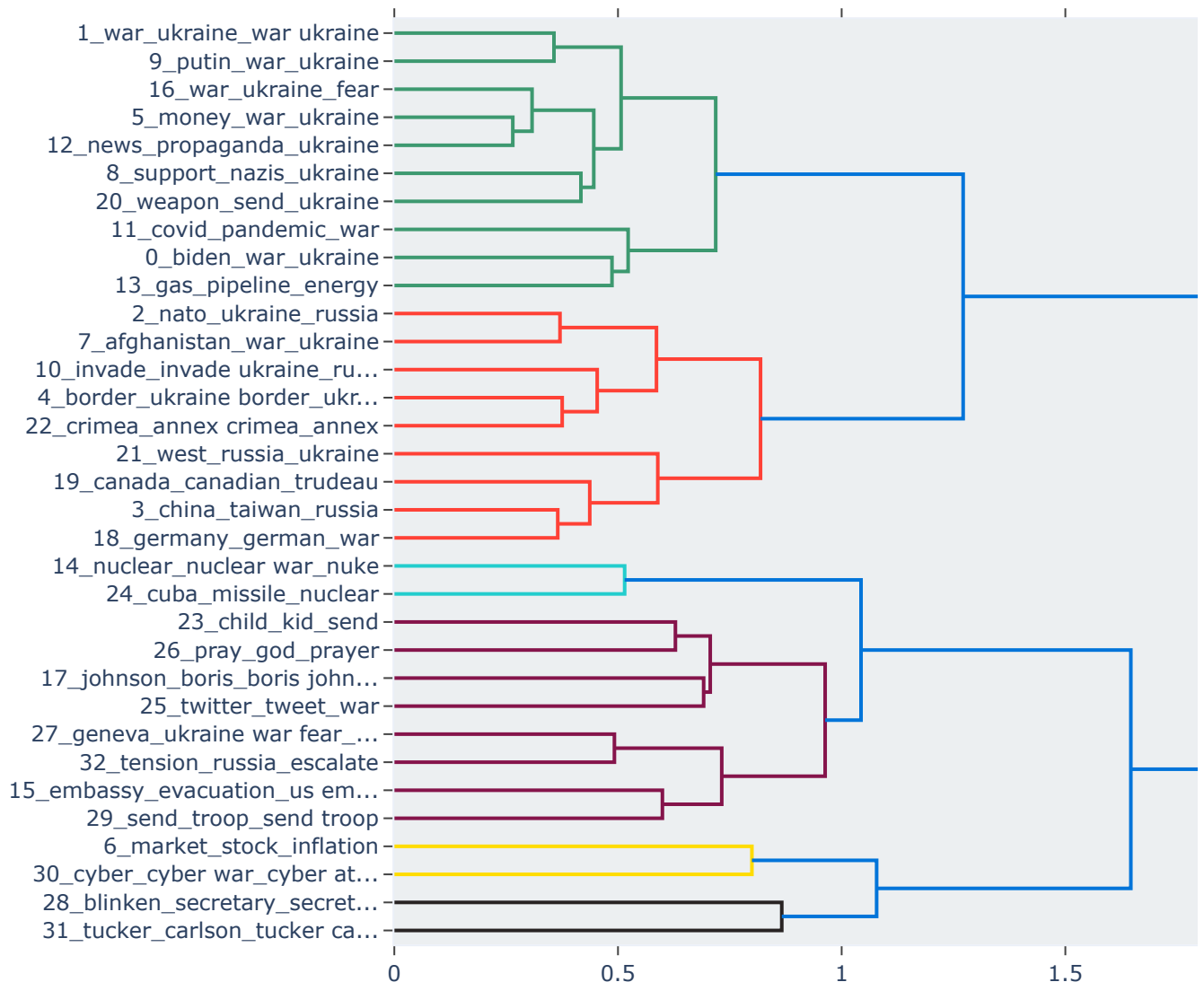
▼ 1.2.2.4. BERTopic Topics over time

```python
# visualize how topics change over time

def get_BERTopic_over_time(data, date_group_, group):
    """
    Parameters:
      data: dataframe
      date_group_: list (time intervals)
      group: int (selected period of x days)

    Returns:
      topic_modeling.visualize_topics_over_time()
    """
    date_group_ix = group
    sentence_vects = list(data[date_group_ix]['lemmatized_sent_no_stops'])
    topic_modeling = BERTopic(n_gram_range=(1,3), min_topic_size=70)
    topics, probs = topic_modeling.fit_transform(sentence_vects)
    print(f'{date_group_[date_group_ix][0].date()} – {date_group_[date_group_ix][-1].dat

    timestamps = list(data[date_group_ix]['date'])

    topics_over_time = topic_modeling.topics_over_time(sentence_vects, topics, timestamp
    return topic_modeling.visualize_topics_over_time(topics_over_time, top_n_topics=10)
```

```python
# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 7)
date_groups = tweets_by_time_interval(tweets, 7, True)
get_BERTopic_over_time(tweets_date, date_groups, 7)
```

▼ 1.2.2.4. BERTopic Topics over time

```
    2022-02-18 - 2022-02-24
```

Topics over Time

```
# Generate data with specified number of days in each interval
tweets_date = tweets_by_time_interval(tweets, 8)
date_groups = tweets_by_time_interval(tweets, 8, True)
get_BERTopic_over_time(tweets_date, date_groups, -1)

    2022-02-25 - 2022-03-04
```

Topics over Time

▾ 1.3. Clustering

▾ 1.3.1. Network Graph with Cosine Similarity

```
# tweets by date
tweets_date = tweets_by_time_interval(tweets, 1)
date_groups = tweets_by_time_interval(tweets, 1, True)
# get subset of tweets
group_num = 32
selected_tweets = tweets_date[group_num]
```

```python
# compute tfidf
tf = TfidfVectorizer(analyzer='word', ngram_range=(1, 3), min_df=0)
X = tf.fit_transform(selected_tweets['content_clean'])


# cos sim matrix -- using linear kernal from sklearn which is the same as cosine_simil
# source: https://scikit-learn.org/stable/modules/metrics.html#cosine-similarity

sim_matrix = linear_kernel(X, X)


matrix_with_cos_sim = [sim_matrix]
data_sets = [selected_tweets['content_clean']]

top_n_sentences = []
for cs, t in zip(matrix_with_cos_sim, data_sets):
    no_dups = np.array(t)
    i = 0
    top_frame = []
    for c, z in zip(cs, tnrange(len(cs))):
        # Create vector of tweets
        start_name = pd.Series([no_dups[i]]*3)
        # Index of top 3 similar tweets
        ix_top_n = np.argsort(-c)[0:3]
        cos_sim = pd.Series(c[ix_top_n])
        names = pd.Series(no_dups[ix_top_n])
        i += 1
        top_frame.append(pd.DataFrame([start_name, names, cos_sim]).transpose())

    top_frame = pd.concat(top_frame)
    top_frame.columns = ['tweet1', 'tweet2', 'cos_sim']
    # Remove the similarities for the same sentences
    top_frame['is_same'] = [bool(i==j) for i, j in zip(top_frame['tweet1'], top_frame|
    top_frame = top_frame[top_frame['is_same'] != True]

    top_n_sentences.append(top_frame)
```

```
  100%                                      3851/3852 [00:06<00:00, 587.93it/s]
```

```python
top_frame
```

	tweet1	tweet2	cos_sim	is_same
1	the sky is the limit for the pm flying the fla...	kay burley has continually bolstered johnson u...	0.126033	False
2	the sky is the limit for the pm flying the fla...	the pm s off to ukraine on a diplomatic missio...	0.072288	False
1	kinda following this russia ukraine pissin mat...	does the uk know what they went to war in agha...	0.068154	False
2	kinda following this russia ukraine pissin mat...	russia is willing to go to war and incur sanct...	0.056375	False
1	that doesn t answer the question of what exact...	russia is willing to go to war and incur sanct...	0.082225	False

```
# define graph structure
top_frame = top_n_sentences[0]
edges = list(zip(top_frame['tweet1'], top_frame['tweet2']))
weighted_edges = list(zip(top_frame['tweet1'], top_frame['tweet2'], top_frame['cos_sim
nodes = list(set(top_frame['tweet1']).union(set(top_frame['tweet2'])))
```

| 1 | nobody s asking the us to fight this | really no american wants to go to war | 0.124123 | False |

```
# get graph
G = nx.Graph()
G.add_nodes_from(nodes)
G.add_edges_from(edges)
G.add_weighted_edges_from(weighted_edges)


# get community partitions
partition = community_louvain.best_partition(G)
modularity = community_louvain.modularity(partition, G)


# create graph
print(f'{date_groups[group_num][0].date()} - {date_groups[group_num][-1].date()}')
pos = nx.spring_layout(G, dim=2)
community_id = [partition[node] for node in G.nodes()]
fig = plt.figure(figsize=(10,10))
nx.draw(G, pos, edge_color = ['silver']*len(G.edges()), cmap=plt.cm.tab20,
        node_color=community_id, node_size=100, with_labels=False)
```

```
2022-02-01 - 2022-02-01
```



```python
title, cluster = [], []
for i in partition.items():
    title.append(i[0])
    cluster.append(i[1])


frame_clust = pd.DataFrame([pd.Series(title), pd.Series(cluster)]).transpose()
frame_clust.columns = ['Title', 'Cluster']


top_clust = frame_clust.groupby('Cluster').count().sort_values('Title', ascending=Fals
top_clust
```

	Title 🪄
Cluster	
14	237
29	175
2	173

```python
# prepare sub-graph
largest_clusters = list(top_clust.index)
nodes_in_select_community = [node for node,community in partition.items() if community
sub_G = G.subgraph(nodes_in_select_community)
nodes_in_select_community2 = [(community,node) for node,community in partition.items()


node_type = largest_clusters
node_color = ['#ff0085', '#b6fcf5', '#0ed5ee', '#d189f9', '#b98501', '#380568', '#9b0
nodeTypeDict = dict(zip(node_type, []))
nodeColorDict = dict(zip(node_type, node_color))

fig, ax = plt.subplots(1, figsize=(12,12))

for idx, cluster_num in enumerate(node_type):
  nodelist = []
  for i in range(len(nodes_in_select_community2)):
    if nodes_in_select_community2[i][0] == cluster_num:
      nodelist.append(nodes_in_select_community2[i][1])
  nodecolor = node_color[idx]
  nx.draw_networkx(sub_G,
                        pos=pos,
                        nodelist=nodelist,
                        ax=ax,
                        cmap=plt.cm.brg,
                        vmin=0.0,
                        vmax=1.0,
                        node_color=nodecolor,
                        label=cluster_num,
                        with_labels=False)
plt.legend(scatterpoints=1)
plt.show()
```
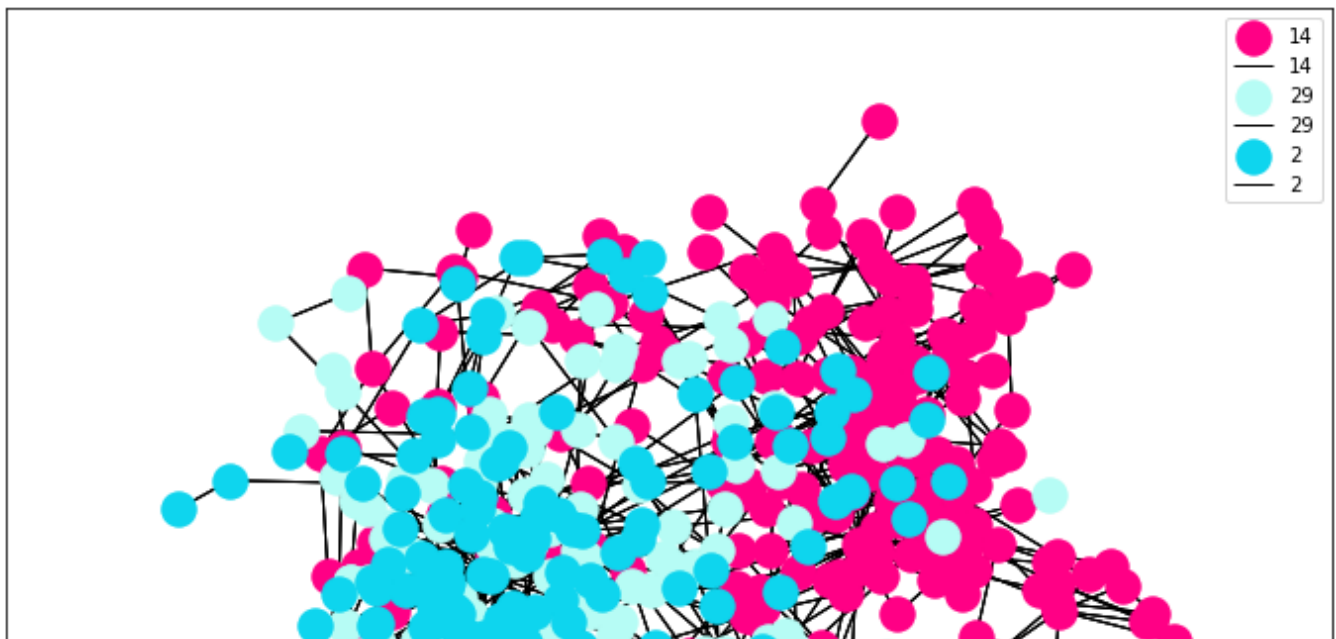
▾ 1.3.2. Clustering with Transformers

▾ 1.3.2.1. Create Embeddings

```
# get sentences for vectorization/embedding

# keep stops for embedding
sentence_vects = list(tweets['content_clean'])
# create batches to avoid OOM errors in clustering
sentence_vects1 = sentence_vects[:55000]
sentence_vects2 = sentence_vects[55000:110000]
sentence_vects3 = sentence_vects[110000:165000]
sentence_vects4 = sentence_vects[165000:]


# load pre-trained sentence embeddings, run with GPU
model = SentenceTransformer('all-MiniLM-L6-v2', device='cuda')


# get sentence embeddings -- in batches
tweet_embeddings1 = model.encode(sentence_vects1, batch_size=32, show_progress_bar=Tru
tweet_embeddings2 = model.encode(sentence_vects2, batch_size=32, show_progress_bar=Tru
tweet_embeddings3 = model.encode(sentence_vects3, batch_size=32, show_progress_bar=Tru
tweet_embeddings4 = model.encode(sentence_vects4, batch_size=32, show_progress_bar=Tru
```

Batches: 100%   1719/1719 [00:24<00:00, 110.08it/s]

```
# get clusters
clusters1 = util.community_detection(tweet_embeddings1, min_community_size=25, thresho
clusters2 = util.community_detection(tweet_embeddings2, min_community_size=25, thresho
clusters3 = util.community_detection(tweet_embeddings3, min_community_size=25, thresho
clusters4 = util.community_detection(tweet_embeddings4, min_community_size=25, thresho
```

```
# see clusters from batch 1:
for i, cluster in enumerate(clusters1):
  print('Cluster', i)
  for elem in cluster[:10]:
    print(sentence_vects[elem])
    some economic consequences of the war in ukraine
    wsj war in ukraine complicates the fed s inflation strategy
    ukraine russia war impact on gas stocks inflation and the us economy howto cnet
    Cluster 46
    heard this quote if russia stops fighting the war would stop if ukrainians stop
    if russia stops fighting no more war if ukraine stops fighting no more ukraine
    if russia stops fighting there will be no war if ukraine stops fighting there wil
    if russia stops fighting the war ends if ukraine starts fighting ukraine ends it
    if russia stops fighting there will be no war if ukraine stops fighting there wil
    if russia stops fighting there will be no war if ukraine stops fighting there wil
    if russia stops fighting there will be no more war if ukraine stops fighting the
    repeating if russia stops fighting no war if ukrainians stop fighting no ukraine
    if russia stopped the war would be over if ukraine stopped they lost the war
    if ukraine stops fighting there is no ukraine if russia stops fighting there is
    Cluster 47
    ukraine is an innocent country this are normal people there are no neo nazis in
    blah blah blah blah ukraine has been killing innocent russian civilians for year
    i m sure the average russian citizen does not want a war with ukraine the innoce
    so sad for people of ukraine always innocents who bare the brunt of any war
    anyone whoa person in ukraine is a war criminal ukrainians are innocent victims
    whatever is the political reason for the war between russia and ukraine the inno
    stop the war for all the innocent people in ukraine ukrainerussiawar
    ukraine did not have a nazi run government russia wanted to invade so that they
    both there are russian citizens killing ukrainians in their own sovereign country
    russia and ukraine are like a brother from another mother same blood same people
    Cluster 48
    wheat about to increase in price the russia ukraine war is fueling the biggest su
    the russia ukraine war is fueling the biggest supply shock to global grain marke
    a record wheat shortage russia s war with ukraine could devastate global grain ma
    russia ukraine war fuels biggest supply shock to global grain markets in living
    the grain market finished higher again today with wheat leading the way up the l
    russia ukraine war has pushed fas prices hogher and ukraine is one of the bigges
    grain prices sharply higher to limit higher today as the war in ukraine is not o
    war could also disrupt the food supply chain with russia and ukraine together re
    by the numbers war in ukraine driving up wheat corn prices
    both russia and ukraine are among the top producers and suppliers of wheat on the
    Cluster 49
    we will not stop putin with sanctions but we will harm the russian people with t
    so as i see these sanctions keep coming are they gonna stop russianinvasion or p
    if we don t stop putin he will invade other countries after he finishes destroyi
```

```
sanctions will not stop a megalomaniac narcissist with nukes people if putin can
sissy type sanctions on russia will not stop vladimir putin he still has china to
sanctions will punish russia they won t help ukraine it will be a destroyed vassa
the us should never again drop sanctions on putin no matter what the result of pu
putin can not be stopped by sanctions he will continue until ukraine is crushed b
we need actions that will cause putin to exit ukraine sanctions are necessary bu
agree diplomacy looks like it won t stop putin but sanctions can make it hard fo
Cluster 50
if its ok for russia to invade ukraine why isnt okay for and us to defend them th
so it s okay for russia to invade ukraine because of what the west has done in th
sorry are people genuinely suggesting we ought to have had a war with russia to
you are cowards putin wants war so give him war you had to protect ukraine with u
russia was not at war with ukraine eight years ago unless you wish to blatantly
putin has no right to invade ukraine his behavior is an act of war i support nat
what is happening is very bad and the whole world is supporting ukraine as much
tell that to putin this is a war of his making and the ukrainian s have every ri
ukraine is not going to war with them russia just putin tbh not even his own ppl
important to accept this isn t russia invading ukraine it s putin and his cronie
```

1.3.2.2. Visualize with Wordclouds of Clusters

```python
all_cluster_list = []
for i, cluster in enumerate(clusters1):
  cluster_list = []
  #print('Cluster', i)
  for elem in cluster:
    cluster_list.append(sentence_vects[elem])
    #print(sentence_vects[elem])
  all_cluster_list.append(cluster_list)
cluster_df = pd.DataFrame(all_cluster_list)


# make the columns the separate clusters and the rows the individual tweets under that
cluster_df = cluster_df.T


# create wordcloud for a sample cluster
text = cluster_df[3].loc[~cluster_df[3].isna()]
text = " ".join([row for row in text])
wordcloud = WordCloud(max_words=100, background_color="white", width=1000, height=600)

plt.figure(figsize=[20,10])
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```

```
# create wordcloud for a sample cluster
text = cluster_df[15].loc[~cluster_df[15].isna()]
text = " ".join([row for row in text])
wordcloud = WordCloud(max_words=100, background_color="white", width=1000, height=600)

plt.figure(figsize=[20,10])
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```

```
# create wordcloud for a sample cluster
text = cluster_df[25].loc[~cluster_df[25].isna()]
text = " ".join([row for row in text])
wordcloud = WordCloud(max_words=100, background_color="white", width=1000, height=600)

plt.figure(figsize=[20,10])
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```

1.3.2.3. Keywords from Clusters

```python
# get keywords from clusters
keywords_by_cluster = []
for i in range(cluster_df.shape[1]):
  text = cluster_df[i].loc[~cluster_df[i].isna()]
  text = " ".join([row for row in text])
  kw = keywords(text).split('\n')[2:17]
  keywords_by_cluster.append(kw)
keywords_by_cluster
```

```
        'russians',
        'innocent country',
        'people',
        'nazis',
        'ukrainian',
        'ukrainians',
        'russia',
        'citizen',
        'citizens',
        'countries',
        'like',
        'nazi run government',
        'god'],
       ['prices',
        'russia ukraine war',
        'food',
        'supply',
        'export',
        'exporter',
        'exports',
        'exporting',
        'market',
        'grains',
        'amp',
        'global grain markets',
        'bread',
        'world',
        'worlds'],
       ['sanction',
        'stop putin',
        'war',
        'ukraine',
        'stopping',
        'stopped',
        'stops',

        'russian people',
        'nuclear',
        'russia'.
```

```
       'need',
       'needs',
       'destroying',
       'destroy',
       'destroyed'],
      ['putin',
       'want putins',
       'russia',
       'wants',
       'people',
       'countries',
       'country',
       'nato',
       'like',
       'military',
       'russians',
       'russian',
       'civilians',
       'fair',
       'isn']]
```

▾ 1.4. Sentiment Analysis

▾ 1.4.1. Data Cleaning and Preparation

```python
# get data
tweets_ = tweets.copy()
# convert dates column into datetime format
tweets_.date = pd.to_datetime(tweets_['date']).dt.date
# get relevant columns
tweets_ = tweets_[['content','date', 'content_clean']]


# defining a lambda function to combine tweets
combine_tweets = lambda text: ".".join(text)


# combining tweets for same day
combined_tweets = tweets_.groupby(by='date').agg({'content_clean': combine_tweets}).re

pd.set_option('max_colwidth',·1000)
combined_tweets.head()
```

date	content_clean
0 2021-12-31	the us want russia in ukraine so they can fight them in a proxy war they will supply ukraine equipment maybe thru other nations and watch russia get stuck into a grind similar to vietnam or afghanistan a serious war like that will shatter the russian military.after the cold war the usa made guarantees to russia that nato wouldn t expand to eastern europe can t blame russia for drawing a line at ukraine.nato really wants to lure russia to war with ukraine nato should stop provoking russia won t attack first.if putin moves in ukraine he wins but at a cost to russia future ukraine will fight into a quagmire and russia doesn t have the youth population to replace their army after a bloody vietnam afghanistan type war.look forward to seeing you propagandists end up in the docket in the hague on war crimes charges.i didn t know that the term european theater was still in use lol i mean there s the ukraine russia war but still.happy new year s ukraine i want you to know i still love you a...
1 2022-01-01	what is the purpose of whitewashing russian bellicose stance justifying russian threats all while it is russia that wages war of agression in ukraine which has already taken more than lives and forced millions of ukrainians to become internally displaced fleeing the war.what is the purpose of mental gymnastics to position russia as a threatened side again it was russia that started the war in ukraine and continues attacks in ukrainian military from russian occupied ukrainian territory.war drums uss harry s truman carrier group ordered to stay in mediterranean as tensions rise between russia ukraine.what happened next both nazi germany and ussr as allies simultaneously invaded poland and started ww now we have a situation when russia invaded ukraine in and wages war of aggression on ukraine for years noone else is willing to invade ukraine why the false analogies.do the separatists in ukraine count what is their problem anyway why do they want autonomy do they have russian citizensh...
2 2022-01-02	hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland.biden vows us to act decisively if russia invades ukraine what s the meaning of biden s statement the us to act decisively if russia invade ukraine hopefully biden isn t going to get us into a nuclear war with russia because of ukraine or anyone else other than our own security.actually decentamericans are fully behind drawing a red line when it comes to putin we know they they have been waging a

▾ 1.4.1.1. Combining tweets grouped by two days

invasion on and on never underestimate the stupidity of the hum

```
# defining column names
col_names = list(tweets_.columns)
print('column names:\n',col_names)


# initializing an empty dataframe with those column names
comb_tweets_2d = pd.DataFrame(columns=col_names)
```

```
    column names:
     ['content', 'date', 'content_clean']
```

```
# get range of dates
end = tweets_.date.max() + timedelta(days=1)
begin = tweets_.date.min()
all_date = pd.date_range(start=begin, end=end)
all_date
```

```
    DatetimeIndex(['2021-12-31', '2022-01-01', '2022-01-02', '2022-01-03',
```

```
                    '2022-01-04', '2022-01-05', '2022-01-06', '2022-01-07',
                    '2022-01-08', '2022-01-09', '2022-01-10', '2022-01-11',
                    '2022-01-12', '2022-01-13', '2022-01-14', '2022-01-15',
                    '2022-01-16', '2022-01-17', '2022-01-18', '2022-01-19',
                    '2022-01-20', '2022-01-21', '2022-01-22', '2022-01-23',
                    '2022-01-24', '2022-01-25', '2022-01-26', '2022-01-27',
                    '2022-01-28', '2022-01-29', '2022-01-30', '2022-01-31',
                    '2022-02-01', '2022-02-02', '2022-02-03', '2022-02-04',
                    '2022-02-05', '2022-02-06', '2022-02-07', '2022-02-08',
                    '2022-02-09', '2022-02-10', '2022-02-11', '2022-02-12',
                    '2022-02-13', '2022-02-14', '2022-02-15', '2022-02-16',
                    '2022-02-17', '2022-02-18', '2022-02-19', '2022-02-20',
                    '2022-02-21', '2022-02-22', '2022-02-23', '2022-02-24',
                    '2022-02-25', '2022-02-26', '2022-02-27', '2022-02-28',
                    '2022-03-01', '2022-03-02', '2022-03-03', '2022-03-04',
                    '2022-03-05', '2022-03-06'],
                dtype='datetime64[ns]', freq='D')


# make groups of 2 days
dateList = list(all_date)
N = 2
subdateList = [dateList[n:n+N] for n in range(0, len(dateList), N)]
subdateList


    [[Timestamp('2021-12-31 00:00:00', freq='D'),
      Timestamp('2022-01-01 00:00:00', freq='D')],
     [Timestamp('2022-01-02 00:00:00', freq='D'),
      Timestamp('2022-01-03 00:00:00', freq='D')],
     [Timestamp('2022-01-04 00:00:00', freq='D'),
      Timestamp('2022-01-05 00:00:00', freq='D')],
     [Timestamp('2022-01-06 00:00:00', freq='D'),
      Timestamp('2022-01-07 00:00:00', freq='D')],
     [Timestamp('2022-01-08 00:00:00', freq='D'),
      Timestamp('2022-01-09 00:00:00', freq='D')],
     [Timestamp('2022-01-10 00:00:00', freq='D'),
      Timestamp('2022-01-11 00:00:00', freq='D')],
     [Timestamp('2022-01-12 00:00:00', freq='D'),
      Timestamp('2022-01-13 00:00:00', freq='D')],
     [Timestamp('2022-01-14 00:00:00', freq='D'),
      Timestamp('2022-01-15 00:00:00', freq='D')],
     [Timestamp('2022-01-16 00:00:00', freq='D'),
      Timestamp('2022-01-17 00:00:00', freq='D')],
     [Timestamp('2022-01-18 00:00:00', freq='D'),
      Timestamp('2022-01-19 00:00:00', freq='D')],
     [Timestamp('2022-01-20 00:00:00', freq='D'),
      Timestamp('2022-01-21 00:00:00', freq='D')],
     [Timestamp('2022-01-22 00:00:00', freq='D'),
      Timestamp('2022-01-23 00:00:00', freq='D')],
     [Timestamp('2022-01-24 00:00:00', freq='D'),
      Timestamp('2022-01-25 00:00:00', freq='D')],
     [Timestamp('2022-01-26 00:00:00', freq='D'),
      Timestamp('2022-01-27 00:00:00', freq='D')],
     [Timestamp('2022-01-28 00:00:00', freq='D'),
      Timestamp('2022-01-29 00:00:00', freq='D')],
     [Timestamp('2022-01-30 00:00:00', freq='D'),
```

```
        Timestamp('2022-01-31 00:00:00', freq='D')],
       [Timestamp('2022-02-01 00:00:00', freq='D'),
        Timestamp('2022-02-02 00:00:00', freq='D')],
       [Timestamp('2022-02-03 00:00:00', freq='D'),
        Timestamp('2022-02-04 00:00:00', freq='D')],
       [Timestamp('2022-02-05 00:00:00', freq='D'),
        Timestamp('2022-02-06 00:00:00', freq='D')],
       [Timestamp('2022-02-07 00:00:00', freq='D'),
        Timestamp('2022-02-08 00:00:00', freq='D')],
       [Timestamp('2022-02-09 00:00:00', freq='D'),
        Timestamp('2022-02-10 00:00:00', freq='D')],
       [Timestamp('2022-02-11 00:00:00', freq='D'),
        Timestamp('2022-02-12 00:00:00', freq='D')],
       [Timestamp('2022-02-13 00:00:00', freq='D'),
        Timestamp('2022-02-14 00:00:00', freq='D')],
       [Timestamp('2022-02-15 00:00:00', freq='D'),
        Timestamp('2022-02-16 00:00:00', freq='D')],
       [Timestamp('2022-02-17 00:00:00', freq='D'),
        Timestamp('2022-02-18 00:00:00', freq='D')],
       [Timestamp('2022-02-19 00:00:00', freq='D'),
        Timestamp('2022-02-20 00:00:00', freq='D')],
       [Timestamp('2022-02-21 00:00:00', freq='D'),
        Timestamp('2022-02-22 00:00:00', freq='D')],
       [Timestamp('2022-02-23 00:00:00', freq='D'),
        Timestamp('2022-02-24 00:00:00', freq='D')],
       [Timestamp('2022-02-25 00:00:00', freq='D'),
        Timestamp('2022-02-26 00:00:00', freq='D')],
```

```python
# make dataframe having start date , end date and combined two days tweets
df_comb2_tweets = pd.DataFrame(columns=['content','date1','date2'])
for i in subdateList:
  date1,date2 = i[0],i[1]
  #tweets_date_ = pd.DataFrame(columns=['text'])
  filter1 = combined_tweets['content_clean'].loc[(combined_tweets.date == date1)].valu
  filter2 = combined_tweets['content_clean'].loc[(combined_tweets.date == date2)].valu
  v2 = np.concatenate([filter1,filter2])
  df_comb2_tweets = df_comb2_tweets.append({'content' : v2, 'date1' : date1, 'date2' :


# displaying data
df_comb2_tweets.head(2)
```

	content	date1	date2
	[the us want russia in ukraine so they can fight them in a proxy war they will supply ukraine equipment maybe thru other nations and watch russia get stuck into a grind similar to vietnam or afghanistan a serious war like that will shatter the russian military after the cold war the use made guarantees to russia that nato wouldn t		

```
# converting object to string
df_comb2_tweets = df_comb2_tweets.astype({"content": str})
df_comb2_tweets.head(2)
```

	content	date1	date2
0	['the us want russia in ukraine so they can fight them in a proxy war they will supply ukraine equipment maybe thru other nations and watch russia get stuck into a grind similar to vietnam or afghanistan a serious war like that will shatter the russian military.after the cold war the usa made guarantees to russia that nato wouldn t expand to eastern europe can t blame russia for drawing a line at ukraine.nato really wants to lure russia to war with ukraine nato should stop provoking russia won t attack first.if putin moves in ukraine he wins but at a cost to russia future ukraine will fight into a quagmire and russia doesn t have the youth population to replace their army after a bloody vietnam afghanistan type war.look forward to seeing you propagandists end up in the docket in the hague on war crimes charges.i didn t know that the term european theater was still in use lol i mean there s the ukraine russia war but still.happy new year s ukraine i want you to know i still love you...	2021-12-31	2022-01-01
	['hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland biden vows us to act decisively if russia invades ukraine what s the meaning		

1.4.2. Textblob

```
# rename columns
df_comb2_tweets = df_comb2_tweets.rename(columns={'content':'content_clean'})


# evaluate sentiment
df_comb2_tweets['polarity'] = df_comb2_tweets['content_clean'].apply(lambda x: tb(x).s
df_comb2_tweets['subjectivity'] = df_comb2_tweets['content_clean'].apply(lambda x: tb(

df_comb2_tweets.head(10)
```

	content_clean	date1	date2	polarity	subjectivity
0	['the us want russia in ukraine so they can fight them in a proxy war they will supply ukraine equipment maybe thru other nations and watch russia get stuck into a grind similar to vietnam or afghanistan a serious war like that will shatter the russian military.after the cold war the usa made guarantees to russia that nato wouldn t expand to eastern europe can t blame russia for drawing a line at ukraine.nato really wants to lure russia to war with ukraine nato should stop provoking russia won t attack first.if putin moves in ukraine he wins but at a cost to russia future ukraine will fight into a quagmire and russia doesn t have the youth population to replace their army after a bloody vietnam afghanistan type war.look forward to seeing you propagandists end up in the docket in the hague on war crimes charges.i didn t know that the term european theater was still in use lol i mean there s the ukraine russia war but still.happy new year s ukraine i want you to know i still love you...	2021-12-31	2022-01-01	0.040928	0.423296
1	['hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland.biden vows us to act decisively if russia invades ukraine what s the meaning of biden s statement the us to act decisively if russia invade ukraine hopefully biden isn t going to get us into a nuclear war with russia because of ukraine or anyone else other than our own security.actually decentamericans are fully behind drawing a red line when it comes to putin we know they they have been waging a stealth war against us with your super willing help treasonweasel amp a real one against ukraine we owe them for standing up to tfg.hopefully we the people see through this war spin the deception and not hand them our vote russian collusion ukraine quid pro quo now ukraine invasion on and on.never underestimate the stupidity of the h...	2022-01-02	2022-01-03	0.029276	0.456600
2	['to avert war the west should welcome ukraine and a reformed russia into nato i like this idea.russian hybrid forced launched attacks in the war zone in e ukraine over the last h official empr russiaukrainewar.this is potentially politically destabilising for central asia and in particular russia who are on the cusp on war with ukraine how is this not being reported by and.the best explanation forget the cheese let s get out of the trap ending the threat of war in ukraine a negotiated solution to the donbas conflict and the crimean dispute quincy	2022-01-04	2022-01-05	0.046338	0.420943

institute for responsible statecraft.you morons are so
easily led this photo is real but does not show
journalists or doctors in nuremberg germany rather it
captures the moment nazi officers were executed for
war crimes in kyiv ukraine read a freaking history
book before posting ignorant stuff.seeking is fine but
with their wish to be in nato as you ve stated they
want to be under the american national security
umbrella at least be honest...

['color revolution ukraine syria lybia iraq etc just the
same game but beware the russian bear we saw
what happened in syria expect a swift solution to this
situation without all out got war thank you russia.the
current black swans i could see occurring are the ray
dalio style debt bubble bursting or a war with russia

```
# rename columns
df_comb2_tweets = df_comb2_tweets.rename(columns={'polarity':'TextBlob_polarity','sub
```

01-06   01-07

▾ 1.4.3. VADER

```
# intialize parallel computation
pandarallel.initialize(nb_workers=4, progress_bar=True)
```

```
    INFO: Pandarallel will run on 4 workers.
    INFO: Pandarallel will use Memory file system to transfer data between the main
```

```
# define sentiment analysis function with VADER
def vader_sent(row):
  return SentimentIntensityAnalyzer().polarity_scores(row)
```

```
sentimentList = df_comb2_tweets['content_clean'].parallel_apply(vader_sent)
```

100.00%	9 / 9
100.00%	8 / 8
100.00%	8 / 8
100.00%	8 / 8

```
# converting the sentiment values to a dataframe
sentiment_df = pd.DataFrame.from_dict(list(sentimentList))
sentiment_df.head(10)
```

	neg	neu	pos	compound
0	0.251	0.658	0.090	-1.0
1	0.249	0.654	0.097	-1.0
2	0.243	0.661	0.097	-1.0
3	0.255	0.654	0.091	-1.0
4	0.245	0.667	0.089	-1.0
5	0.247	0.661	0.091	-1.0
6	0.265	0.648	0.087	-1.0
7	0.261	0.651	0.088	-1.0

```
# adding the sentiment values to orginial dataframe
df_comb2_tweets['neg'],df_comb2_tweets['neu'],df_comb2_tweets['pos'],df_comb2_tweets['

df_comb2_tweets.head(10)
```

5	brothers and sisters in kazakhstan during christmas services in kyiv.you wanna go to war with a nuclear power over ukraine.putin is a terrorist he has threatened europe and is holding the west hostage yet he has no standing to make these demands so he has threatened war not just against ukraine but against the west.it would be a very quick war and no russia is not going to take a huge swath of ukraine.don t leave ukraine alone in this brutal war against putin s dictatorship.russia always surprises they will respond effectively if us derails these talks but not necessarily militarily or on ukraine front line if kiev provokes war that will be the end of ukraine as it now is tony kevin.has putin decided he s going to war for all the noise democrats made about russia why are the sanctions not being powerful putin wants ukraine not ...	2022-01-10	2022-01-11	0.026258	0.448954	0.247

['now the american government is ordering russia to stop training its russian soldiers because they are supposedly going to invade ukraine but the united states will teach american democracy with a

6	war on the russians.huge no thank you to this one the us must prepare for war against russia over ukraine via.nuclear war over ukraine f via.if it ever becomes clear russia is going to invade why would ukraine wait for those units to disperse i don t know that ukraine has the capacity to attack right now but something along the lines of whay israel did in the day war to egypt should be considered.if another invasion of ukraine is attempted and another eastern european war is instigated by putin i hope to god things don t pan out like they did in georgia putin has the blood of thousands of russians and georgians on his hands and hundreds of thousands of displacements.nato chief warns of real risk of conflict as talks with russia over	2022-01-12	2022-01-13	0.030035	0.442166	0.265

```
# assigning the tweets as negative, positive, compound
sntmnt = []
for index, row in df_comb2_tweets.iterrows():
    neg = row['neg']
    neu = row['neu']
    pos = row['pos']
    compound = row['compound']
    if compound >= 0:
        snt = "positive"
    elif compound <=  0:
        snt = "negative"
    else:
        snt = "neutral"
    sntmnt.append(snt)
        western ukraine is
```

western ukraine is

```
# assigning the created list to original dataframe
df_comb2_tweets['Vader_sentiment'] = sntmnt
```

ukraine but even that

```
positive = df_comb2_tweets[df_comb2_tweets['Vader_sentiment'] == 'positive']
negative = df_comb2_tweets[df_comb2_tweets['Vader_sentiment'] == 'negative']
neutral  = df_comb2_tweets[df_comb2_tweets['Vader_sentiment'] == 'neutral']
```

what the kremlin is

```
len(positive),len(negative),len(neutral)
```

```
(0, 33, 0)
```

01-14   01-15

▼ Tweets are predominantly negative

```
sentiment_df.head()
```

	neg	neu	pos	compound
0	0.251	0.658	0.090	-1.0
1	0.249	0.654	0.097	-1.0
2	0.243	0.661	0.097	-1.0
3	0.255	0.654	0.091	-1.0
4	0.245	0.667	0.089	-1.0

▼ Plotting the sentiment analysis over time grouped by 2 days

```
data = df_comb2_tweets.copy()


# Set type of polarity
polarity = []

for i in range(len(data)):
    if (data['compound'][i] < 0):
        polarity.append("Negative")
    elif (data['compound'][i] > 0):
        polarity.append("Positive")
    else:
        polarity.append("Neutral")

polarity = pd.DataFrame(polarity)
data['Polarity'] = polarity
data.tail()
```

30	sent our best to fight to save europe we need to do the same now if nuclear war breaks out it s still a better option than to lose ukraine the breadbasket of the world.you get the tucker carlsons and donald trumps doing your job for you the fact that putin managed to persuade trump that ukraine belongs to russia and that trump would be willing to give up ukraine without any kind of fight that s a major success for putin s information war.do you really think there would be war in ukraine if donald trump hadn t been president.bolsonaro does not represent me the brazilian don t want war we are with ukraine stop the ukrainerussiawar peaceforukraine.horrible war destruction suffering pain human loss we are witnessin...	2022-03-01	2022-03-02	0.023255	0.44896
31	['the intercept controlled pseudo opposition ratting out sources for almost as long as the ukraine war has been going on but tankies.this yes this is why there is war in ukraine we really have lost the plot with this woke bullshit wake up ffs.amp just like that america s taken the lead shutting down all russian media now the eu needs to step up propaganda is a covert weapon of war putin uses rt america permanently shuts down us operations lays off staff as russia ukraine crisis escalates.putin would use nukes risk of wider war even if contained the war between nato and russia would destroy ukraine just don t want to risk fighting.lol and then the metaverse war begins and we have a to cyber war with kids in the metaverse looking over ukraine in god mode flying	2022-03-03	2022-03-04	0.024063	0.44910

	ukraine in god mode flying non lethal drones that use pepper spray bombs and just force low level human fighters out of the arena sand in latin robot wars only.english pageview ranks _russian_invasion_of_ukraine vladimir_putin ukraine volodymyr_zelensky...			
32	['there was an anti war protest for ukraine as well but it s not getting any headlines serbia has a good relationship with both ukraine and russia both counties have supported serbian territorial integrity over kosovo stop pitting orthodox christians against each other.nato followed usa into afghanistan forgotten already by tribe of western journalists hopefully not biden who bemoaned us losses not afghan allies all forgotten in the headlines of ukraine war another syria coming west arms insurgents destabilises.it s not russophobia we just hate putin and all his enablers russian people we it s also not special military operation it s putin war crimes against ukraine and its people istandwithukraine.this war could have been avoided by ensuring to putin that ukraine could not join nato.remember the biggest mistake made by those who supported afghanistan s war against the soviets was they abandoned a nation that had an average male age of years imagine that scenario in ukraine with az...	2022-03-05	2022-03-06	0.032171	0.44904

```
data['date1'] = pd.to_datetime(data['date1'])
data['date1'] = data['date1'].dt.strftime('%D')

x = data[['date1', 'neg', 'pos']]
```

```
y = x.set_index('date1')
z = y.groupby('date1').mean()

z.plot.bar(stacked=True, title='Polarity per 2 Days', figsize=(16,5))
plt.show()
```
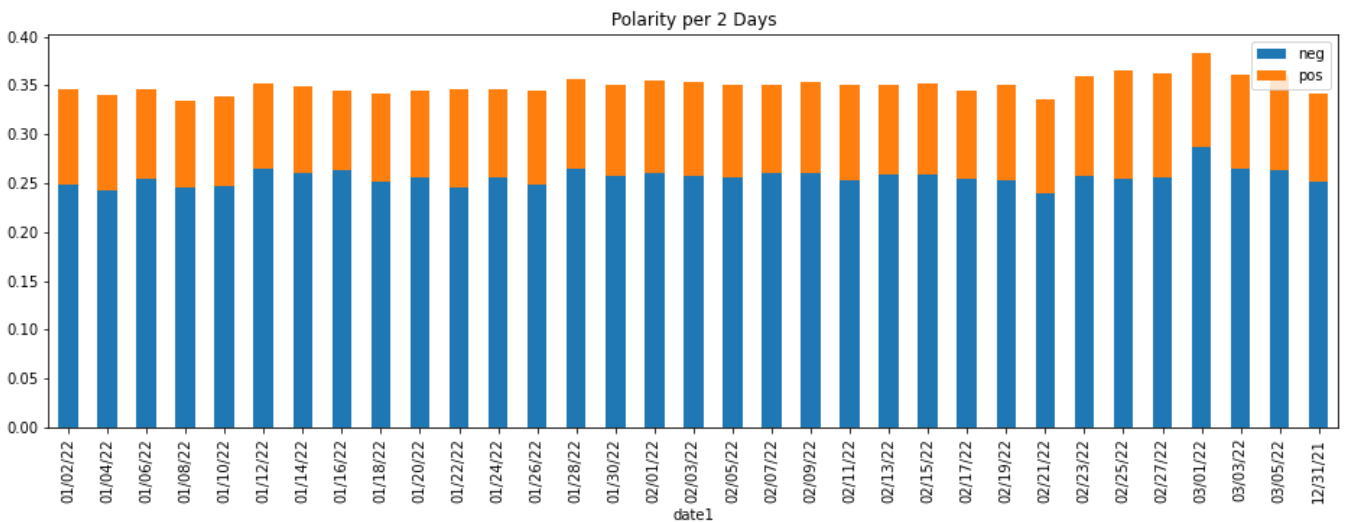

Part 2. Event Summarization and Performance Evaluation

2.1. Abstractive Text Summarization

2.1.1. Custom data preparation

```
tweets_ = tweets.copy()


# convert to datetime object
tweets_.date = pd.to_datetime(tweets_['date']).dt.date


# tweet counts
tweets_counts = tweets_.groupby(['date']).size().reset_index(name='counts')


# defining a lambda function to combine tweets
```

```
combine_tweets = lambda text: ".".join(text)
```

```
# combining tweets for same day
combined_tweets = tweets_.groupby(by='date').agg({'content_clean': combine_tweets}).re
combined_tweets.head()
```

	date	content_clean
0	2021-12-31	the us want russia in ukraine so they can fight them in a proxy war they will supply ukraine equipment maybe thru other nations and watch russia get stuck into a grind similar to vietnam or afghanistan a serious war like that will shatter the russian military.after the cold war the usa made guarantees to russia that nato wouldn t expand to eastern europe can t blame russia for drawing a line at ukraine.nato really wants to lure russia to war with ukraine nato should stop provoking russia won t attack first.if putin moves in ukraine he wins but at a cost to russia future ukraine will fight into a quagmire and russia doesn t have the youth population to replace their army after a bloody vietnam afghanistan type war.look forward to seeing you propagandists end up in the docket in the hague on war crimes charges.i didn t know that the term european theater was still in use lol i mean there s the ukraine russia war but still.happy new year s ukraine i want you to know i still love you a...
1	2022-01-01	what is the purpose of whitewashing russian bellicose stance justifying russian threats all while it is russia that wages war of agression in ukraine which has already taken more than lives and forced millions of ukrainians to become internally displaced fleeing the war.what is the purpose of mental gymnastics to position russia as a threatened side again it was russia that started the war in ukraine and continues attacks in ukrainian military from russian occupied ukrainian territory.war drums uss harry s truman carrier group ordered to stay in mediterranean as tensions rise between russia ukraine.what happened next both nazi germany and ussr as allies simultaneously invaded poland and started ww now we have a situation when russia invaded ukraine in and wages war of aggression on ukraine for years noone else is willing to invade ukraine why the false analogies.do the separatists in ukraine count what is their problem anyway why do they want autonomy do they have russian citizensh...
2	2022-01-02	hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland.biden vows us to act decisively if russia invades ukraine what s the meaning of biden s statement the us to act decisively if russia invade ukraine hopefully biden isn t going to get us into a nuclear war with russia because of ukraine or anyone else other than our own security.actually decentamericans are fully behind drawing a red line when it comes to putin we know they they have been waging a stealth war against us with your super willing help treasonweasel amp a real one against ukraine we owe them for standing up to tfg.hopefully we the people see through this war spin the deception and not hand them our vote russian collusion ukraine quid pro quo now ukraine invasion on and on.never underestimate the stupidity of the hum...
		imagine putin xi and the mullahs simultaneously making their moves the biden administration

```
combined_tweets['date'] = pd.to_datetime(combined_tweets['date'], format='%Y-%m-%d')
tweets_counts['date'] =  pd.to_datetime(tweets_counts['date'],format='%Y-%m-%d')
combined_df = pd.merge(combined_tweets,tweets_counts,on='date')
```

▼ 2.1.2. Using T5 Transformers

```
summarizer = pipeline("summarization", model="t5-small", tokenizer='t5-base', framewor
```

```
    All model checkpoint layers were used when initializing TFT5ForConditionalGenera

    All the layers of TFT5ForConditionalGeneration were initialized from the model cl
    If your task is similar to the task the model of the checkpoint was trained on, y
```

```
def get_transformer_summary(cleaned_tweets):
    preprocess_text = str(cleaned_tweets)
    summary = summarizer(preprocess_text, max_length=300, min_length=10)
    return summary
```

```
# get the summary of tweets of a requested date.
def tweets_against_dates(given_date,functionName):
  combined_df['date'] = pd.to_datetime(combined_df['date'], format='%Y-%m-%d')
  sampled_tweets = combined_df.loc[combined_df['date']==given_date]
  sampled_tweets['content_clean'] = sampled_tweets['content_clean'].values[0][:1500]
  sampled_tweets['trans_summary'] = sampled_tweets['content_clean'].apply(functionName
  sampled_tweets.reset_index(inplace=True, drop=True)
  return sampled_tweets
```

```
dated_tweets = tweets_against_dates('2022-01-02',get_transformer_summary)
```

```
pd.set_option('max_colwidth', 10000)
dated_tweets
```

	date	content_clean	counts	trans_summary
0	2022-01-02	hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland.biden vows us to act decisively if russia invades ukraine what s the meaning of biden s statement the us to act decisively if russia invade ukraine hopefully biden isn t going to get us into a nuclear war with russia because of ukraine or anyone else other than our own security.actually decentamericans are fully behind drawing a red line when it comes to putin we know they they have been waging a stealth war against us with your super willing help treasonweasel amp a real one against ukraine we owe them for standing up to tfg.hopefully we the people see through this war spin the deception and not hand them our vote russian collusion ukraine quid pro quo now ukraine invasion on	286	[{'summary_text': 'kremlin propaganda bullshit i could start tweeting photos of nazi lovers .biden vows us to act decisively if russia invades ukraine . mr

▾ 2.2.3. Using BART

```
tokenizer = BartTokenizer.from_pretrained('facebook/bart-large-cnn')
model = BartForConditionalGeneration.from_pretrained('facebook/bart-large-cnn')
```

```python
def BART_summary(ARTICLE):
  print(ARTICLE)
  input_tokens = tokenizer.batch_encode_plus([ARTICLE], return_tensors='pt', max_lengt
  encoded_ids = model.generate(input_tokens,num_beams=4,length_penalty=2.0,max_length=
  summary = tokenizer.decode(encoded_ids.squeeze(), skip_special_tokens=True)
  summ = textwrap.fill(summary, 100)
  summ = summ.strip().replace("\n","")
  return summ


dated_tweets_BART = tweets_against_dates('2022-01-02',BART_summary)
```

    hilarious kremlin propaganda bullshit i could start tweeting photos of russian na

```python
pd.set_option('max_colwidth', 10000)
dated_tweets_BART.head()
```

	date	content_clean	counts	trans_summary
0	2022-01-02	hilarious kremlin propaganda bullshit i could start tweeting photos of russian nazi lovers what s the point the fools the fools the fools if you support the kremlin in its war against ukraine you support imperialism and as such british imperialism in ireland.biden vows us to act decisively if russia invades ukraine what s the meaning of biden s statement the us to act decisively if russia invade ukraine hopefully biden isn t going to get us into a nuclear war with russia because of ukraine or anyone else other than our own security.actually decentamericans are fully behind drawing a red line when it comes to putin we know they they have been waging a stealth war against us with your super willing help treasonweasel amp a real one against ukraine we owe them for standing up to tfg.hopefully we the people see through this war spin the deception and not hand them our vote russian collusion ukraine quid pro quo now ukraine invasion on	286	biden vows us to act decisively if russia invades ukraine. decentamericans are fully behind drawinga red line when it comes to putin. we know they they have been waging a

2.2. Extractive Text Summarization

2.2.1. Custom data preparation

```python
tweets_0 = tweets_original.copy()
# convert to datetime object
tweets_0['date'] =  pd.to_datetime(tweets_0['date'],format='%Y-%m-%d')
tweets_0.date = pd.to_datetime(tweets_0['date']).dt.date
gen_df = tweets_0.groupby('date', as_index=False)['content'].apply('.'.join)
gen_df.head(1)
```

date	content

@PJZNY @POTUS @CNN @MSNBC @FoxNews The US want Russia in Ukraine so they can fight them in a proxy war. They will supply Ukraine equipment maybe thru other nations and watch Russia get stuck into a grind similar to Vietnam or Afghanistan. A serious war like that will shatter the Russian military..@andrewmichta @NATO After the cold war the USA made guarantees to Russia that NATO wouldn't expand to Eastern Europe. Can't blame Russia for drawing a line at Ukraine..@somlu1968 Was glaubst Du, was in den ganzen Weihnachtspäckchen aus Polen, der Ukraine, Bulgarien etc war?\nDa können wir schon froh sein, dass UPS, DPD und die anderen nicht in die Luft geflogen sind..@EndGameWW3 nato really wants to lure russia to war with ukraine, nato should stop provoking, russia won't attack first..@robert_spalding If Putin moves in Ukraine he wins but at a cost to Russia future. Ukraine will fight into a quagmire and Russia doesn't have the youth population to replace their army after a bloody Vietnam Afghanistan type war..@mfa_russia @NATO @RusembUkraine @OSCE_SMM @MFA_Ukraine @RF_OSCE @OSCE @ConsRusLvov @RusConsKharkov @genconrfodessa @RussianEmbassy @RusEmbUSA Look forward to seeing you propagandists end up in the docket in The Hague on war crimes charges..@akihheikkinen I didn't know that the term "European Theater" was still in use lol\n\nI mean there's the Ukraine - Russia war, but still....Happy New Year's! #Ukraine!! I want you to know, I Still Love You, And I Want To End This War in 2022!! I must focus on de-escalation. Mr. Putin knows what else is prepared should he invade Ukraine.."Putin threatened Biden with a complete collapse of US-Russia relations if he launches more sanctions over Ukraine" From Business Insider.\n\n@POTUS \nIf we would pull our heads out of our asses and treat that lil bitch like the threat he is. He had already declared war on the US!!.print from a negative. This author had encountered this unforgettable picture in an early 1920s publication of a Russian famine of the period following World War I. In any event, it will be recalled that Walker was never in Ukraine in 1932-1933.".RT @CoffeeOrDieMag: When the clocks strike midnight this evening, it will mark a new year — and for Ukraine, the beginning of a ninth straight calendar year at war.\n\nStory by @nolanwpeterson.\nhttps://t.co/BB6bGT2W4N.@JanJeuring @Reuters The reason ruSSia is doing whatever they're doing is not to let NATO accept Ukraine. ruSSia is afraid of the USA & will never win the war against the USA.\nThey need to stop painting grass green before even dreaming of being close to the power of the USA.@lifebiomedguru War breaks out in Ukraine..@CormacS63 @Andy_Scollick @CharlesTannock @brucemcd23 @the_mcquade @olex_scherba @Makeiev @KatyaYushchenko Another armchair Hero promoting war as long as it's far far away. You obviously no nothing of Ukraine's history and the coup by the EU/US, giving rise to Fascists..@Reuters Is this why the military defense budget was set so high? A war with Russia over Ukraine?.@MOFA_Taiwan @kristina_wong the USA cannot let Taiwan and Ukraine fall. I hate war. But......@shoe0nhead Slow jobs growth will continue\nInflation will begin to subside\nCold war with Russia starts up over Ukraine\nChina takes Taipei with no global challenge\nCovid still a problem until around September\nWar with Iran doesn't happen\nRepublicans win back house & senate.If Russia does invade Ukraine, how about the Americans remain neutral and let Canadians deal with protecting the Ukrainian people and be in charge of peace keeping operations in Russia. If the Americans get involved, then it would be the cause for world war 3.During #NewYear2022 #speech by #Zelensky of #Ukraine, Zelensky set a main goal for 2022 to end the war in #Donbass. Sounds really good for all, but he was stating the same thing when he ran for presidency. He won presidential election in 2019. So much for promises. #HAPPYNEWYEAR https://t.co/o1oqm5iUWI.@Szabadsag1956 @farsa_twt The plan is still a go! Ukraine is now secretly part of the new USSR, but the Deep Deep State will launch a thermonuclear war if it becomes official. Russian and Ukrainian troops will now only be pretend fighting. Trust the plan, WWG1WGAWFFWTF!.@medit8now @POTUS Awesome, behind the Scenes , Biden is already solidified the Entry of Ukraine into NATO. This may provoke Putin. Bring it on. Ukraine is War Ready & will inflict Russia. Another Afghanistan, & we know how that Ended. Kudos Joe Biden, & let's HURT Russia. They did it To Us..hoping Putin does not give Ukraine a war for New Years.Aggy Frustrated Take: \n\nSend men back to war. This nonsense is fun for them — fantasy blazing glory shoot em up stuff. Get them off of residential streets

and up and out helping the Ukraine or Ehtiopia or the Balkans or Venezuela or something.
Front lines! https://t.co/waWHg8Opqc.@AlphaGoII1 @asatarbair @KarenAJCohen Who is

```
# clean tweets


def genism_clean_text(corpus):
    corpus = [re.sub(r'@\w+','',tweet) for tweet in corpus]


    # remove amp
    corpus = [re.sub(r'&amp','',tweet) for tweet in corpus]
    # remove hashtag symbols
    corpus = [re.sub(r'#','',tweet) for tweet in corpus]
    # remove twitter handles
    corpus = [re.sub(r'@[A-Za-z0-9_]+','',tweet) for tweet in corpus]
    # remove urls
    corpus = [re.sub(r'http\S+','',tweet) for tweet in corpus]
    return corpus


gen_df['raw_content'] = genism_clean_text(gen_df.content)
# remove emojis
gen_df['raw_content']= gen_df['raw_content'].apply(lambda x: remove_emoji(x))
gen_df.head(1)
```

0   2021-12-31

something. Front lines! https://t.co/waWHg8Opqc.@AlphaGoII1 @asatarbair @KarenAJCohen Who is "Ukraine", with which there was a war of no one knows whom? If this is a state, then who elected its government, who adopted the laws of this state, how they were observed, who supported the army of this state and for what funds?.@POTUS If Russia Invades Ukraine by the end of the month. We need to move troops in immediately. This could start tension between our two nations. If you don't respond with force we could be facing a brink of War! I hope you know this Mr. President..@Aontaithe2021 @DCBMEP Ironic EU wants UK army protecting EU but wants war in Ukraine & Ireland !!!\n\n#BrexitsavedUKfromEUvaccineshambles !.Biden already told Putin that he will not go to war over the Ukraine. So expect annexation soon https://t.co/01FEsaWmtz.@wisniaplpirate @bsn260179 @lsot_podcast @0netech @mfa_russia @RusembUkraine @MFA_Ukraine @OSCE_SMM @RF_OSCE @ConsRusLvov @RusEmbUSA @RussianEmbassy @RusBotschaft @RusMission_EU @eu_eeas No, no, Polish were the ones who are equally guilty, leave your reprisal bullshit revisionism for dumber. Nope, it begun in 1942 by Polish attacks om Ukrainians in Kholmshchyna. Not to mention hundreds of years of oppression from polish. Operation Vistula is a war crime, shame..@tagesschau Zitat:"Das Jahr 2021 war von wachsenden Spannungen zwischen Russland & westlichen Staaten wegen des Ukraine-Konflikts gekennzeichnet."Nein, nicht so! Wegen der praktischen Schritte des Westens für Nato-Mitgliedschaft der Ukraine. Z. B. gemeinsame Militärmanöver&Waffenlieferungen..Every year, but especially today, I am shocked at the idiocy of people who set fireworks in #Ukraine. \n\nThe country is in the middle of war and is on the brink of another escalation. \n\nWhy am I hearing explosions all around me? Forget me, but the veterans?.Russia has deaths exceeding births for 30 yrs and the population has gotten older and poorer under Putin\n\nThey have attacked US elections, and our Internet commerce already\n\nPutin starting war w NATO will not fair well. And he's trying to make Ukraine the new Archduke Ferdinand?.@LeninBol Right now \nUkraine has failed to copy tito \nOr mao or vietnam \n\nNote vietnam yielded ground to PRC \nDuring deng incursion\n\nStrategy \nPeoples war.we're gonna have world war 3 over ukraine guys... lol....When the clocks strike midnight this evening, it will mark a new year — and for Ukraine, the beginning of a ninth straight calendar year at war.\n\nStory by @nolanwpeterson.\nhttps://t.co/ZAPtnhN53r.Biden's Hail Mary is to start a war with Russia over Ukraine. It might work.\nhttps://t.co/24gx3HuOyp.@some_guy_hsdhed @SWEEDTRADER @RonOBrien17 @willvernon @SFischer_EU Lasts ten weeks & no T cells !!! 😭 😂 😭 \n\nEuseless Kraut technology = #euvaccineshambles !!!\n\nJust like #nordstream2 = Ukraine war !!!.@geol_uk @vicktop55 Think Nato wont agree and will have to be defeated but it will be a short story, they will throw in the

towel within 3 days and might even result in NATO dissolving or atleast will be on very shaky legs,americans will not risk nuclear war over Ukraine thats 100% sure, its a bluff."No to war with Ukraine".Biden urges Putin to seek diplomacy, not war, with Ukraine https://t.co/yqZjRW3kgo.Russian threats, China's rise, Afghanistan's collapse: Biden enters 2022 facing crises around world Tens of thousands of Russian troops massed on Ukraine's border have sparked fear of a potentially imminent war https://t.co/uq1Xhs97Os https://t.co/92SBLEcY2g.@LeninBol Consider russia in 1918 \nUkraine lost as well as \nEastern poland \nBaltics \nTrans caucasia\n finland \nCivil war \n\nThe revolution survived \n to revive another day \nWith NEP \n\nStalin like putin played\nCzar \ncreeping out the borders \nof the realm.2022 predictions:\n\n1. new covid variant >:)\n2. 355 followers\n3. uuhhh...\n4. you can legally send me nudes\n5. russia may or may not go to war with ukraine.@MikeCarlton01 Well soon a war over Taiwan or Ukraine may be the distraction the LNP are hoping for. Anything to stimulate capitalisms g-spot and maintain power. \n\n2022 isn't looking great to me.🤔 .Was there anti-allied resistance groups during #WW2? When things get messy in Western Ukraine, @Kochevnik81 details the fighting that breaks out in a multisided civil war. #MilHist #Twitterstorians\nhttps://t.co/cdi5SoHP0I.And nothing ever happens as in war betwixt Russia&the US? A war that would quickly escalate into a thermo nuclear war.. Every time Putin&America talk shit or make Ukraine their chess board of death the International Military Industrial Mafiosi stocks skyrocket \n\nwar is a racket https://t.co/4x7gMGv0jo.@1mZer0Cool @x4eileen #DemocratsAreDestroyingAmerica by weakening our military & doing all they can to create war - whether it's Ukraine, Taiwan, or the Middle East. Wars make millions for corrupt politicians. You can bet #LyingBiden made $$$ from CCP abandoning US equipment in Afghanistan..Russian

2.2.2. Gensim Summary

```python
def genism_summary(cleaned_tweets):
    summ = summarize(cleaned_tweets, word_count=100)
    summ = summ.strip().replace("\n","")
    return summ


def tweets_against_dates_gen(given_date,functionName):
    # print(functionName)
    gen_df['date'] = pd.to_datetime(gen_df['date'], format='%Y-%m-%d')
    sampled_tweets = gen_df.loc[gen_df['date']==given_date]
    sampled_tweets['trans_summary'] = sampled_tweets['raw_content'].apply(functionName)
    return sampled_tweets
```

```python
dated_tweets_genism = tweets_against_dates_gen('2022-01-02',genism_summary)
dated_tweets_genism.head()
```

TROOPS TO UKRAINE BORDER – 'SHORT, SHARP WAR WITHIN DAYS' https://t.co/ODtmmfvcnB.@Biz_Ukraine_Mag Yes we all remember when #Obama, #NATO destroyed ukrainian independence and democracy, set in NATO & EU marionettes for government and sunk Ukraine in civil war 8 yrs ago!\n\nAre ukrainians more stupid than croatians, serbs, iraqians, afghans, sudanese, somalians? \n\nReally? https://t.co/GeVrMFwgrF.#Biden talking nonsense to the Ukrainians again. #Russia has never invaded #Ukraine and #Crimea was always Russian until Kruschev gave it away as a gift. Absolutely no chance the US Administration will risk nuclear war for their Ukrainian puppets. \n\nhttps://t.co/cYNiNJtelY.'US Senators want to designate #Russia a "terrorist state" if "forces further invade #Ukraine". Such a designation of a nuclear superpower is unprecedented, an insane move that'd make diplomacy & negotiation impossible. It's tantamount to declaring war.'\nhttps://t.co/LJSW3rrE7e https://t.co/HwJSQjN6DU.Biden is going to get us into a war with Russia because he's been bribed by Ukraine. https://t.co/sozvvxeM8f.@Realistqx @ZelenskyyUa @POTUS If war breaks out between Ukraine and Russia, the United States and NATO member states will condemn Russia and impose some sanctions. Ukraine will be invaded and in a few years they will re-establish relations that will lift the sanctions on Russia..@marwilliamson Going to war against Russia over the Ukraine?.@KunYKA @ItsEricBlakeney @headi420 @SabbySabs2 One of your keyboard buttons is locked....\nIs Russia really planning a war in Ukraine - or is Washington? \nhttps://t.co/H7DAxX59vv.@NatashaBertrand So is POTUS stating that the US will engage in war with Russia over Ukraine?.Schiff says Ukraine invasion 'likely' as Biden prepares for call with Zelensky https://t.co/Vak0hqPs8U via @nypost\nBidens an idiot. Almost as bad as schitt. They can go to war. Leave the rest of us out of it. FJB.@FaceTheNation @margbrennan @RepAdamSchiff U.S. must take responsibility 4 few WAR MONGERS, DIE HARD Pro israeli politicians INTERFERING in INTERNAL affairs of FOREIGN nations.😭 \nVictoria Nuland, HELPED over throw Ukraine government.Her conversation of (F*CK EU) was heard ALL

Ukraine..A must read for those interested in the historical context of Russia's war against Ukraine.\n\nThe Gates of Europe: A History of Ukraine : Plokhy, Serhii: Books Who is declaring war on anyone? The fuck world do you live in? Outside of Russia beating up Ukraine what fucking nation wants to risk a full on war..PUTIN CONTINUES TO FLOOD TROOPS TO UKRAINE BORDER – 'SHORT, SHARP WAR WITHIN DAYS' Yes we all remember when Obama, NATO destroyed ukrainian independence and democracy, set in NATO ; EU marionettes for government and sunk Ukraine in civil war 8 yrs ago!\n\nAre ukrainians more stupid than croatians, serbs, iraqians, afghans, sudanese, somalians? \n\nReally? talking nonsense to the Ukrainians again. Russia has never invaded Ukraine and Crimea was always Russian until Kruschev gave it away as a gift. Absolutely no chance the US Administration will risk nuclear war for their Ukrainian puppets. \n\n Senators want to designate Russia a "terrorist state" if "forces further invade Ukraine". Such a designation of a nuclear superpower is unprecedented, an insane move that'd make diplomacy ; negotiation impossible. It's tantamount to declaring war.'\n is going to get us into a war with Russia because he's been bribed by Ukraine. If war breaks

over🌐 , tryin REP...   out between Ukraine and
Russia, the United States
and NATO member states
will condemn Russia and
impose some sanctions.
Ukraine will be invaded
and in a few years they
will re-establish relations
that will lift the sanctions
on Russia.. Going to war
against Russia over the
Ukraine?. One of your
keyboard buttons is
locked....\nIs Russia really
planning a war in Ukraine
- or is Washington?\n So
is POTUS stating that the
US will engage in war with
Russia over
Ukraine?.Schiff says
Ukraine invasion 'likely' as
Biden prepares for call
with Zelensky via
\nBidens an idiot. Almost
as bad as schitt. They can
go to war. Leave the rest
of us out of it. FJB. U.S.
must take responsibility 4
few WAR MONGERS,
DIE HARD Pro israeli
politicians INTERFERING
in INTERNAL affairs of
FOREIGN
nations.\nVictoria Nuland,
HELPED over throw
Ukraine government.Her
conversation of (F*CK
EU) was heard ALL over,
tryin REPLACE Ukrainian
government. FTB I don't

2.2.3. TextRank - using SUMY

have to be enforced on

```python
def sumy_textRank_summarizer(cleaned_text):
    parser =PlaintextParser.from_string(cleaned_text,Tokenizer("english"))
    TR_summarizer = TextRankSummarizer()
    summary =TR_summarizer(parser.document,2)
    summary_list = [str(sentence) for sentence in summary]
    result = ' '.join(summary_list)
    return result
```

Afghanistan to figure out

```python
dated_tweets_sumy_TR = tweets_against_dates_gen('2022-01-02',sumy_textRank_summarizer)
```

```
dated_tweets_sumy_TR.head()
```